Children of the internet: An investigation into the associations between social media use, gaming, and young people's mental health.

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Thesis Declaration Form

I confirm that the work presented in this thesis is my own. Where information has been used from other sources, I confirm that this has been indicated and references within the thesis.

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Overview

This D.Clin.Psy thesis is divided into three parts. Part one is a conceptual introduction discussing key evidence and theories of social media and gaming use, pertaining to their association with mental health and social variables. Part two is an empirical study, which explores relationships between social media use, gaming, and multiple outcome variables: depression, social connectedness, and social capital, in a sample of young people. This is a longitudinal study involving data collection at two time points. Both parts one and two draw on the interpersonal-connections-behaviour-framework (Clark et al., 2018), which suggests that social media use is associated with positive outcomes when it connects users to others but may be associated with negative outcomes when users are more disconnected. Results suggest that greater time spent on social media is associated with higher depressive symptomology, and lower social connectedness in both cross sectional and longitudinal analyses. Findings for gaming are less robust, suggesting that gaming may not be as important in the relationship between digital technology and mental health. The third section is a critical appraisal, reflecting on the process of undertaking and writing up the project. It discusses the challenges encountered, and what was learned through completing the project.

Impact Statement

The ubiquity of social media use among young people has led to concerns about it's potential to impact wellbeing of users (Twenge, 2019). The relationship between social media and young people's mental health is a topical and contentious issue, with controversy in the literature regarding whether social media may cause harm or may help to develop relationships (Ahn, 2011). A similar discourse exists around the potential risks and benefits of gaming in adolescence (Kimball & Cohen, 2019).

Despite this interest, there is a paucity of longitudinal research investigating both the sign and direction of the relationship between social media and gaming, and mental health outcomes in adolescence. In order to support young people to use social media and video games in ways which are most likely to be beneficial, it is important to understand the nature of this relationship. The empirical paper is also informed by some of the shortcomings of previous research, namely that social media/gaming research is predominantly cross-sectional and lacks an overarching theory. This research uses a longitudinal design, in an effort to meet some of the prerequisites for causality: covariation and precedence. It is also grounded in a theoretical framework: the interpersonal-connections-behaviour-framework (Clark, Algoe & Green, 2018).

Investigating social media and digital technology use is particularly important in the current context of the Covid-19 pandemic, with recent data suggesting that social media use since the onset of the pandemic has increased by 61% in comparison to usual rates ("Covid-19 Barometer: consumer attitudes, media habits and expectations", 2020). Gaming has also been on the rise, with an increase of 30% in gamers identified as playing more than five hours a week and a shift towards online multiplayer games, with one multiplayer genre showing 143% increase in US players (The Global Gaming Study: Impacts of COVID-19, 2020).

Recent reviews (Brooks et al., 2020; Orben, Tomova & Blakemore, 2020) highlight that self-isolation has negative psychological effects. Therefore, this research may have applications in preparation for and response to future pandemics or crises which may include periods of isolation and an associated increase in social media/gaming use.

Findings from this study suggest that although higher social media use is associated with higher depressive symptomatology, it does not appear to account for *change* in depressive symptomatology. Greater social media use was also found to be associated with lower social connectedness. Although causality cannot be determined, these findings lend some weight to the 'disconnection' pathway. Findings for gaming use were less robust, time spent gaming was not associated with depression when controlling for social media use. More time spent gaming was associated with lower offline social capital, again lending some support to the disconnecting pathway of technology use, however this finding was not replicated in the longitudinal analyses.

These findings have several implications, they support a nuanced view of social media/gaming use, rather than a concern-centric narrative. In terms of clinical implications, the findings do indicate that social media use in particular appears to be an important consideration in young people's mental health. Routinely asking young people about their social media use is vital to understand their experience of this online social world. Other clinical implications include the possibility of psychoeducation with young people, highlighting how technology use has the potential to both connect and disconnect us to others.

Implications for future research include the importance of longitudinal designs, with more than two time points, in order to better understand change over time, as well as the role of potential mediating or moderating variables. This, alongside with high quality experimental

studies, would better determine the direction of causality in the relationship between digital technology use and mental health. Future research could also focus on more nuanced measures than simply 'time spent' using these technologies. Differential associations with social media platforms and single vs multiplayer gaming are important areas for future research.

This project is intended to be disseminated through the publication of the empirical paper in relevant peer-reviewed journals. Some preliminary findings have already been presented as part of the UCL DClinPsy conference on social media in 2021.

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Part 1: Conceptual Introduction

Bringing digital technologies together: the mental health and social outcomes associated with social media and gaming use.

Introduction

There is debate within academic literature and wider society concerning whether digital technologies should be regarded as beneficial or potentially harmful. This debate has been particularly divisive when considering social media use and gaming amongst young people, the population of interest in this study. This conceptual introduction will introduce the debate with a focus on social media and gaming and their associated outcomes for young people's wellbeing. It will also attempt to bring the two literatures together by considering whether a single theoretical framework might help explain conflicting findings on the risks and benefits of both technologies.

There is a significant body of research into potential benefits and harms of video gaming and social media. Social media research has considered a range of mental health indicators; this introduction will consider measures pertaining to both psychological wellbeing and psychopathology as indicators of mental health. Previous research has linked high levels of social media use to poor psychological wellbeing (Riehm et al., 2019). The increase in prevalence of mental health difficulties in young people has been linked to increased use of social media with social comparison, cyberbullying and isolation implicated as potential threats (Twenge, Joiner, Rogers & Martin, 2017). However, there is also evidence that social media use may be linked to more positive outcomes, such as building social capital and improved wellbeing (Ellison, Steinfield & Lampe, 2007).

Research into the relationship between gaming and mental health outcomes has also generated mixed findings. In earlier publications there is an emphasis on putative negative impacts of gaming, including links to aggression (Lemmens, Valkenburg & Peter, 2011), negative impacts on social relationships, and increased social anxiety (Lo, Wang & Fang, 2005). Chief among these concerns have been the purported addictive properties of gaming (Meerkerk et al., 2006; Young, 2009) resulting in the inclusion of 'Internet Gaming disorder' in the ICD-11(World Health Organization, 2018), and in section III of the DSM-V (American Psychological Society, 2013). Despite fears around gaming, there is also a range of research linking gaming to positive outcomes. These studies emphasise the role of video games in generating positive emotions, supporting wellbeing, increasing connectedness with peers (Jones et al., 2014) and positive school engagement (Durkin & Barber, 2002).

The majority of research into the relationship between social media/gaming and outcomes relating to wellbeing has focussed on duration and frequency of use alone or focussed on either activity rather than both. In contrast, there is a relative lack of longitudinal or experimental research that investigates the direction/s of causality underpinning the relationship between social media use and gaming, and mental health outcomes in adolescence (Odgers & Jensen, 2020). In order to support young people to use social media and video games in ways that are most likely to be beneficial, it is important to understand the nature of this relationship. Further, there is relatively little published work investigating individual differences in use and possible mediating/moderating variables. This project aims to address some of these shortcomings, using a longitudinal design, investigating potential mediating variables, and using a single theoretical framework to investigate both social media and gaming.

This introduction aims to summarise the theories, constructs, mediators/moderators, and behaviours that have been investigated in an attempt to understand the mixed and at times

contradictory outcomes of research in this field. It will begin by describing social media and gaming and their use among adolescents, followed by a discussion of the essential research exploring outcomes related to both. This discussion will link the fields of gaming and social media research using the Interpersonal Connections Behaviour Framework (ICBF) focussing specifically on pathways of disconnection and connection in both gaming and social media. Finally, the usefulness of this framework across both fields will be considered, and the current study will be introduced.

Social Media and Gaming

Both of the terms 'social media' and 'gaming' can be difficult to define due to the developing nature of these technologies. Many technologies that could have been defined as either social media or gaming are now multi-functional and contain aspects of both. Examples being games within social network sites e.g., Farmville, games containing social networks e.g., Animal Crossing: new horizons, or social networks used to discuss and livestream video games e.g., Discord, Twitch. An online platform can be considered to constitute social media if "makes it possible for people to form online communities and share user-created content." (Kim, Jeong & Lee, 2010, p.216). Social media communities can include friends, acquaintances both online/offline and exclusively online, such as special interest groups. A subsection of social media, social network sites are networked communication platforms that involve user-generated profiles, public connections to other users, and interactive content created by users (Ellison and Boyd, 2013.) Social communication is often possible via commenting publicly or sending direct messages. Popular social media sites include Facebook, Instagram, Twitter, Snapchat, Reddit, and Discord. Video hosting platforms such as YouTube and TikTok can also be considered social media, where the primary means of communication is creating and sharing video content.

Social media use among young people (in this paper defined as aged between 10 and 24, as per The Lancet definition of adolescence, Sawyer et al., 2018) is widespread. In 2018 an OECD wellbeing report found that 94.8% of 15-year-olds in Britain use social media (OECD, 2018). Findings from the Millennium cohort study showed that 40% of girls and 20% of boys used social media for over 3 hours per day. In the context of the covid-19 pandemic, recent data suggest that social media engagement has increased by 61% in comparison to usual rates (Covid-19 Barometer: consumer attitudes, media habits and expectations, 2020). This increase in use highlights the importance of understanding the relationship between social media use and young people's wellbeing.

Video games encompass a wide range of technologies, on platforms such as: personal computers, consoles (Xbox, PlayStation, Switch), tablets and mobile devices. Types of game include single player, online multiplayer (played alongside friends or unknown others), social media games, mobile games, MMORPG (massively multiplayer online role-playing games (e.g., World of Warcraft, The Elder Scrolls online). Video games are a hobby and an interest, traditionally viewed as a solitary pursuit (Selnow, 1984). However, there has been a significant increase in playing with others, either co-operatively or competitively. Data from a study of American adolescents found that 89% played games with friends they knew in person, 54% with friends they know online, and 52% with people they don't know (Lenhart et al. 2015). Gaming has also increased since the onset of the Covid-19 pandemic with 30% of gamers identified as playing more than five hours a week. The pandemic also seems to have accelerated the shift towards online multiplayer games, with one multiplayer genre showing 143% increase in US players (The Global Gaming Study: Impacts of COVID-19, 2020).

Given the increasingly social nature of gaming and use of both gaming and social media to meet social needs during the pandemic, it is vital to explore how these new social worlds impact their users.

Defining mental health

This project focusses on the relationship between social media/gaming, and adolescent mental health. As Meier & Reinecke state, research in this field has focussed on two separate but related constructs: psychopathology and psychological wellbeing. Psychological or psychosocial wellbeing has been defined as a state equilibrium between psychological, social, and physical resources and challenges (Dodge, Daly, Huyten & Sanders, 2012). Psychological resources include self-esteem, and life satisfaction. This definition also emphasises the importance of social support, as a key factor in maintaining psychological wellbeing. On the other hand, psychopathology refers to "actions, emotions, motivations, cognitive and regulatory processes – that cause personal distress or impact upon significant life functions such as social relationships, education, work, and health maintenance." (Lahey, Krueger, Rathouz, Waldman, & Zald, 2017, p. 143). Psychological wellbeing should not be viewed as merely the absence of psychopathology, or vice versa, as individuals can score highly on some indicators of wellbeing whilst also scoring highly on some indicators of psychopathology (e.g., Greenspoon & Saklofske, 2001). Similarly to Meir and Reinecke, this introduction will consider outcomes related to both psychological wellbeing and psychopathology, using a 'two-continua' model of mental health.

The Interpersonal-Connections-Behaviour-Framework (ICBF)

In an attempt to make sense of conflicting findings in social media research Clark, Algoe & Green (2017) created a framework for understanding the risks and benefits of social media use. This framework, the Interpersonal connections behaviour framework (ICBF) suggests that when social media use involves behaviours that connect users to others, resulting in

belongingness and acceptance, it can promote wellbeing. When social media use is characterised by behaviour that does not promote connection it can have a negative impact on wellbeing. Much of the literature used to support the ICBF is correlational or cross-sectional in design, therefore it lacks causal evidence. This gap in the literature prompted the current study, aiming to investigate social connectedness as a potential mediator in the relationship between social media use and mental health outcomes in adolescence. This framework was also used as a starting point for reviewing literature in this introduction. Studies that address pathways for connection and disconnection in social media use will be considered, as well as studies that explore connection and disconnection in gaming. The ICBF may be a useful framework for considering the risks and benefits of gaming for several reasons, firstly there is a lack of integration between the two fields at present, despite the convergence in the two technologies with the rapid expansion of networked gaming. Fears around gaming have also centred on its capacity to isolate young people in particular and displace other valued activities.

Social Media Use: Studies pertaining to connection and disconnection

In this section a proposed theory, key mediators, and online behaviours will be discussed, all of which relate to the capacity of social media to connect or disconnect its users. Although the focus of this project is on adolescents, some important papers focussing on adult social media use will be included.

The Stimulation vs Displacement theory

The Stimulation vs Displacement framework (Valkenburg & Peter, 2007) consists of two opposing hypotheses regarding outcomes of social media use. The stimulation hypothesis suggests the social media use has a positive effect on wellbeing by increasing and improving interactions with existing friends, and thus improving friendship quality. The displacement

hypothesis suggests that online communication displaces time spent with existing friends, and therefore reduces friendship quality.

Earlier researchers of internet communication assumed that social media use represented adolescents' prioritisation of forming new online friendships at the expense of existing offline relationships (displacement). These online relationships were viewed as lower quality (Kraut et al.,1998). Kraut et al. (1998) argue that adolescents were 'substituting weak ties for strong ones' by forming online friendships. This reduces friendship quality overall and has a negative impact on wellbeing.

Other authors favoured the stimulation hypothesis, noting that developments in instant messaging technology and social media meant that adolescents were more frequently in contact with existing offline friends than new online acquaintances (Bryant, Sanders-Jackson & Smallwood, 2006). Several studies found that much of adolescents' time spent online was used to maintain their friendships (Gross, 2004; Subrahmanyam, Kraut, Greenfield & Gross, 2000; Valkenburg & Peter, 2007).

Valkenburg & Peter (2007) investigated the stimulation vs displacement hypotheses, highlighting that both hypotheses are based on the same two mediators. They suggest that online communication impacts adolescent wellbeing via it's influence on (1) time spent with existing friends and (2) friendship quality. Displacement predicts a negative influence and stimulation a positive one. In their survey of 1210 Dutch adolescents, Valkenburg & Peter (2007) found support for the stimulation hypothesis and not the displacement hypothesis. Instant messaging positively predicted wellbeing via the mediators (1) time spent with existing friends and (2) friendship quality. They also found that chat rooms, more commonly used to talk with strangers, had no effect on wellbeing.

This study demonstrates positive associations with online communication, but it should be acknowledged that the instant messaging and chat rooms of the early 2000s differ from social media use today. A more recent example of a study offering support to one or both of these hypotheses is that of Baek, Bae & Jang (2013) who surveyed a representative sample of Korean adults (n=404) using social media. They investigated social and 'parasocial' relationships, defining 'social' as interactions between a user and their friends, and 'parasocial' as a user following the activities of a celebrity who does not acknowledge or interact with them. These two types of use could fulfil both stimulation and displacement hypotheses, with social relationships online stimulating wellbeing, and 'parasocial' relationships displacing time spent with friends and therefore undermining wellbeing. Their findings supported both stimulation and displacement hypotheses; 'parasocial' relationships positively correlated with loneliness, and social relationships negatively correlated with loneliness. As this is a cross-sectional study, it cannot indicate whether social or 'parasocial' relationships have a causal impact on loneliness, demonstrating the need for longitudinal research investigating these hypotheses.

This theory poses important questions about how social media use might influence relationships, and the type of use which may or may not be beneficial. However, it relies heavily on the assumption that time spent with 'existing' or offline friends is superior to connections formed online. Subsequent theories have moved away from the online vs offline dichotomy and focussed on social connectedness more broadly.

Key mediators: Social connectedness and social capital

Social media research has questioned whether social connectedness can be derived online, and what implications this has for wellbeing. Social connectedness is defined as the experience of belonging to a social relationship or network (Lee & Robbins, 1995). Social connectedness has been consistently linked to wellbeing (Cohen, Gottleib & Underwood

2000; Lee, Draper & Lee, 2001). The drive to form meaningful interpersonal relationships and belong to a group is linked to theories of human development such as attachment theory (Bowlby, 1969; 1973), Maslow's hierarchy of needs (Maslow, 1943) and self-determination theory (Deci & Ryan, 1991).

Social connectedness is especially important to adolescent development. Forming friendships with peers is an important part of the developmental trajectory and the formation of close bonds has been linked to a variety of positive outcomes. When adolescents experience belongingness in school they place higher value on learning (Neel & Fuligni, 2013). Adolescents who show low belongingness with peers are more likely to engage in internalising and externalising behaviours (Newman, Lohman & Newman, 2007) and experience greater negative emotions (Shochet, Smith Furlong & Homel, 2011). Social connectedness also seems to offset the impact of negative experiences. Youth who experience peer victimisation often show symptoms of depression (Fitzpatrick, Dulin & Piko, 2010), however, this relationship is mediated by loneliness, the absence of social connectedness (Baker & Bugay 2011).

Social media use described as 'social networking' seems inherently designed to foster social connectedness. Studies have supported this assumption: Greive et al. (2013) investigated Facebook use and social connectedness in a cross-sectional design; using exploratory factor analysis on their 40 item 'Facebook connectedness questionnaire' they found that, Facebook connectedness was distinct from offline social connectedness. This construct of Facebook connectedness was associated with lower depression and anxiety, and higher life satisfaction. Greive et al. concluded that Facebook appears to function as a separate social environment that enables the development and maintenance of relationships.

A study of adolescents with learning disabilities (Sharabi & Margalit, 2011) found that online communication with existing friends predicted less loneliness in a group known to be vulnerable to loneliness (Koster, Nakken, Pijl & Van Houten, 2009). This supports other research demonstrating that individuals who may be vulnerable to social isolation gain additional benefits from social media use, including socially anxious adolescents (Bonetti, Campbell and Gilmore, 2010; Laghi et al., 2013). The additional benefit of social media use for people who are socially anxious or isolated has been labelled the social compensation or 'poor get richer' hypothesis (Laghi et al., 2013) Similar to Valkenburg and Peter's (2007) social stimulation hypothesis, it positions social media as a tool to boost social connection, especially for those who may struggle to form offline connections.

Several studies have used the construct of social capital and applied this to social media use. There are several definitions of the term; Bordieu described social capital as membership of social groups which possess cultural and financial wealth (Bordieu, 1986). Group membership, therefore, means access to financial, cultural, and social resources (Ahn, 2011). Coleman (1994) expanded on this, emphasising group norms and bonds within a group; high trust and close bonds result in social capital as group members are more likely to support one another. Putnam (2000) added the concepts of bonding and bridging social capital, with homogenous groups likely to result in bonding capital, providing social support, and heterogenous groups providing bridging capital in the form of new information and ideas (Ahn, 2011).

Ellison Steinfield & Lampe (2007) investigated Facebook use and social capital, finding that among 800 American undergraduates Facebook use was associated with increased social capital and functioned both to keep in touch with old friends and to foster relationships with new peers. Interestingly, for students with low self-esteem, greater Facebook use was associated with higher bridging social capital than their peers who were high in self-esteem.

The authors interpreted this finding as evidence that social media use is a tool for building ties between members of an extended social circle. A follow up longitudinal study (Ellison, Steinfield and Lampe, 2008) found a causal relationship, showing that gains in social capital were a direct result of Facebook use. It is important to note that these results come from 2006 to 2008, and Facebook has changed significantly since. In an attempted replication (Vitak, Ellison & Steinfield, 2011) intensity of Facebook use no longer predicted bonding social capital but remained a predictor of bridging social capital. Studies of social media use and social capital among adolescents are fewer in number. Ahn (2012) found that adolescents who used Facebook and Myspace had higher social capital than those who did not.

Returning to social connectedness more broadly, some research has demonstrated that social media use may create threats to connectedness as well as facilitating it. These threats include ostracism, and cyberbullying (Allen at al., 2014). Being ostracised online, or 'cyberostracism' (Williams, Cheung & Choi, 2000), can result in lower levels of belonging, as demonstrated in an experimental study where students were asked to post Facebook statuses (Tobin, Vanman, Verreyenne & Saeri, 2015). Those whose statuses were not responded to by peers reported lower levels of belongingness.

In contrast to previous research a longitudinal study by Teppers, Luyckx, Klimstra & Goossens, (2014) found that Facebook use increases loneliness in socially anxious adolescents. They also found that anxious adolescents who used Facebook to make new online friends experienced reduced loneliness. This calls into question the previous assumption that social media is best used to augment existing relationships.

Scholars of social media research are presented with the challenge of reconciling how social media can be a tool that may connect and isolate its users. As Ahn (2011) states, social media sites themselves do not *cause* outcomes related to wellbeing and social connectedness.

Although features of a site may influence user behaviour, existing 'social, psychological and emotional' characteristics of users determine how social media is used and experienced. It follows that a focus on individual differences in communication behaviours may better explain outcomes of interest.

Online behaviours: social media 'addiction'?

With the increasing ubiquity of social media use among young people, parents, professionals, and academics have voiced concerns about 'addiction' to social media. This concern has been especially apparent around young people or 'digital natives' who spend more time socialising online, using devices (Billieux et al., 2015). The construct of social media addiction is relevant to the ICBF as addiction to social media would imply that social media use eclipses other activities therefore disconnecting the user from offline relationships.

Studies of social media 'addiction' have suggested that excessive use of social media may result in symptoms similar to that of substance use, such as salience (preoccupation with SM use, such that it is the single most important activity they engage in), mood modification, tolerance, and withdrawal. Kuss and Griffiths (2017) also report that social media addiction can cause intra and inter-psychic conflict, the former due to feelings of loss of control, and the latter due to relationships, work and/or education being compromised.

Banyai et al (2017) estimated that 4.5% of Hungarian adolescents were at risk of social media 'addiction' in a sample of 5961. A recent meta-analysis estimated the prevalence of social media addiction to be 5% across adult and adolescent studies but noted that the prevalence of social media addiction was higher in adolescent studies (Cheng, Lau, Chan & Luk, 2021). One study of personality and social media addiction found that extroversion and neuroticism predicted social media addiction, and clearly differentiated those who used social media

excessively from those who used the internet excessively or used video games excessively, arguing that it is a separate behavioural problem (Wang et al. 2015.)

One construct that has been studied as a risk factor for social media addiction is 'FOMO' (fear of missing out). FOMO is defined as 'a pervasive apprehension that others might be having rewarding experiences from which one is absent' (Przybylski, Murayama, DeHaan, and Gladwell, 2013, p.1841). Some research suggests that FOMO predicts excessive social media use and is associated with social media addiction (Al-Menayes, 2016; Oberst et al., 2016). In one study of 506 users of Facebook in the UK, FOMO was found to mediate the relationship between high SNS use and decreased self-esteem. This suggests that using social media excessively to neutralise fear that others may be having fun, or that if they do not use social media, they may be excluded from something contributes to excessive use and has a negative impact on wellbeing.

There is a sizeable body of research on 'internet addiction' and 'smart phone addiction', although it has been questioned whether users are addicted to the means of accessing an activity or might be more accurately described as addicted to the activity itself, i.e., social media use. An estimated 80% of social media use occurs on mobile phones, therefore 'smartphone addiction' may be part of SNS addiction.

Studies have indicated that the line between frequent but non-problematic social media use, and excessive use or addiction is hard to draw. Although younger people appear to be more at risk, they also appear to view their technology use as less problematic than their parents do (Schofield Clark, 2009). Kuss and Griffiths (2017) point to the danger of pathologizing normal behaviour amongst young people, whose high level of use does not cause them difficulty.

Online behaviours: the role of social comparison

In an effort to understand conflicting evidence around social media use and its association with mental health, scholars have begun to focus on the online behaviours of individuals using social media, i.e., how users are engaging with the technology. Two particular behaviours have received considerable attention: active vs passive social media use and online social comparison.

Social media appears to attract people higher in loneliness but may fail to meet their needs for social support and belongingness (Morahan-Martin & Schumacher, 2003). Behaviours such as 'social snacking' which include 'stalking' other users' profiles, or passively scrolling on Instagram or Twitter (Carpenter, Green & LaFlam, 2011) are associated with increased feelings of anxiety and low mood (Thorisdottir et al., 2019). This kind of use is known as 'passive use' which lacks meaningful interactions with other users. It has been suggested that these activities appear social but actually fail to make users more connected, resulting in a deficit in social resources (Clark, Algoe and Green, 2018).

A second phenomena of interest is social comparison online. Social comparison with a perceived 'superior other' has been linked to negative outcomes such as increased envy, guilt and defensiveness (White, Langer, Yariv & Welch, 2006). Social media has been considered a fertile ground for such comparisons, with users presenting the most flattering versions of themselves. The transformation framework Nesi et al. (2018) may explain the use of 'selective self-presentation' on social media, due to the 'visualness' (emphasis on visual content) and 'quantifiability' (countable social metrics). The combination of these things might explain the motivation to present content, particularly photos, which show an idealised representation of an individual's life. Passive use of social media may lead to more social comparisons, as individuals are less likely to be closely connected to other users and therefore less aware of their offline lives (Clark, Algoe & Green, 2018). Being unaware of the

reality of other users lives, which may contrast with an idealised online life, could increase the likelihood of social comparisons occurring.

Multiple studies suggest that outcomes associated with social media use may be partially mediated by self-comparison. In an experimental approach using fake Facebook profiles Vogel, Rose, Roberts and Eckles (2014) found that self-esteem evaluations were lower when participants were exposed to profiles that represented an upwards social comparison (popular profile, healthy lifestyle, etc.). Vogel at al. (2015) also investigated social comparison orientation (SCO), the tendency to compare the self with others; they found that participants high in SCO had higher Facebook use, and that those with high SCO showed lower self-esteem and greater negative affect after a social comparison task on Facebook. These findings have been replicated beyond Facebook use; Yang (2016) found that Instagram use is associated with lower loneliness, but only for individuals with low self-comparison orientation.

Clark, Algoe & Green (2018) pulled on this evidence to create the interpersonal-connections-behaviour-framework (ICBF). This framework suggests that when social media use involves behaviours that connect users to others, resulting in belongingness and acceptance, it is good for wellbeing. When social media use is characterised by behaviour that does not promote connection it can have a negative impact on wellbeing. Much of the literature used to support the ICBF is correlational or cross-sectional in design, therefore it lacks causal evidence. This gap in the literature prompted the current study, aiming to explore changes in the relationship between social media use and mental health outcomes in adolescence, over time.

Video Gaming: key studies and theoretical developments

The perceived threats to wellbeing posed by video gaming have followed similar theories yet found a different focus. Primarily, literature has centred around theories of addiction,

aggression, and displacement of other activities. As with social media, fears around the harms of video games have been described as 'moral panic' (Aarseth et al. 2017; Przybylski & Weinstein, 2019). This highlights the intensity of feeling and debate around gaming, both within the academic community and outside of it.

Video gaming addiction and Gaming disorder

Internet gaming disorder was included in the DSM-V in 2013, as a disorder requiring further study (American Psychiatric Association, 2013). In 2017 "Gaming disorder" was included in the ICD-11 as a recognisable and clinically significant diagnosis (World Health Organization, 2018). Both diagnoses describe a 'pattern of gaming…of such a nature and intensity that it results in marked distress or impairment in functioning', with the DSM-5 criteria focussing more on symptoms of addiction, such as withdrawal, tolerance, and inability to quit.

Studies investigating the prevalence of high levels of video gaming amongst adolescents have contributed to the development of Internet gaming disorder/Gaming disorder. Gentile (2009) found that 8.5% of American children aged 8 to 18 showed pathological patterns of play, as measured by their impact on family, educational, social, and psychological functioning. A similar study found a prevalence of 9.9% amongst Spanish adolescents (Tejeiro Salguero & Bersabe Moran, 2002). Other studies have produced more modest estimates of prevalence; Mentzoni et al. (2011) investigated the prevalence of both gaming addiction and problematic gaming (as measured by the gaming addiction scale for adolescents) in a Norwegian sample aged 15 to 40. They found that only 0.6% could be considered 'addicted' and 4.1% showing problem video game use, with being young and male the strongest predictors of this. Problematic gaming was associated with lower life satisfaction and increased scores on measures of anxiety and depression. Gentile (2009) also found that 'pathological' gamers spend twice the amount of time gaming than 'non-pathological' gamers, received poorer grades in school and showed co-morbidity with attention problems.

Defining the use of entertainment media as an addiction or disorder has been extensively critiqued by scholars (Przybylski & Orben, 2018; Aarseth et al. 2017). Key criticisms of the diagnoses include a lack of high-quality research, lack of consensus over what constitutes gaming disorder, and questions around the scale of the 'problem' (Griffiths et al., 2016). A further criticism is the over-reliance on substance use and gambling criteria, applied to use of video games. Aarseth et al. (2017) argue that applying symptoms of substance use disorders to gaming risks pathologizing normal thoughts, feelings, and behaviours of gamers. Applying such criteria to gaming, which Aarseth et al. (2017) argue is no different to many forms of entertainment, opens the door to many other hobbies being labelled as behavioural addictions. Most importantly they caution against the premature application of such diagnoses to children and adolescents. This would likely result in false-positives, stigma towards gamers, and straining of child-parent and familial relationships due to heightened fears around gaming.

Furthermore, the majority of evidence used to support the inclusion of Gaming disorder is cross-sectional / correlational. This raises the question of whether pathological video game use *causes* negative outcomes or is in fact a coping mechanism for / expression of pre-existing poor wellbeing. Lemmens, Valkenburg & Peter (2011) investigated this hypothesis, using a longitudinal design to analyse relationships between gaming and wellbeing in Dutch adolescents. Using structural equation modelling, they found that lower psychosocial wellbeing (as indicated by self-esteem, loneliness, and social competence) predicted pathological gaming six months later. Pathological gaming did not predict changes in the majority of wellbeing measures at time point two, leading the authors to conclude that lower psychological wellbeing is generally an antecedent of pathological gaming. This supports the hypothesis that gaming may be a coping mechanism for poor wellbeing. The exception to this was the measure of loneliness, which was shown to be both a cause and a consequence of

pathological gaming, a reciprocal relationship, lending some support to the theory that gaming displaces offline social interactions.

The debate around Gaming disorder illustrates the current climate of fears around video gaming, but a thorough examination of the diagnoses is beyond the scope of this introduction. Instead, the current study will focus on the majority of adolescents who use video games 'normally' in their day to day lives.

Video Games and Aggression

An extensive body of literature has focussed on the possibility that 'violent video games' cause an increase in aggressive emotions, cognitions, and behaviour. The use of violent video games has anecdotally linked to violent crime such as school shootings in the USA (Anderson & Bushman, 2001), prompting several US states to ban or restrict the use of violent video games by young people. A Supreme Court ruling overturned these bans, concluding that there was a lack of causal evidence linking gameplay to real-world aggressive acts (Brown v EMA, 2011). Despite this, debate continues, with meta-analyses producing contradictory findings and scholars divided into harm vs no harm camps.

The term 'violent video games', which dominates this literature, appears somewhat misleading. Around 85% of video games contain some form of violence (APA, 2020). From minor acts of aggression, to acts of extreme brutality, rendered in a colourful cartoon style or hyper realistic, all of these games will be labelled as 'violent video games.' It is beyond the scope of this introduction to answer the question of why fears around gaming appear to be greater than other forms of media, but important to hold in mind, nonetheless. For a thoughtful exploration of the politics of gaming research see: Markey & Ferguson (2017).

Three meta-analyses, including meta-analyses led by Craig Anderson and colleagues, have concluded that playing violent video games is a causal factor in increased aggression

(Anderson & Bushman, 2001; Anderson, 2004; Anderson et al. 2010). In the first of these three meta-analyses, Anderson and Bushman begin by describing anecdotal enjoyment between the Sandy Hook school shooting and the killers' enjoyment of the video game 'Doom'. They conclude that violent video game exposure is positively associated with heightened aggression in adults and children, for both males and females, and borne out through experimental and non-experimental designs, although this meta-analysis did not include longitudinal studies as none were published at this time. They find that increases in aggression include aggressive thoughts, affect, behaviour, and decreases in empathy and prosocial behaviour.

In the latter two meta-analyses (Anderson, 2004; Anderson et al., 2010) The authors argue that that they used restrictive quality inclusion criteria, cross cultural comparisons, longitudinal data, and conservative statistical controls. They report similar findings to their first meta-analysis, emphasising the positive association between violent video game exposure and aggressive behaviour, cognitions and affect in experimental, cross-sectional, and longitudinal studies. They conclude that longitudinal research further supports the theory that violent video game play is a causal risk factor for aggressive behaviour. Although keen to state the harms of video game play, authors acknowledge that effect sizes are small, with the effect of violent video game play on aggressive behaviour when sex and T1 aggression is partialed out was 0.152^2. Despite this, Anderson et al. (2010) claim that this effect is likely to have practical significance due to the widespread usage of these games. This body of research would suggest that video games do make young people more aggressive and less prosocial, even if effect sizes are small.

However, scholars who are more sceptical the 'harm' position have reached different conclusions, using meta-analysis as well as critiquing research in the field more broadly. In a 2013 Open letter to the American Psychological Association, signatories expressed concerns

about meta-analyses reporting bivariate effect sizes, due to the possibility that small correlations may be explained by third variables rather than violent media exposure and highlighted the limits of correlational research. They also highlighted publication bias and failed replications. An important drawback of much of the research in this field is the application of findings from laboratory research to real life instances of aggression. Elson and Ferguson (2013) elaborate on this in their review of the debate on violent video games, describing a 'debate gone astray.' They emphasise the importance of valid measurements for different aspects of aggression and discourage the conflation of aggressive affect or cognitions with real-life violence. For example, the conflation of aggression-related semantic activations (e.g., seeing a gun in a video game increasing availability of aggressive thoughts) with thoughts about aggressive acts in the real world. Furthermore, they argue that studies producing effects are often subject to measures lacking standardisation and validation, or an artificial laboratory set up.

Recent longitudinal studies support such scepticism. Przybylski & Weinstein (2019) investigated the amount of violent video game play among British adolescents (n=1004) in the prior month as well as parent-reported aggressive behaviour. They found no evidence that violent video gaming is associated with aggressive behaviour. A second longitudinal study (Ferguson & Wang, 2019) used a large sample of Singaporean youth (n=3034). Like Przybylski & Weinstein, the authors attempted to directly combat questionable researcher practices by using preregistration and standardised measures. Young people (Mean age at T1: 11.21) who played games were assessed on measures of aggression and prosocial outcomes at three time points over two years. The authors also included theoretically relevant control variables, including T1 aggressiveness, intelligence, family environment, empathy, and demographics. Effect sizes were compared to 'nonsense' outcomes theoretically unrelated to gameplay, to help demonstrate how statistically significant outcomes may be spurious in

large samples. They found that violent video game play was not significantly linked to any measure of aggression, with effect sizes similar to those of nonsense variables. Although the effect of violent video game play on aggression was in the positive direction, based on their findings it would take 27 hours a day of M rated video game play to produce clinically relevant changes in aggression.

For years the debate around video gaming has focussed on harm-based narratives. More recently scholars have become interested in positive outcomes related to gaming, adding nuance to this divided field.

Video Games and social connections

Displacement theory and negative impacts on wellbeing

In a clear parallel to social media research, scholars have wondered whether time spent playing video games displaces other activities, such as socialising with friends. In the context of increased availability of networked gaming, recent surveys indicate that the majority of gamers play with friends they know offline, or with new connections they form online; in light of this, we must consider that video games may serve as a means of social connection.

Some studies have indicated that time spent playing video games predicts negative outcomes such as decreased quality of interpersonal relationships and increased social anxiety in adolescents (Lo, Wang & Fang, 2005), as well as problematic use being linked to elevated anxiety and depression (Mentzoni et al., 2011). However, adolescents experiencing social anxiety or low mood may use video games to compensate, potentially leading to patterns of problematic use, meaning poor mental health is a causal factor in problematic use not vice versa. A longitudinal study by Stenseng, Wold Hygen & Wichstrom (2020) found that children with greater ADHD symptomology at T1 spent more time gaming at T2, rather than time spent gaming predicting higher symptomology. However, they found no relationship

between emotional difficulties and time spent gaming. Further, some cross-sectional research has shown evidence of a displacement effect, with one sample of adolescents showing that higher levels of social online gameplay were associated with smaller and lower quality offline friendships circles (Kowert, Domahidi, Festl & Quant, 2014).

However, some studies suggest that time spent gaming does not *necessarily* displace time spent with others; instead, gaming may be used to strengthen social connections. For example, in their study of adolescent gamers, Colder-Carras et al. (2017) identified groups of social and non-social gamers from measures of problematic video game use and social video game/internet use, using latent class analysis. They identified two types of heavy gamers, the first engaging in high levels of online social interactions and the second engaging in little social interaction. Even with high levels of use, the 'social gamers' showed low levels of 'problematic' gaming symptoms. Male 'social gamers' were lower in social anxiety than their non-social counterparts, and female social gamers were lower in both social anxiety and loneliness. When friendship quality was added to the model, male social gamers were no longer more likely to report depression than the normative groups. This suggests that superficial online relationships may not protect from the adverse effects of heavy gaming, but more meaningful online relationships are protective in this way. Colder-Carras et al. conclude that this research is helpful in demonstrating how gamers can spend extensive time in virtual worlds whilst still being socially connected to others. They describe a group of adolescents for whom gaming is 'part of their active participation in a digital community.'

Social gaming and positive associations with wellbeing

There is now a body of research demonstrating the benefits of video gaming on wellbeing and social outcomes. Social activity within games has been linked to improved wellbeing. This social content may include interactions with non-player characters (NPCs, i.e., characters that are not controlled by the player) or other players; games that include these

elements have been linked to higher wellbeing among players (Herodoutou, Kambouri & Winters, 2014; Jin & Li, 2017). Research has also shown that players of MMORPG who played moderately and with social motivations showed lower depression, stress, and anxiety than those who played excessively or for purely achievement purposes (Longmann, Connor & Obst, 2014.) Of particular relevance to the current study, players who had higher levels of both online and offline social support showed further reductions in psychological symptoms.

Video games may even influence players to be more prosocial. A study of school children found that those who played prosocial games were more able to share, co-operate and have positive relationships offline (Harrington & O'Connell, 2016). If positive interactions online function in the same way as interactions offline, this presents an opportunity for people who may find offline spaces difficult to access, due to location, disability, or psychological difficulties. This mirrors the 'poor get richer' hypothesis applied to social media research. Co-operation with other players in games has also been shown to moderate the link between 'violent video games' and aggression. Playing violent video games with others appears to reduce feelings of hostility compared to playing alone (Eastin, 2007), and playing violent video games collaboratively increases subsequent prosocial behaviour outside of the game (Ewoldsen et al.,2012). In light of this evidence, and counter to harm-based narratives, Halbrook, O'Donnell & Msetfi (2019) conclude that social activity in video games is healthy unless it is overshadowed by achievement orientation or played in excess.

The debate around gaming often appears to overshadow the fact that playing video games is enjoyable, and increasingly, may involve a social dimension. Despite fears around gaming and increased aggression, multiple studies have shown that gaming results in improved mood and can increase positive emotions (Ryan, Rigby & Przybylski, 2006; Russoniello, O'Brien, & Parks, 2009). Gamers also experience 'flow' states, a positive emotional experience where they are immersed in the activity and lacking in self-consciousness (Sherry, 2004). Beyond

simply being an enjoyable experience, gaming may increase social connectedness among players through a variety of avenues. Vella et al. (2019) found that the mobile exploration game Pokemon Go increased players' sense of belongingness linked to their environment, encouraged conversations with strangers, and strengthened existing social ties. Players also referenced a 'shared passion' for the game. This example differs to others as it brought players outside of their homes, but similar findings exist for more traditional games. Vella, Johnson and Mitchell (2016) interviewed male social gamers to determine if gaming was used as a means of social support. They found that the men interviewed formed new social connections and gained support from these, as well as developing trusted relationships that deepened through gameplay. The interviews showed examples of help seeking and help offering between players. The players often described these interactions in MMORPGs, online virtual worlds, with gameplay high in collaboration. Interestingly, these games are often associated with heavy use and potential for 'addiction'. It is worth questioning whether the benefits of these kinds of games and motivations for heavy use have been maligned.

Gaming and social capital

Previous research has also shown that gamers experience increased *bridging* social capital, i.e., weak ties defined by information sharing and being inspired by others (Steinkuehler & Williams, 2006). Whether gaming can lead to bonding social capital, defined by strong ties and social support is less clear. Trepte, Reinecke and Jutchems (2011) investigated online gaming and social capital, specifically whether online social capital acquired through gaming transfers offline. They found that among online e-sports players, gaming fostered both bonding and bridging social capital, and that both measures of social capital predicted offline social support. They conclude that online gaming can build social connections, especially if these ties extend into offline activities. Zhong (2011) found similar results in a study of

Chinese gamers, finding that online gameplay fosters bonding and bridging social capital, although this did not translate into offline social capital.

Cole and Griffiths' (2007) study of gamers from 45 countries found MMORPG players to be involved in a highly interactive online environment, where they met lifelong friends and partners for the first time. In fact, two fifths of players said they could discuss sensitive issues that they would not discuss with offline friends. Similarly, Yee's (2006) study of MMORPG players found that among players under 18, roughly half stated that friendships they had made through online gameplay were comparable or better in quality than their offline friendships. Cole and Griffiths (2007) speculate on the reasons for the closeness of online friendships, suggesting that these online gaming environments may be particularly valuable in allowing players to express themselves in ways they may not be comfortable with offline, due to appearance, ethnicity, gender, or age.

In a study comparing 'problematic' and 'non-problematic' MMORPG players, Collins & Freeman (2013) found differences in social capital between the two groups. The gamers who engaged in problematic gaming, which entailed compulsive or detrimental use, showed greater online social capital, but reduced offline social capital in comparison to non-gamers. By contrast, the 'non-problematic' gamers showed greater online social capital than non-gamers and no significant difference in offline social capital. It appears that gamers who had supportive relationships on and offline were less likely to engage in compulsive or detrimental play, whereas the problematic gamers were trapped in a pattern of increasingly heavy use. This pattern may be perpetuated by the fact that these gamers were receiving social support primarily online. In another study of gaming and social capital Perry et al. (2018) found that different types of relationships were linked to different types of social capital when playing with others online. Gaming with offline friends was associated with bonding social capital, gaming with strangers was associated with bridging social capital, and

gaming with online friends was associated with both bonding and bridging social capital. This emphasises the value of different forms of online connection and cautions against valuing 'real-life' friends over online ones.

Applying the interpersonal connections behaviour framework to both social media and gaming

Considering the research into potential harms and benefits of video gaming, it appears that possible risks are mediated by gameplay which connects gamers to others, whether through multiplayer gaming, a shared passion and community, or playing together with friends. Gaming together appears to convey a number of benefits, with gamers accruing bonding and bridging social capital, considering online friends to be as important as offline ones, seeking help from, and supporting their online friends. However, when gaming displaces other social activities or becomes a compulsive activity, perhaps compensating for pre-existing emotional difficulties, it is linked to poorer outcomes. This fits neatly with Clark, Algoe & Green's interpersonal-connections-behaviour-framework, where online behaviours that connect people with others are likely to result in positive outcomes, whereas behaviours that isolate people lead to worse outcomes.

The current study: A longitudinal analysis of social media use, gaming, and mental health outcomes in adolescents

The current study aims to test Clark, Algoe and Green's (2018) interpersonal-connections-behaviour-framework. This study will empirically test the framework in a field where its use is established (social media) and attempt to apply the framework to the field of gaming, where it has not been used before. The rationale for using the same framework for both technologies relates to the changing nature of video game use (i.e. an increase in social / networked gaming) and near ubiquity of gaming among adolescents. Social media has been extensively studied as a social environment, whereas gaming has not. In light of the rapid

increase of multiplayer gaming and gaming with others, video games should also be viewed as a social environment and a means to connect with others. Orben's (2020) review of adolescent technology use highlights several pitfalls of research in the field. Studies and reviews are limited by an undifferentiated focus on 'screen time', this conflates all digital technology use, regardless of purpose. It seems an outdated conceptualisation when adolescents will access various screens throughout the day, for the purpose of schoolwork, consuming TV and music, as well as to connect with others. In order to understand the effects of digital technologies we must be specific about which platforms we are interested in. Orben (2020) expands on this by suggesting that we must also consider different types of use of technologies of interest. For example, active or passive use of social media; individual or multiplayer gaming. It is important to move away from questions which assume social media and gaming are used in the same way by all users and move towards questions which consider the behaviours of users interacting with these technologies.

Digital technologies research is dominated by cross-sectional studies. This leads to an inability to infer causality in relationships between social media use or gaming and wellbeing. The effects of posting on Instagram may be very different after thirty minutes, to two weeks, or six months. Longitudinal research is vital to establish the sign and direction of relationships between social media, gaming, and adolescent wellbeing. Orben (2020) explains that where longitudinal studies do exist results are contradictory, but often show small negative relationships between social media use and wellbeing. However, similar effect sizes have also been found bi-directionally, with higher social media use leading to lower wellbeing and higher wellbeing leading to lower social media use (Wang, Gaskin, Rost & Gentile, 2017). Research must be open to exploring bi-directional relationships between digital technology use and wellbeing, and longitudinal research is required to do this.

The empirical study will use a representative sample of adolescents aged between 11 and 18. This demographic are known to be high frequency users of both social media and video gaming. Heavy usage of these technologies has been typical in the 2020-2021 period of the Covid -19 pandemic, where other forms of entertainment and connection have been inaccessible due to restrictions.

There are significant clinical implications of research considering social media and gaming and their associations with mental health and social outcomes. Key ideas such as 'FOMO', social comparison, displacement effects and addiction/problematic use could be useful in helping young people and adults in their lives to understand how technology might play a role in their wellbeing, and how to guide this in a positive direction. Further research is necessary to understand which ideas are most salient and how they might best be transmitted to young people.

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Part 2: Empirical paper

Abstract

In the context of rapid development of digital technologies and the COVID-19 pandemic, young people are increasingly socialising online. Concerns about time spent on social media and/or gaming are prominent in public discourse. These concerns commonly relate to young people's mental health, with the suggestion that high levels of social media and gaming use might contribute to poor mental health. However, some research indicates that social media and gaming use is associated with higher social connectedness and social capital. There is a lack of longitudinal research that investigates the relationship between social media use/gaming and mental health and psychosocial outcomes. This longitudinal study aims to explore these relationships in a sample of adolescents aged 11-18, across two time points. Regression analyses are used to explore associations between social media use and measures of depression, social connectedness, and social capital. The same analyses are also used to explore associations between time spent gaming and these variables. Findings indicate that higher social media use in particular is associated with lower social connectedness and higher

depressive symptomology, in both cross-sectional and longitudinal analyses. Findings for gaming use show weaker associations with depression and social variables.

Introduction

The rapid development of digital technologies continually prompts psychologists to investigate their impact on users. Social media (SM) and gaming media (GM) are two technologies at the centre of current debates around possible harms of such technology. In what Orben (2020) describes as the 'Sisyphean cycle of technology panics' new technologies elicit widespread concern as they result in changes to how people, and particularly young people, spend their time. These changes are attributed to the technology itself, with society having little power to divert its course; panic becomes politicised and prompts research into the latest technology, which Orben describes as 'wheel reinvention' as previous technology panics are left by the wayside. One of the problems with research conceived through these technology panics is the lack of theoretical underpinning, causing researchers to begin anew, as if the latest 'threat' is entirely new. Similar questions are posed, often around the potential for technology to cause addiction or to impact on aggression and mental health. This paper will explore the relationship between SM and video game use, and mental health, starting from a theoretical framework and mindful of pitfalls.

Social media, gaming, and mental health

The discourse around potential harms of SM use is characterised by controversy in both the academic and public sphere. Touchpoints include COVID-19 lockdowns, which brought

social lives even more online; Frances Haugen's report of Facebook and Instagram's capacity for polarisation, addiction, and deleterious effects on mental health; and Netflix's 'The Social Dilemma' watched by approximately 100 million people, focussing again on addiction, polarisation, and adolescent mental health.

An examination of the research literature reveals a more nuanced picture, characterised by small effect sizes, mixed positive and negative effects on wellbeing, and unclear directions of causality (Ivie et al., 2020; Valkenburg, Meier & Beyens, 2022) Systematic reviews of adolescent SM use and mental health contain predominantly cross-sectional studies and have found small but statistically significant positive correlations between higher levels of SM use and higher levels of depressive symptoms (McCrae, Gettings & Purssell, 2017). A more recent review looking beyond time spent on SM (also including type of activity, investment, and addiction measures) found all domains were positively correlated with depression and anxiety (Keles, McCrae & Grealish, 2020). The authors note that many of these studies are limited as they do not consider important mediating or moderating variables. Further, the predominance of cross-sectional research means that the direction of relationship between SM use and mental health outcomes cannot be established.

Some research has identified positive outcomes associated with SM use, including perceived social support, opportunities for identity experimentation self-disclosure (see systematic review: Best, Mankeltow & Taylor, 2014). There is a body of evidence suggesting that SM use is associated with higher social capital; Ellison Steinfield & Lampe (2007) investigated Facebook use and social capital, finding that among American undergraduates Facebook use was associated with increased social capital and functioned both to keep in touch with old friends and to foster relationships with new peers. Facebook use also appeared to have a different relationship to social capital for different users; for students with lower self-esteem, greater Facebook use was associated with higher social capital than their peers who were high

in self-esteem. Further, some evidence suggests that for young people who might be vulnerable to social isolation SM use is more strongly associated with positive outcomes (e.g., socially anxious adolescents (Bonetti, Campbell and Gilmore, 2010; Laghi et al., 2013). This additional benefit of SM use for people who are more socially isolated or struggle with offline interactions has been labelled the social compensation or 'poor get richer' hypothesis (Laghi et al., 2013).

Debates in academic literature around GM have focussed more on fears of GM addiction and fears that 'violent' video games may cause an increase in real-life aggression. However, there is a smaller body of research focussed specifically on the impact of GM on mental health. One systematic review of GM and various health outcomes, including mental health, found that there is a 'fine line' between beneficial use and negative consequences of GM (John, Sharma & Kapanee, 2019). The authors suggest that up to five hours of GM is associated with social, educational, and mental health benefits, whereas more than five hours a week is associated with adverse outcomes among adolescents. A recent, pre-registered longitudinal study of adolescent use of 'violent' video games found that exposure to violent video games was not a risk factor for anxiety, depression, somatic symptoms, or ADHD two years later (Ferguson & Wang, 2021).

In fact, there is a growing body of work that focusses on the potential for GM to improve mental health. In their narrative review, Kowal et al. (2021) suggest mechanisms for beneficial video game play, emphasising GM as a way of producing positive emotion and immersive flow states, alleviating depressive symptoms as well as facilitating goal achievement and emotional regulation. This systematic review found that commercial video game play was associated and alleviating symptoms of anxiety and depression, both in the short term, and with consistent play. The authors note that in a global pandemic, a time of

increased social isolation and barriers to accessing mental health support, video games represent a source of potential connection to others and a source of positive emotion.

Digital technologies and social (dis)connection

In an attempt to make sense of how digital technologies, and in particular SM, may impact on mental health, theories of social connection and disconnection have emerged. The stimulation vs displacement hypothesis (Valkenburg and Peter, 2007) suggests that SM use might have beneficial outcomes where it stimulates social connections with others or might have negative outcomes if it displaces more valuable social interactions, implied to occur in 'real-life' (Kraut, 1998). Evidence supports both hypotheses, with Valkenburg and Peter (2007) finding that internet messaging positively predicted wellbeing via the mediators: time spent with friends and friendship quality. More recent research has explored the role of SM in connecting with friends and/or following and interacting with celebrities or online content creators. Baek, Bae and Yang (2013) found that interacting with friends online was negatively correlated with loneliness, whereas interacting with celebrities or content creators, in what they call a 'parasocial' relationship, was positively correlated with loneliness.

SM use can both stimulate connection and displace offline connection with friends; therefore, it is important to consider how the behaviours of users may lead to either outcome, i.e., *how* SM use may connect or disconnect its users. The interpersonal-connections-behaviour-framework (ICBF) (Clark, Algoe & Green, 2018) attempts to capture this by suggesting that SM use involving behaviours that connect users to others, resulting in belongingness and acceptance, is good for wellbeing; see Tibber and Silver (2022) also. In contrast, when SM use is characterised by behaviour that does not promote connection (or indeed actively leads to a sense of *dis*connection), it can have a negative impact on wellbeing.

The ICBF may also be relevant to the experiences of gamers. Thus, research focusing on addiction and isolation suggests that GM may be associated with social disconnection. The inclusion of GM disorder/Internet GM disorder in ICD-11 and Section 3 of the DSM-V (American Psychiatric Association, 2013; World Health Organization, 2018) demonstrate concerns about the time young people spend GM, displacement of other activities and a dependent, compulsive style of play. Further, some research does indicate that video game play is associated with lower friendship quality and smaller friendship circles, although this does not point to a direction of causality (Lo, Wang & Fang, 2005; Kowert, Domahidi, Festl & Quant, 2014).

In their study of adolescent gamers, Colder-Carras et al. (2017) identified groups of gamers, using latent class analysis (LCA), a statistical technique used to identify qualitatively different groups within populations that often share certain characteristics. LCA identified two classes of heavy gamers, the first engaging in high levels of online social interactions and the second engaging in little social interaction. Even with high levels of use, these 'social gamers' showed low levels of 'problematic' GM symptoms. Male 'social gamers' were lower in social anxiety than their non-social counterparts, and female social gamers were lower in both social anxiety and loneliness. Colder-Carras et al. concluded that gamers can spend extensive time in virtual worlds whilst still being socially connected to others. This research highlights the role of social connection as a potential mediator between high levels of GM and mental health outcomes. Thus, those who are heavy gamers and highly connected may be protected from negative outcomes, whilst those who are not 'social gamers' (assuming a direction of causality) may use GM in a way which is isolating with potential negative consequences for their mental health.

With the explosion of networked GM, enabling play with offline friends, online friends and strangers, GM should no longer be viewed as a solitary activity. In fact, online GM is a social

endeavour. Gamers who play together, sharing positive experiences and completing achievements together, exemplify the capacity for GM to foster social connection. Vella, Johnson, & Mitchell (2016) interviewed male social gamers to determine if GM was used as a means of social support. They found that the men interviewed formed new social connections and gained support from these, as well as developing trusted relationships that deepened through gameplay. The interviews showed examples of help seeking and help offering between players, often occurring within the context of MMORPGs (massively multiplayer online replaying games), which are commonly associated with heavy use and the potential for addiction in GM literature (Hussain, Griffiths & Baguley, 2012). Research such as this emphasises the importance of considering GM as part of an online social world, with players part of digital communities.

The current study

The relative paucity of longitudinal research into the relationship between SM use, GM and mental health outcomes inspired this longitudinal study. Using a longitudinal design fulfils some but not all of the criteria for establishing causality: 1) Covariation/correlation (variables occur together) and 2) precedence, cause precedes effect (requires temporal component) and 3) the theoretical plausibility of the assumed causal relationship. It is not possible to exclude the possibility that associations are explained by variables not included in this study. Therefore, we are unable to prove causal relationships but may argue that certain statistical associations between SM, GM and mental health could be plausibly understood in causal terms.

To improve the ability to draw conclusions about the variables of interest, demographic variables (age and gender) and the use of the other technology (SM or GM) were controlled for in all regression analyses. The purpose of this was to separate any effects of the

explanatory variable of interest, and to prevent these other variables from becoming confounders that could bias the results. This is of particular importance when considering the separation of SM and GM use, in order to understand any specific effects of either technology.

This study focusses on SM and GM use among young people (defined broadly in this study by the sample age of 11-18) for several reasons. Firstly, because young people are heavy users of these technologies (Keeley & Little, 2017) and the first generation of 'digital natives' who have grown up with access to the internet and are familiar with digital technologies from an early age (Prensky 2001). They have also been the focus of considerable concerns around negative effects of technology use in this age group, with language in media reports skewed towards a negative and harm-focussed narrative (Stern & Odland, 2017). It is also of interest how these technologies interact with developmental processes, such as increased importance of social connection with peers in adolescence (Brown & Larson, 2009), as well as the incidence of mental health problems, particularly depression, where the first episode most commonly occurs in adolescence or young adulthood (Avenevoli et al., 2015).

The need for a framework to consider potential mediators of these relationships led to the consideration of Clark, Algoe & Green's (2018) interpersonal-connections-behaviour-framework. It accounts for the potential to both connect and disconnect users, suggesting social connectedness and social capital as potential mediators in the relationship between digital technologies and mental health. Due to smaller than anticipated sample size, and attrition between time points one and two, mediation analyses were not conducted as initially planned. The lack of three-wave data prevented the use of cross-lagged panel modelling to conduct longitudinal mediation analysis. Mediation analysis was not conducted on the two-wave data as the Baron & Kenny (1986) method has been shown to lack potency in samples

smaller than 500, similar problems are also evident in the Preacher & Hayes (2004) method. For a broader discussion of these limitations see Pardo & Roman (2013).

Instead, this study design pivoted towards an exploration of the relationships between SM use, GM and mental health and social variables, in the hope of better understanding whether social variables, and if so, which, might be important mediators in the purported relationship between digital technology use and mental health.

Aims

The project has four aims; to explore, in a sample of young people, the relationship between time spent:

1. using SM and depression.
2. using GM and depression.
3. using SM and social connection (social connectedness, social capital).
4. using GM and social connection (social connectedness, social capital).

Hypotheses

Hypotheses are divided into cross sectional (pertaining to data collected at time point one: T1) and longitudinal (including baseline T1 data and follow up data collected 6 months later: T2).

Cross-sectional SM hypotheses:

SM-H1: Time spent using SM at T1 will predict depression scores at T1 (primary outcome variable).

SM-H2: Time spent using SM will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness] (secondary outcome variables).

Cross-sectional GM hypotheses:

G-H1: Time spent GM at T1 will predict depression scores at T1 (primary outcome variable).

G-H2: Time spent GM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness] (secondary outcome variables).

Longitudinal SM hypotheses:

SM-H3: Time spent using SM at T1 will predict depression scores at T2.

SM-H4: Time spent using SM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness].

Longitudinal GM hypotheses:

G-H3: Time spent GM at T1 will predict depression scores at T2.

G-H4: Time spent GM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness].

Finally, for each hypotheses noted above, models were re-run whilst controlling for basic demographic variables (age, gender; multivariate model 1) and then a model was run controlling for just time spent using the *other* technology, i.e., SM or GM (multivariate model 2). In longitudinal analyses, models were also run controlling for baseline (T1) depression

and each social variable, for both SM and GM. As noted in the Methods, this enabled a more robust assessment of the relationship between these digital technologies and mental health/social variables.

Methods

Ethical approval

Ethical approval was granted by University College London (UCL) Research Ethics Committee (Ethics number: 17383/001; see Appendix 3).

Participants

Recruitment & Data collection

Participants were recruited from Years 7 to 12 in two secondary schools in London. Data was collected from two schools to capture a broader demographic and socioeconomic sample. The consent process had two stages: first, an opt-out parental consent stage, and second, an active student consent procedure. At time point one (T1), participants were also asked whether they would consent to being contacted in six months' time to complete the longitudinal follow up (T2).

Students and parents/carers were emailed information sheets regarding the study (Appendix 1) by participating schools. Parents/carers were also contacted to outline how they could opt-out of study participation on behalf of their child. Parents/carers were given a two-week window in which to opt-out of the study, such that their child would not be invited to participate (see Appendix 2).

At T1 the questionnaire was disseminated by email in September 2020. At this time most students had recently begun attending school in person following the March 2020 (COVID-

19) lockdown. Consenting students were sent a hyperlink by email, directing them to the information sheet, consent form and questionnaire, which were hosted by the REDCap (Research Electronic Data Capture) platform (Harris et al., 2009).

The full questionnaire was made up of both standardised, validated questionnaires and custom-written questions intended to gather demographic information and the information on SM and GM use. On the final page of the questionnaire, participants were asked if they had any concerns about their own, or someone else's well-being and could indicate that they would like to be contacted by a member of the school wellbeing staff. If they requested follow up, they were contacted within one week. This was put in place to manage any potential risk. Participants whose responses exceeded the clinical threshold on the Revised Children's Anxiety and Depression scale Major Depressive Disorder (MDD) (R-CADS; Chorpita et al., 2000) subscale were also identified. These scores were identified by members of the research team within 24 hours of questionnaire completion. Normative data, alongside consideration of participant's gender and age, was used to calculate the risk threshold for follow up (Chorpita et al., 2000).

This procedure was then repeated for T2; participants who had consented for 6 month follow up were contacted by email, inviting them to complete the full questionnaire for a second time. All participant identifiable data was stored on the UCL Data Safe Haven and password protected to maintain confidentiality. Unique identifiers were used to link participants in the anonymised databases and to identify participants to be contacted due to scoring above the clinical threshold or requesting follow up. All Participants were provided with a list of resources including information about maintaining wellbeing, signposting to further resources and emergency and crisis services.

I joined the project during the first wave of data collection, following ethics approval. I was therefore involved with creating the online questionnaire, monitoring responses for risk or follow up requests, and then for the entire procedure when repeated at T2.

Demographics

Demographic information including gender, ethnicity, date of birth and school year was collected.

Measures

Data collection included demographics, SM and GM use, mental health, and psychosocial outcome measures (full survey included in Appendix 4).

SM use

To investigate SM use, standardised questionnaires frequently used in SM research were administered. These were adapted to enable the inclusion of the broad range of SM platforms used, rather than focussing on individual platforms such as Facebook. Previous research has tended towards individual platform focus (Rains & Brunner, 2015; Sigerson & Cheng 2018). Adaptions included substituting the word "Facebook" with "SM" as used by Raudsepp & Kais (2019).

Participants were asked: (1) if they used SM, and if not, to indicate why, (2) to record up to three SM platforms they used most frequently, and (3) approximately how much time per day, as an average across the past week, they had spent on SM (less than 10 minutes, 10-30 minutes, 31-60 minutes, 1- 2 hours, 3-5 hours or more than 5 hours).

Social capital

Online and offline social capital was measured using a version of the Internet Social Capital Scale (ISCS; Williams, 2006). This measure was adapted by the research team to include

questions worded to prime participants to consider relationships they build online through SM use (replacing the word 'online' with 'on SM'). This adapted version of the ISCS also includes a measure of offline social capital, which replaced phrases such as 'on SM' with 'offline'. Items from the online measure include: "there are people who I interact with on SM who I trust to solve my problems" whereas the offline measure states "there are people who I interact with offline who I trust to solve my problems". The ISCS and the adapted offline SCS measure use a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree), where higher scores indicate higher social capital.

The full questionnaire, including both online and offline scales is made up of two further subscales, each with five items measuring bonding social capital and five measuring bridging social capital. The ISCS is a commonly used measure of social capital, with over 90% of studies using this version since its publication (Appel et al., 2014). A similar adaption used by Ahn (2012) showed good internal consistency for both bonding and bridging subscales (Cronbach's alpha 0.89 and 0.72 respectively) when used in a study with young people aged 12-18. Reliability analyses undertaken indicated there was acceptable internal consistency for both the online (Cronbach's $\alpha = .75$) and offline measure (Cronbach's $\alpha = .73$).

Social Connectedness

Social connectedness was measured using the Social Connectedness Scale – Revised (Lee & Robbins, 1995), this was used to measure the degree to which SM users feel connected to others in their social environment. It uses twenty items, ten related to positive perceptions and ten related to negative perceptions. Items are rated on a six-point Likert scale from 1 (strongly agree) to 6 (strongly disagree). The scale shows strong internal consistency (Chronbach's alpha of 0.91) and stability (test-retest correlation of 0.96). A similar scale was used by Grieve et al. to investigate online and offline social connectedness in an adult

population. Reliability analyses indicated that there was good internal consistency for this measure (Cronbach's α = .80).

Depression

To measure depression, the Major Depressive Disorder (MDD) subscale of the Revised Children's Anxiety and Depression Scale (R-CADS; Chorpita et al., 2000) was used. As part of a larger study, the Generalised Anxiety disorder (GAD) and Social Phobia (SP) subscales were also administered. Designed to evaluate the mental health of young people aged 8-18, the MDD subscale is consistent with the Diagnostic and Statistical Manual (DSM) diagnostic criteria for MDD (Chorpita et al., 2000).

The RCADS, (including MDD subscale) has shown good reliability and validity in clinical and non-clinical samples. It has shown good convergent and discriminant validity, as well as high internal consistency and test-retest reliability (Chorpita et al., 2000; Kosters et al. 2015). The MDD subscale is made up of ten items rated on a four-point Likert scale, from 0 (never) to 3 (always), with higher scores indicating higher symptomatology. Analyses of reliability showed good internal consistency for the MDD subscale in this study (Cronbach's α = .88)

Data analysis

Data distribution

Data were analysed using JASP/R version (JASP Team 2022). Descriptive statistics and measures of normality, including skewness and kurtosis, were conducted. Values of skewness and kurtosis were within acceptable ranges (+2/-2) for all variables (George & Mallory, 2010). Scatterplots were used to identify any significant outliers and to check linearity. Several variables violated assumptions of normality as indicated by Shapiro-Wilk tests; however, regression analyses do not require normally distributed variables, rather normally distributed errors. Assumptions for regression analyses were checked, including

homoscedasticity, independence of errors and distribution of residuals. The independence of errors was checked using the Durbin-Watson test which was non-significant for all analyses. Regression analyses were also checked for multicollinearity using the variance inflation factor (VIF) and all values were within the acceptable range. Q-Q plots and histograms were used to check normality of residuals. When running regression analyses, Q-Q plots and histograms of residuals indicated that the errors for the MDD variable were not normally distributed. This variable was transformed using a square-root transformation, which resulted in normally distributed errors.

SM and GM indicators were assumed to be linear for the purpose of regression analyses, as described in recommendations by Pasta (2009). Separate analyses were also run with these variables coded as ordinal. As data are easier to interpret with linear predictors and the findings were consistent across approaches, data from ordinal analyses are presented in Appendix 5.

Results

Missing data

The parents of 51 children requested that they opt out of the study. 1282 pupils were contacted for participation. Of these, 443 initiated and 162 completed the full questionnaire at T1 and formed the basis of T1 (complete case) analyses. Of these, only 142 used SM (see Figure 1). At T2, the 162 pupils who had completed the T1 questionnaire were contacted for participation at T2. Of these, 58 completed the full T2 questionnaire, and formed the basis of longitudinal analyses.

Following completion of the questionnaire seven pupils (4.9%) requested contact with school wellbeing support, and a further 14 (8.6%) scored above the risk threshold for the MDD

subscale of the RCADS (Chorpita et al., 2000). These pupils were contacted by the wellbeing team for support and/or signposting. A risk assessment was completed with all students scoring above the threshold or requesting follow up.

Figure 1

Flow chart to demonstrate study participation and attrition in questionnaire completion.

T1	T2
443 participants clicked the hyperlink to access the questionnaire	86 participants clicked the hyperlink to access the questionnaire
↓	↓
203 completed the demographic questions	70 completed the demographic questions
↓	↓
184 completed questions regarding their digital screen use	67 completed questions regarding their digital screen use
↓	↓
162 participants completed the full questionnaire at T1	58 participants completed the full questionnaire at T2

Sample size

A common 'rule of thumb' for regression analysis is that samples must comprise a minimum of 10 observations for each independent variable (Harrell et al. 1984). For the cross-sectional analyses (T1 data), given 4 independent variables (Time spent using SM, time spent GM, Age, and Gender) the sample of 141 participants meant that regression analyses were appropriate. For the longitudinal analyses (T1 and T2 data), given 5 independent variables (SM, time spent GM, Age, Gender, and baseline MDD score) the sample of 58 participants meant that regression analyses were appropriate.

Descriptive statistics

The median age of participants at T1 was 13.52 (interquartile range = 2.90), the ratio of female to male participants was 1.41 (93 females to 66 males; 2 unspecified). The majority of participants recorded their ethnicity as White (56.8%), with the second largest group recording their ethnicity as Asian (14.8%). Most of the young people sampled were users of SM (87.7% at T1 and 87.9% at T2). The majority of participants spent between 1-2 hours each day on SM (29%). Among participants who reported they did not use SM, common reasons included that they were "not allowed", did "not enjoy or want to use it", or it "took up too much time". The median value for depression (MDD score) at T1 (N = 162) was 6.00.

Table 1

Descriptive statistics of SM users and full sample.

Note: Data are shown for a full sample of 162 participants, as well as a reduced sample of SM users (N=142). IQR = Inter-quartile range.

Variable		Users of SM (N = 142)	Full Sample (N = 162)
Age, Median (IQR)		13 (3)	13 (3)
Year Group, N (%)	7	26 (18.31)	33 (20.37)
	8	26 (18.31)	33 (20.37)
	9	27 (19.01)	32 (19.75)
	10	19 (13.38)	19 (11.72)
	11	17 (11.97)	17 (10.49)
	12	27 (19.01)	28 (17.28)
Ethnicity, N (%)	White	81 (57.04)	92 (56.79)
	Mixed	19 (13.38)	23 (14.20)
	Asian	21 (14.80)	24 (14.82)
	Black	8 (5.63)	10 (6.17)
	Other	12 (8.45)	12 (7.41)
	Prefer not to say	1 (0.70)	1 (0.62)
Gender, N (%)	Male	58 (40.85)	66 (40.74)
	Female	81 (57.04)	93 (57.41)
	Prefer not to say	2 (1.41)	2 (1.24)
	Other	1 (0.70)	1 (0.62)
MDD Score, Median (IQR)		6.5 (7)	6.00 (7)

Table 2

Descriptive statistics of SM and GM use

Variable		
User of SM, N (%)	Yes	142(87.7)
	No	20 (12.3)
Total number of SM platforms used, mean (SD)		3.33 (1.79)
Daily time on SM, N (%)	Less than 10 minutes	7 (4.32)
	10 – 30 Minutes	28 (17.28)
	31 – 60 Minutes	35 (21.61)
	1 - 2 Hours	47 (29.01)
	3 – 5 Hours	19 (11.73)
	More than 5 Hours	6 (3.70)
GM, N (%)	Yes	106 (65.43)
	No	56 (34.57)
Daily time spent GM, N (%)	Less than 10 minutes	17 (16.04)
	10 – 30 Minutes	37 (34.91)
	31 – 60 Minutes	25 (23.59)
	1 - 2 Hours	19 (17.92)
	3 – 5 Hours	4 (3.77)
	More than 5 Hours	4 (3.77)
Social Capital, Median (IQR)	Online	26 (6.00)
	Offline	32 (5.00)
Social Connectedness, Median (IQR)		41 (9.00)

Correlations

Bivariate associations between variables of interest were measured using Spearman's rho.

Analyses showed that higher SM use was associated with higher major depression score

($rs_{(140)}$ = .44, p < .001). Higher SM use was also associated with higher online social capital

$rs_{(140)} = .33$, $p < .001$. However, spending more time on SM was associated with lower offline social capital $rs_{(140)} = -.18$, $p < .05$ and with lower social connectedness $rs_{(140)} = -.35$, $p < .001$.

Spending more time GM was also associated with higher major depression score $rs_{(140)} = .21$, $p < .05$ and with higher online social capital $rs_{(140)} = .19$, $p < .05$. Similar to the SM use data, time spent GM was associated with lower offline social capital $rs_{(140)} = -.25$, $p < .01$.

When examining associations between depression scores and the social variables, there was a moderate negative relationship between depression scores and offline social capital $rs_{(140)} = -.41$, $p < .001$, and social connectedness $rs_{(140)} = -.60$, $p < .001$. There was also a small but significant positive relationship between online social capital and depression score $rs_{(140)} = .22$, $p < .05$.

Table 3

Spearman's correlations between main variables of interest, *p>.05, **p>.01, ***p>.001

	Time on SM	Time GM	MDD score	Online Social capital	Offline Social capital	Social connectedness
Time on SM	1					
Time GM	0.24*	1				
MDD Score	0.44***	0.21*	1			
Online Social Capital	0.33***	0.19*	0.22*	1		
Offline Social capital	-0.18*	-0.25**	-0.41***	0.09	1	
Social Connectedness	-0.3***	-0.04	-0.56***	-0.19*	0.41***	1

Regression models (cross-sectional analyses)

A number of regression models were run, with both time spent using SM and GM as the predictors of depression and social outcome variables. To simplify the explanation of which variables were included in regression models, see tables below. Coefficients for these models are shown in Tables 6 and 7. The same models were used for GM as the primary predictor variable.

Table 4

Table showing the three regression models used to address SM-H1

SM-H1	Model 1	Model 2	Model 3
Time spent using SM at T1 will predict depression scores at T1.	MDD score regressed onto SM use.	MDD score regressed onto SM use, controlling for Age and Gender.	MDD score regressed onto SM use, controlling for GM use.

Table 5

Table showing the regression models used to address SM-H2

SM-H2	Model 1	Model 2	Model 3
Time spent using SM will predict (a) online social capital.	(a) online social capital regressed onto SM use.	(a) online social capital regressed onto SM use, controlling for Age and Gender.	(a) online social capital regressed onto SM use, controlling for GM use.
Time spent using SM will predict (b) offline social capital.	(b) offline social capital regressed onto SM use.	(b) offline social capital regressed onto SM use, controlling for Age and Gender.	(b) offline social capital regressed onto SM use, controlling for GM use.
Time spent using SM will predict (c) social connectedness.	(c) social connectedness regressed onto SM use.	(c) social connectedness regressed onto SM use, controlling for Age and Gender.	(c) social connectedness regressed onto SM use, controlling for GM use.

SM-H1: Time spent using SM at T1 will predict depression scores at T1 (primary outcome variable).

Cross-sectional associations between SM use and the primary outcome variable depression (MDD Score) were investigated (Table 6). First, MDD scores were regressed onto SM use indicators. Following this, two multivariate models were run: the first with age and gender added (Multivariate model 1), and the second with just time spent GM included (Multivariate model 2). These additional models were run to determine whether any effects persisted after controlling for demographic variables as well as use of the other digital technology. Univariate linear regression of MDD scores on time spent on SM use indicated a significant positive association ($F_{(1, 140)}$= 35.45, p<.001) and explained 20.2% of the variance in MDD scores. This effect persisted after controlling for demographics (coefficient = 0.42, CI 0.24, 0.51 p < .001) and also when controlling for GM use (coefficient = 0.37, CI 0.28, 0.56, p <.001) see Table 6).

SM-H2: Time spent using SM will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness] (secondary outcome variables).

Cross-sectional associations between SM use and secondary outcome variables were also investigated. These variables –grouped as 'social variables'- included social capital (online and offline) and social connectedness (Table 6).

Univariate linear regression of *online* social capital on time spent using SM indicated a significant positive association $F_{(1, 140)}$ =15.12, p <.001, and explained 9.7% of the variance in online social capital scores. This result survived after controlling for demographics (coefficient = 0.97, CI: 0.33, 1.60, p= 0.003) and GM use (coefficient = 1.17, CI: 0.56, 1.79, p <.001).

Regression of SM use on *offline* social capital indicated a significant negative association between time spent using SM and offline social capital $F_{(1, 140)} = 3.91$, p=0.05, with SM use explaining 2.7% of the variance in offline social capital This result was on the threshold of significance and should therefore be interpreted with caution. It remained significant after controlling for demographics (coefficient= -0.69, CI: -1.26, -0.11, p = 0.02), but did not survive after controlling for GM use (coefficient= -0.34, CI: -0.88, 0.21, p = 0.23)

Regression of social connectedness on time spent using SM indicated a significant negative association $F_{(1, 140)} =18.14$, p < .001 with SM use explaining 11.5% of the variance in social connectedness. This survived after controlling for demographics (coefficient= -2.02, CI: -3.10, -0.95, p<.001), and GM use (coefficient= -1.99, CI: -3.38, -0.47, p = 0.01).

G-H1: Time spent GM at T1 will predict depression scores at T1 (primary outcome variable).

Following analyses of the association between SM use and outcome variables, regression analyses were used to investigate the relationship between GM and the same mental health and social outcome variables (Table 5).

Univariate linear regression of MDD score on time spent GM indicated a significant positive association $F_{(1, 104)} = 8.72$, p= 0.004, with time spent GM explaining 7.7% of the variance in MDD scores.

This effect persisted after controlling for age and gender (coefficient= 0.28, CI: 0.10, 0.45, p = .002). However, the association between GM and MDD score did not survive after controlling for SM use (coefficient = 0.12, CI: -0.05, 0.28, p=0.169; see Table 7, multivariate model 2).

G-H2: Time spent GM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness] (secondary outcome variables).

Next, the cross-sectional associations between GM use and secondary outcome variables were investigated, i.e., 'social variables' including social capital (online and offline) and social connectedness (Table 7).

Univariate linear regression of GM use on *online* social capital indicated that time spent GM was not significantly associated with online social capital $F_{(1, 104)} = 3.73$, p = 0.06.

With respect to *offline* social capital, there was a significant negative association between time spent GM and offline social capital $F_{(1, 104)} = 10.18$, p = 0.002, with time spent GM explaining 8.9% of the variance in offline social capital score. This survived after controlling for demographics (coefficient = -0.90, CI: -1.47, -0.32, p= 0.003) and SM use (coefficient= -0.93, CI: -1.58, -0.29, p=0.005).

Finally, time spent GM was not significantly associated with social connectedness, $F_{(1, 104)}$= 0.90, p = 0.35.

Table 6

Regression analyses showing the regression of T1 outcome variables: MDD score, social connectedness, and online/offline social capital on SM use. Values in bold indicate significant predictors.

Note: Multivariate model 1 controls for age and gender, whereas multivariate model 2 controls for GM use.

	Depression			Social connectedness			Online Social capital			Offline social capital		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value
Univariate model: SM use	**0.39**	**0.26, 0.52**	**<.001**	**-2.17**	**-3.18, -1.16**	**<.001**	**1.17**	**0.58, 1.77**	**<.001**	**-0.55**	**-1.09, -0.81**	**0.05**
Multivariate model 1: controlling for Age and gender	**0.42**	**0.28, 0.56**	**<.001**	**-2.02**	**-3.10, -0.95**	**<.001**	**0.97**	**0.33, 1.60**	**0.003**	**-0.69**	**-1.26, 0.11**	**0.02**
Multivariate model 2: controlling for GM use	**0.37**	**0.24, 0.51**	**<.001**	**-1.99**	**-3.38, -0.47**	**0.010**	**1.17**	**0.56, 1.79**	**<.001**	-0.34	-0.88, 0.21	0.23

Table 7

Regression analyses showing the regression of T1 outcome variables: MDD score, social connectedness, and online/offline social capital on GM use. Values in bold indicate significant predictors.

Note: Multivariate model 1 controls for age and gender, whereas multivariate model 2 controls for SM use.

	Depression			Social connectedness			Online Social capital			Offline social capital		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value
Univariate model: GM use	**0.25**	**0.08, 0.41**	**0.004**	-0.59	-1.82, 0.64	0.345	0.73	-0.02, 1.48	0.056	**-0.94**	**-1.52, -0.36**	**0.002**
Multivariate model 1: controlling for Age and gender	**0.28**	**0.10, 0.45**	**0.002**	-0.80	-2.01, 0.41	0.192	0.84	0.09, 1.60	0.059	**-0.90**	**-1.47, -0.32**	**0.003**
Multivariate model 2: controlling for SM use	0.12	-0.05, 0.28	0.169	-0.01	-1.36, 1.33	0.986	0.01	-0.72, 0.74	0.972	**-0.93**	**-1.58, -0.29**	**0.005**

Regression models (longitudinal analyses)

For longitudinal analyses, baseline measures of time spent using SM and GM were analysed

as predictors of depression and social variables at time point two (T2), six months after

baseline measurement. For clarity, the tables below demonstrate which variables were

included in each regression model for each hypothesis. The same analysis was repeated with

GM as the primary predictor variable. Coefficients for these models are shown in Tables 10

and 11.

Table 8

Tables showing regression models used to address SM-H3

SM-H3	Model 1	Model 2	Model 3	Model 4
Time spent using SM at T1 will predict depression scores at T2.	SM use regressed onto T2 MDD score.	SM use regressed onto T2 MDD score, controlling for Age and Gender.	SM use regressed onto T2 MDD score, controlling for GM use.	SM use regressed onto T2 MDD score, controlling for T1 MDD score.

Table 9

Table showing regression models used to address SM-H4

SM-H4	Model 1	Model 2	Model 3	Model 4
Time spent using SM at T1 will predict (a) T2 online social capital.	SM use regressed onto (a) T2 online social capital.	SM use regressed onto (a) T2 online social capital, controlling for Age and Gender.	SM use regressed onto (a) T2 online social capital, controlling for GM use.	SM use regressed onto (a) T2 social capital, controlling online soci
Time spent using SM will predict (b) T2 offline social capital.	SM use regressed onto (b) T2 offline social capital.	SM use regressed onto (b) T2 offline social capital, controlling for Age and Gender.	SM use regressed onto (b) T2 offline social capital, controlling for GM use.	SM use regressed onto (b) T2 social capi controlling offline soc
Time spent using SM will predict (c) T2 social connectedness.	SM use regressed onto (c) T2 social connectedness.	SM use regressed onto (c) T2 social connectedness, controlling for Age and Gender.	SM use regressed onto (c) T2 social connectedness, controlling for GM use.	SM use regressed onto (c) T2 connectedn controlling social conn

SM-H3: Time spent using SM at T1 will predict depression scores at T2.

First, the relationship between SM use at T1 and MDD score at T2 was investigated to establish whether cross-sectional findings were replicated, and to attempt to establish causality. Univariate linear regression of MDD at T2 on SM use at T1 indicated that time using SM was a significant positive predictor of T2 MDD scores $F_{(1, 49)} = 5.74$, p= 0.02, and explained 10.5% of the variance in MDD scores. This effect persisted after controlling for demographics (coefficient = 0.30, CI: 0.04, 0.57, p= 0.03) and then for GM use (coefficient = 0.24, CI 0.01, 0.47, p= 0.04; see Table 10).

Controlling for baseline MDD score to investigate change in the depression variable. To attempt to establish whether differences in SM use might explain changes in depression over time, the relationship between time spent on SM and depression scores was analysed, controlling for baseline MDD score.

Time using SM at T1 was no longer a significant predictor of T2 MDD score after controlling for T1 (baseline) MDD score (coefficient = 0.04, CI: -0.17, 0.25, p= 0.73).

SM-H4: Time spent using SM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness].

Following longitudinal analyses of the primary outcome variable (depression) the relationship between SM use at T1 and social outcomes at T2 was analysed (Table 10).

Univariate linear regression of online social capital scores at T2 on SM use at T1 indicated that time using SM at T1 was a significant positive predictor of T2 online social capital scores $F_{(1, 49)} = 8.01$, p= 0.01, and explained 14% of the variance in online social capital scores. This result survived when controlling for demographics (coefficient =2.71, CI 1.16, 4.25, p<.001) and GM use (coefficient = 1.95, CI: 0.55, 3.36, p= 0.01)

Regression of T2 offline social capital scores on T1 SM use indicated that time using SM at T1 was not a significant predictor of T2 offline social capital score $F_{(1, 49)} = 3.37$, p= 0.073.

Regression of SM use at T1 on Social Connectedness score at T2 indicated that time using SM was a significant negative predictor of T2 Social connectedness $F_{(1, 49)} = 4.91$, p= 0.031 and explained 9.1% of the variance in T2 Social connectedness scores. This result survived when controlling for demographics (coefficient = -2.48, CI -4.63, -0.32, p= 0.025), but did not survive when controlling for GM us (coefficient = -1.90, CI: -3.83, 0.02, p= 0.053)

Controlling for baseline social variables.

Regression models were also run controlling for T1 social connectedness, online social capital, and offline social capital. When T1 online social capital was controlled for, time spend using social media was no longer a significant predictor of T2 online social capital (coefficient = 0.43, CI: -0.31, 2.57, p= 0.121). When T1 social connectedness was controlled for, time spent using social media was no longer a significant predictor of T2 social connectedness (coefficient = -0.04, CI:-1.41, 1.33, p= 0.955)

G-H3: Time spent GM at T1 will predict depression scores at T2.

Following analyses of the longitudinal relationship between T1 SM use and T2 outcome variables, regression analyses were used to investigate the longitudinal relationship between T1 GM and the same mental health and social outcome variables at T2 (Table 7). Regression of T2 MDD score indicated that time spent GM was not a significant predictor of depressive symptomology $F_{(1, 33)} = 0.90$, p= 0.35.

G-H4: Time spent GM at T1 will predict social variables [(a) online social capital, (b) offline social capital, and (c) social connectedness].

Regression of social variables at T2 on time spent GM revealed that GM was not a significant predictor of social connectedness $F_{(1, 33)} = 1.14$, p= 0.21 or social capital (online: $F_{(1, 33)} = 1.95$, p= 0.17; offline: $F_{(1, 33)} = 0.32$, p = 0.58; see table 7).

Table 10

Regression analyses showing the regression of T2 outcome variables: MDD score, social connectedness, and online/offline social capital on SM use at T1. Values in bold indicate significant predictors.

Note: Multivariate model 1 controls for age and gender, whereas multivariate model 2 controls for GM use. Multivariate model 3 controls for the baseline (T1) outcome variable: Depression, Social connectedness and online/offline social capital.

	Depression			Social connectedness			Online Social capital			Offline social capital		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	P value
Univariate model : SM use	**0.26**	**0.04, 0.48**	**<.001**	**-1.99**	**-3.80, -0.19**	**0.031**	**1.86**	**0.54, 3.17**	**0.007**	-0.95	-1.99, 0.09	0.073
Multivariate model 1: controlling for Age and gender	**0.30**	**0.04, 0.57**	**0.003**	**-2.48**	**-4.63, -0.32**	**0.025**	**2.71**	**1.16, 4.25**	**<.001**	**-1.61**	**-2.84, -0.38**	**0.011**
Multivariate model 2: controlling for GM use	**0.24**	**0.01, 0.47**	**0.043**	-1.90	-3.83, 0.02	0.053	**1.95**	**0.55, 3.36**	**0.010**	-0.60	-1.66, 0.46	0.263
Multivariate model 3: controlling for T1 outcome variable	0.04	-0.17, 0.25	0.731	-0.04	-1.41, 1.33	0.955	0.43	-0.31, 2.57	0.121	-0.61	-1.42, 0.20	0.135

Table 11

Regression analyses showing the regression of T2 outcome variables: MDD score, social connectedness, and online/offline social capital on GM use at T1.
Values in bold indicate significant predictors.
Note: Multivariate model 1 controls for age and gender, whereas multivariate model 2 controls for SM use. Multivariate model 3 controls for the baseline (T1) outcome variable: Depression, Social conncectedness and online/offline social capital.

	Depression			Social connectedness			Online Social capital			Offline social capital		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	P value
Univariate model: GM use	0.15	-0.17, 0.47	0.351	-0.75	-2.55, 1.05	0.409	1.28	-1.02, 3.59	0.271	-0.65	-3.01, 1.71	0.584
Multivariate model 1: controlling for Age and gender	0.19	-0.17, 0.55	0.288	-1.20	-3.03, 0.68	0.205	0.60	-1.66, 2.87	0.597	-1.20	-3.583 1.19	0.320
Multivariate model 2: controlling for SM use	0.06	-0.29, 0.47	0.610	-0.21	-2.07, 1.53	0.764	-0.29	-1.60, 1.02	0.663	-1.48	-3.36, 0.39	0.115
Multivariate model 3: controlling for T1 outcome variable	-0.05	-0.37, 0.27	0.76	-0.12	-1.69, 1.46	0.88	0.41	-2.65, 3.46	0.79	1.36	-2.36, 5.09	0.46

Discussion

This study aimed to explore the relationships between time spent using SM/GM, depression, and social variables. Specifically, it explored whether time spent using SM/GM predicts depression and social capital / connectedness, both in cross-sectional and longitudinal analyses, to establish whether SM and GM meet some of the prerequisites for causality: i.e., covariation/correlation, and precedence. All univariate analyses were followed by multivariate regression analyses, controlling for demographic variables: age and gender; and use of the other technology, in order to separate any effects of the explanatory variable of interest, and to prevent these other variables from becoming confounding variables.

Broadly, the results of this study suggest that SM use in particular is associated with positive and negative outcomes, as suggested by the ICBF.

With respect to SM hypotheses and depression, SM-H1 was supported in the cross-sectional analyses. Young people who used SM for longer reported greater depressive symptomatology, after controlling for age, gender, and time spent GM. SM-H2 was partially supported: spending more time on SM predicted higher online social capital, but lower offline social capital and lower social connectedness.

If we assume a direction of causality running from SM use to our outcome variables (more on this below), these findings are broadly consistent with the displacement theory (Kraut et al., 1998), in suggesting that whilst *online* social capital may increase as a result of SM use, *offline* social capital and a sense of connectedness to others (more generally) may decrease. Interestingly, all of these findings survived after correction controlling for demographics and GM use, with the exception of *offline* social capital, which did not survive correction for GM use. One interpretation of this, is that whilst high levels of SM may displace *offline* social capital, the finding may not be specific to SM use *per se but* may instead reflect a more

general association with time spent online. However, once again, this all assumes a particular direction of causality.

With respect to GM, GM-H1 was supported in cross sectional analyses. Young people who spent more time GM showed greater depressive symptomatology when controlling for age and gender; however, this effect did not survive when SM use was controlled for. This suggests that SM use, rather than GM, may be driving this association with depression.

GM-H2 was also (partially) supported in cross sectional analyses; thus, time spent GM was not a significant predictor of *online* social capital, but was a significant predictor of *offline* social capital, with young people who spent more time GM scoring lower on offline social capital. After controlling for demographic variables and other technology use, the association between GM and offline social capital survived. Although causality cannot be established here, these findings indicate the possibility that GM may not create the same opportunities for building online social capital that SM does, but may demonstrate some of the same pitfalls, for example: heavy gamers spending less time socialising offline (consistent with the displacement hypothesis).

Moving on to the longitudinal analyses, SM-H3 was supported: young people who spent more time using SM showed higher depressive symptomatology six months later, this effect survived after controls. However, SM-H4 was not supported, when controlling for baseline depression score, time spent GM was no longer a significant predictor of depression at T2. This suggests that although SM use is associated with depression, it may not be a causal factor in *change* in depressive symptomatology. This raises the possibility that the direction of causality may be reversed, i.e., young people with higher depressive symptoms spend more time on SM, or alternatively, that there may be a third variable confounder effect.

SM-H5 was partially supported: young people who spent more time using SM showed lower social connectedness six months later, this finding survived after controlling for demographic variables; however, it did not survive after controlling for GM or when controlling for baseline (T1) social connectedness. Assuming a direction of causality, this finding also lends support to a general displacement effect of these technologies, rather than something specific to SM, where increased time online leads to decreased social connection. Spending more time on SM predicted higher online social capital six months later but was not a significant predictor of offline social capital at T2. These findings survived after controlling for age, gender, and GM use.

Longitudinal GM hypotheses (GM-H3, GM-H4) were not supported. Time spent GM was not a significant predictor of depression six months later, or of social connectedness, and online/offline social capital. These findings further support the notion, that association between digital technology and outcomes may be more robust and/or pronounced with respect to SM use rather than with respect to GM. Indeed, whilst reported effect sizes were generally small ($R^2 \leq 0.2$), the largest effect was for the cross-sectional analysis with depression scores regressed onto SM use ($R^2 = 0.2$) This is broadly in keeping with findings in the field, which show consistently small effect sizes and a negative association between SM use and wellbeing (Orben, 2020). Alternatively, these findings could represent a Type 1 error, due to small sample size (N=58) at T2. For this reason, the longitudinal findings presented should be interpreted with caution.

Considering SM first, taken together the findings reported provide partial support for the ICBF. Thus, they are consistent with the disconnecting pattern of use, with time spent on SM predicting lower social connectedness, and higher depressive symptomatology in both cross-sectional and longitudinal analyses. The connecting pathway is also *partially* supported, as time spent on SM use was found to be associated with greater *online* social capital in both

cross-sectional and longitudinal analyses. The positive association with online social capital is consistent with a meta-analysis including samples of adolescents and adults (Liu et al., 2016), as well as Ahn's (2012) study of adolescents, which found that SM use was associated with greater bridging social capital. This study did not separate social capital into the two subscales (bonding and bridging) but found the same direction of relationship regardless.

It is important to note that despite time using SM being a significant predictor of higher depressive symptomatology at T2, SM did not emerge as a predictor of *changes* in depression (assessed by including baseline depression scores into analyses). As stated, this could reflect a reversed direction of causality, i.e., that young people higher in depressive symptoms may spend more time on SM, or alternatively, the possibility of a third variable effect. Indeed, there is evidence to suggest that young people with poorer wellbeing and/or those experiencing more difficulties socialising offline may use digital technologies to compensate for difficulties socialising offline and may also benefit more from resulting online social capital (Indian & Grieve, 2013); this is often referred to as the 'social compensation hypothesis' (Zywica & Danowski, 2008).

This support for the disconnection pathway is in keeping with previous research (Tibber, Zhao & Butler, 2020) investigating the relationship between SM use and self-esteem. This study indicated that the association between connecting patterns of use and wellbeing was less robust than that of disconnecting patterns of use and poorer wellbeing.

With respect to the application of the ICBF to GM, evidence is less supportive. Thus, time spent GM was not associated with depression when SM use was controlled for. Further, GM was not a significantly associated with *online* social capital. However, time spent GM was associated with lower *offline* social capital, suggesting a potential displacement effect. It is important to note that these are cross-sectional findings; thus, longitudinal analyses did not

indicate that GM was a significant predictor of depression or social variables. These findings are broadly consistent with those of Domahidi et al. (2018); in their investigation of social GM and social support they found no cross sectional or longitudinal relationship between GM online with friends and social support. For this reason, they argue against a displacement effect of GM. Here we show similar findings for social capital *as well as* depression.

The ICBF suggests that digital technologies have the ability to connect and disconnect, with potential consequences for wellbeing and mental health; with respect to GM, however, whilst there was some evidence for disconnection, there was none for connection. Despite this, spending more time GM did not appear to be a significant predictor of depression. This highlights the stronger associations with SM and depression/social outcomes, both positive and negative. One explanation for this could be the more explicitly social nature of SM, which may be more likely to interact with social/emotional processes. Nesi and colleagues particularly highlight how SM may facilitate negative social comparisons due to the visualness, publicness and availability of content which provides a detailed but curated image of others' lives (Nesi et al. a, 2018; Nesi et al. b, 2018). They also identify the capacity for reassurance and feedback seeking (Nesi & Prinstein, 2015), facilitated by the availability of others and quantifiable metrics (such as likes or comments).

Notably there was no significant association between GM and social connectedness; one possibility is that GM, with its potential to be both social and solitary activity, lacks the same capacity for social comparison, feedback seeking, cyber-ostracism, and FOMO that SM entails. Even social GM is commonly less organised around exchanging social content such as messages, video, or images, with these features often adjunct to collaborative or competitive gameplay mechanics.

The association between both time spent using SM and GM and lower offline social capital lends some support to the displacement theory (Kraut et al., 1998) of digital technologies, although longitudinal results did not show any causal link between either technology and offline social capital. It may be the case that the association between time spent using these technologies and offline social capital is explained by other variables, or that the sample size at T2 was too small to detect an effect.

This study did not find evidence supporting psychosocial benefits of GM, contrary to several reviews (Johnson, Jones, Scholes & Colder Carras, 2013; Raith et al. 2021; Kowal et al. 2021) spending time GM did not appear to build social capital or connectedness. Our findings appears at odds with reports of gamers, particularly during the pandemic, where quantitative self-report measures indicate that GM was an accessible and valuable means of socialising during covid-19 restrictions in (Ballard & Spencer, 2022). The apparent contradiction in reports of gamers using their hobby for connection during the pandemic, and an associated benefit to wellbeing may be explained by the variables considered in this study. During the 2020 COVID-19 lockdowns, loneliness was found to be the strongest predictor of depression (Palgi et al. 2020; Lee al. 2020) it is possible that GM may not have increased social capital (related more to social resources) or connectedness in this period but may offset loneliness for some gamers (Nebel & Ninaus, 2022). Implications of the Covid-19 pandemic on this research will be considered in detail further below.

The broad support for the disconnection pathway of digital technologies also has clinical implications for supporting young people. SM use in particular appears to be an important consideration in young people's mental health. Therefore, routinely asking young people about their SM use is vital to understand their experience of this online social world. Some authors have begun to suggest models of understanding SM/technology use and methods of promoting positive use (Tibber & Silver, 2022). These include considering how young people

engage with SM (whether it is habitual or purposeful), approach vs avoidance behaviours when using SM, and how SM may interact with cognitive biases. Tibber and Silver use a cognitive behavioural and acceptance and commitment therapy (ACT) based approach to help make links between the technology, individual and their behaviour, beginning to formulate SM use and wellbeing. Based on this, psychoeducation and SM literacy training could be an important part of interventions with young people, promoting purposeful use, of the kind which is most likely to fulfil belongingness and social connection needs. For a case study of how this might be applied, and proposed model, see Tibber & Silver (2022.)

Limitations

This study has several limitations: first, the relatively small sample size, particularly for longitudinal analyses. Due to attrition between T1 and T2, the longitudinal sample of children and adolescents who reported playing video games and completed T2 outcome measures was 58. This is a greatly reduced sample size from the planned sample; the COVID-19 pandemic prevented plans for data collection to be administered in schools, which would have resulted in a much larger sample size. Due to this, the longitudinal analyses of time spent GM should be interpreted with caution.

A second limitation is the fact that not all potentially confounding variables were controlled for. This decision was taken to ensure models were parsimonious and theoretically driven, however this does not rule out the fact that variables such as socio-economic status and parenting might be confounders. Theoretically, access to other valued activities, such as sports or hobbies and ability to travel to spent time with friends, may have an effect on the relationship between SM/GM use and wellbeing. Access to resources would determine whether SM/GM is a chosen activity or one of few available options. If SM/GM use is chosen from multiple available options it may be more intentional and active, and therefore a more positive experience.

A second limitation is how the SM use and GM variables were operationalised. This study only considered the *amount* of time spent using either technology rather than the different platforms used, or type of use. Recent reviews have called for a move away from only considering time spent on SM (Parry, 2022; Course-Choi & Hammond 2020). In both fields, there is considerably heterogeneity in different platforms and genres of games. Nesi et al. (2018) consider the differences between platforms in important aspects that may affect communication such as 'visualness' and 'asynchronicity' the extent to which the platform is image based (Instagram, snapchat) and the extent to which content can be sent and received instantaneously. Considering SM platforms as a homogeneous phenomenon precludes exploration of differential association with different platforms. There is evidence in SM research at least that different platforms are likely associated with different patterns of outcomes (Tibber, Wang & Zhang, 2022).

GM is also an incredibly heterogeneous media, with different genres involving competition, collaboration, or individual experiences. There is some survey evidence to suggest that GM alone and GM with others may interact differently with player wellbeing and social capital, with different predicts of wellbeing for social and solitary gamers (Vella, Johnson & Hides, 2015). The current study did not consider multiplayer GM or GM with others separately to individual GM; future research investigating GM with others vs. GM alone will therefore be instrumental to understanding the impact and correlates of social GM. As far as the author is aware, there are currently no longitudinal or experimental studies investigating outcomes associated with GM together compared with GM alone.

The use of self-report measures of SM use and GM is a further limitation. This method has been criticised for lacking in accuracy, with self-reported technology use often differing substantially from behavioural data from usage logs (Parry et al. 2022) and considering usage as something consistent rather than dynamic, which is likely to change over time. There is

debate within the literature whether self-report measures of SM may add noise to estimates of use, leading to inaccuracies (Johannes et al. 2021) or whether inaccurate reporting may be associated with wellbeing i.e., participants self-report is less accurate when their wellbeing is poorer (Sewall et al. 2020). This raises the question of whether self-reports are systematically biased by the same variables under investigation. Despite this, self-reported estimates of time spent using technologies are widely used in large survey research (Coyne et al, 2020; Reihm et al., 2019), alternative behavioural measures may increase accuracy and reduce bias but are difficult and costly to use in large samples.

Finally, it is important to consider the context of the COVID-19 pandemic when discussing the findings of this research. At T1 data collection pupils at participating schools were attending school in person again after a significant absence following the March 2020 lockdown. At this time there were increasing cases of the virus and limits were placed on socialising with more than six people (Public Health England, 2020). The school environment was also regulated, with facemasks and social distancing enforced in classrooms. This means that socialising was limited and face to face interactions often involved face coverings. At T2 restrictions in schools were similar; although national restrictions were easing following the second wave of the pandemic, indoor mixing with different households was still restricted, significantly limiting face-to-face socialising. Qualitative evidence indicates that young people experienced concerns about changes to social connections during this time, and fears about reconnecting after restrictions eased (McKinlay et al. 2022). These restrictions must be acknowledged as a significant disruption to typical social interactions, as well as noting that the contexts were not identical at T1 and T2 data collection. Both the upheaval of the pandemic and restricted socialising may have impacted the associations with digital technology use found in this study, compared to a prior or post-pandemic investigation.

It is likely that reduced face to face interaction may have impacted the results of this study, although it is hard to demonstrate whether, or how, this might have occurred. Certainly, it appears that social interaction moved even more online during the pandemic (Fischer, 2020). The content and type of use may also have changed during the pandemic, with an increased emphasis on information sharing, but added risk of misinformation, or exposure to distressing content (Gonzalez-Padilla & Tortolero-Blanco, 2020). There was also a significant increase in online GM during the pandemic (Pantling, 2020) which was encouraged as complementary to social distancing guidelines, leading to the GM industry hashtag #PlayApartTogether, nominally supported by the World Health Organisation (Ghebreyesus, 2020).

It is important to acknowledge that the circumstances around the COVID-19 pandemic itself are likely to have impacted children and adolescents' mental health. Although this study did not find strong evidence of a causal link between SM use/GM and depression, it is worth noting that in the context of the pandemic there is evidence of increased symptoms of anxiety and depression in adolescents and that school restrictions and home confinement were associated with changes in these symptoms (Hawes et al. 2021).

Conclusions

This study found some evidence in support of the ICBF as a model for understanding digital technology use, particularly with respect to the disconnecting pattern in SM use. Higher levels of SM use at baseline were associated with greater depression at T1 as well as six months later (T2). However, baseline SM use was not associated with *changes* in depressive symptomatology between time-points, suggesting either a reversed direction of causality, or a Type 1 error. Greater time spent on SM also appeared to be consistent with increased online social capital, lending some support to the connection pathway.

 In contrast, the ICBF appears less useful in understanding GM. Overall GM did not show the same consistent pattern of association with both positive and negative outcome measures. GM was associated with lower offline social capital, lending some support to the disconnection pathway, but was not associated with depression (when controlling for SM use) social connectedness or online social capital. This study suggests that there is something uniquely 'social' about SM, beyond screen time alone, that may interact with emotional processes and influence mood or psychopathology or may attract engagement due to differences in mood or psychopathology, assuming a reversed direction of causality.

Future research would benefit from repeating a longitudinal design, with a larger sample size as well as a focus on different SM platforms and genres of game, as well as a more nuanced measure of technology use.

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Part 3: Critical Appraisal

This critical appraisal is made up of reflections on my experience completing the thesis project as part of the Doctorate in Clinical Psychology. I will describe my previous experience before starting the course, personal experiences of social media use, the process of project choice, experiences of project planning and data collection and finally the process of writing up the thesis. I will consider challenges I faced along the way, particularly data collection and writing during the COVID-19 pandemic, and the associated physical and social restrictions. I will attempt to draw on both challenges and more positive experiences of the project and my learning from both.

Previous experience, interests, and project selection

Before I started the D.Clin.Psy, I had worked in CAMHS as an assistant psychologist. I enjoyed working with young people, their families and professionals who support them, and thought that my future career as a qualified psychologist might include working in CAMHS, due to these positive experiences. This was one of the factors which drew me to this project, where the participants would be young people, at an important and interesting developmental stage, adolescence. I also recalled experiences of speaking with young people I had worked with about social media and gaming, and their reports of both positive and negative experiences. More strongly, I recall working alongside other professionals in a CAMHS setting who would frequently express their fears about young people's social media use. In particular, I worked in a service that provided consultation regarding young people's wellbeing, particularly targeted towards education staff. On several occasions teachers and

other members of staff expressed confusion and concern about the rapidly changing landscape of digital technologies and how peer relationships among young people seemed increasingly influenced by this online social sphere. When I saw a project available involving social media, I felt this was an opportunity to really explore this topical and divisive issue.

Before starting the project, I had interests in the role of social media in influencing body image and self-esteem, which I now know fit with ideas about the 'visualness' (Nesi et al., 2018a) of some platforms. I was aware of the concept that SM represented something of a 'highlights reel' which does not accurately reflect real life and had discussed this with young people I worked with. I also grew up during an age of rapid technological development, though I would not describe myself as a 'digital native' as I recall a time in my childhood when I did not have access to the internet or a mobile phone. I think like many 'millennials' I have a sense of nostalgia about this time, which can manifest in a concern about children's technology use in the cycle of technology panics that Orben (2020) describes.

 I have had both positive and negative experiences of using SM myself, and personally feel that it helps me to connect to friends and family, as well as feeling vicarious happiness when I see others positing positive experiences. I have rarely experienced some of the oft-cited drawbacks such as FOMO or negative self-comparison when it comes to seeing content posted by friends or family, which I partly attribute to carefully selecting who I follow and noticing my reactions to content. When images of people I don't know such as celebrities or influencers are suggested to me, I do find myself experiencing negative self-comparison, which I notice and find irritating.

I did notice a significant shift in my relationship with SM use during the covid-19 pandemic and social restrictions. This also coincided with my decision to join Twitter, prompted by a desire to keep up with rapidly unfolding current events. I quickly noticed several things:

when I followed accounts, I was suggested other accounts to follow (which I often did) posting very similar content, and that a lot of the content I was exposed to seemed to lean towards the negative, with emotions of anger, anxiety, fear, and outrage being commonplace. I felt compelled to keep using Twitter to stay informed, but at the same time considerably disheartened by almost everything I saw. At the same time, I felt that rather than experiencing the voices of different people, with different perspectives I had created my own echo chamber, which seemed to magnify the loudest voices. This anecdotal experience for me speaks to how a particular platform, a particular societal context, and my own personality interacted to create this broadly negative experience. After around 6 months I deleted my Twitter account. I'm happy to say that a year later I haven't gone back!

I was also influenced to choose this project due to my interest in how companies like Meta and Google use/sell the data of their users and allow information to inform targeted advertising intended to influence the user base. I took a considerable interest in the Cambridge Analytica exposé and consider myself reasonably cautious and distrustful about how data from social media can be used for large scale manipulation. This definitely prompted me to express interest in the project, however upon speaking to Marc Tibber about the project I realised that these ideas were far beyond the scope of the project as I came to it. Shoshana Zuboff's 'The Age of Surveillance Capitalism' influenced my thinking on this and is an interest I assume will continue following this project.

Meeting with Marc to discuss the project, I realised I shared his interest in understanding the purported relationships between social media use and young people's mental health. I particularly appreciated his non-alarmist approach, keen to consider possible positive and negative outcomes which might be associated with social media use. I also wanted to include another interest of mine in the project, gaming. My own experience of playing video games, and my awareness of the popularity of gaming among young people prompted this. I was

particularly interest in the social aspects of gaming, given the fact that gaming with others has become so much easier to access in recent years. The Covid-19 pandemic was about to make gaming with others even more salient.

I joined the project alongside two trainees in the second year of the course, who had selected the outcome measures and had begun planning data collection for T1. Starting the project at this stage definitely left me with a sense of being 'behind' in terms of my understanding of the literature and some of the intricacies of study design. I ultimately feel I overcame this, firstly through my conceptual introduction, and secondly through administering data collection at T2 myself. Marc introduced the ICBF as a potential framework around which to begin the research, but I felt pleased when reviewing literature which justified the inclusion of gaming into the thesis, and the potential application of the ICBF to this technology.

The conceptual introduction

I had begun the project with the intention to conduct a systematic review. After speaking with both Marc and my course tutor I felt that it was very much my decision whether to do a CI, or a systematic review. However, I do feel there was a general sense from the course that a systematic review is somehow 'better', likely linked to the possibility of publication. Despite this I chose not to do a systematic review, partly due to my experience of trying to do one as part of my Masters. I had found the process complicated, and I had found it difficult to maintain my interest in the area. The idea of something more flexible, similar to a long essay appealed to me much more. I also made this decision during a time of considerable social restrictions due to the pandemic. My wellbeing was generally quite poor at this time, and I wanted to choose something that I felt was an appropriate level of challenge.

I began the literature searching and writing of the CI in June 2020 following my second-year exams. I found exploring the research on gaming particularly interesting, but for both topics,

the level of controversy, fear and sometimes heated academic debate about potential harms was intriguing. This is particularly stark in the gaming field, where 'violent' video games have generated a huge volume of concern-focussed research on purported associations with aggression. It was interesting to notice that although this debate rumbles on, language has generally become milder and fear appears to have died down (as well as considered research and argument from Przybylski, Orben and colleagues). This appears to coincide with the increase in attention given to potential social media harms, and really adds weight to Orben's (2020) technology panics concept.

Despite my interest, the writing of the CI was a challenge. It was longer than piece than I am accustomed to writing, and the fields of gaming, social media and associated mental health outcomes are expansive. I also found it hard to choose the strength of language to state my ideas, and feedback I often received from Marc was that I was stating something too strongly without sufficient precision when drawing on evidence. I think I had previously been taught (especially at undergraduate level) to be reasonably confident in my statements when I have evidence to back it up. This precise academic writing likely reflects the difference between undergraduate and doctoral research. I also think this experience reflects a dip in my confidence and motivation generally, as social restrictions were ending, I was keen to get back to my offline social life but had also spent several months feeling quite isolated and getting little enjoyment from the DClinPsy as a whole.

The empirical paper

Ethics and research design

I was fortunate that two previous trainees had completed the UCL ethics application and re-submission associated with changes due to COVID-19. For this reason, I was less involved with the initial research protocol and questionnaire design than I had hoped, however, due to these delays I actually had more input in editing the questionnaire, coding the questionnaire

on REDCAP, creating materials (information sheets and drafting emails) for the two schools, and reporting on risk concerns than I might otherwise. I feel this was good experience as I was able to take part in manage perhaps the most complex stage of the research process, sending the questionnaire to a large number of pupils, liaising with the schools, and ensuring that all the requirements of our ethics were met. This also meant that when I administered the questionnaire at T2 I had a good understanding of the necessary process and timings for sending out information to various parties.

This project was always intended to use a longitudinal design, however the initial intention was to use three time points, allowing for more advanced statistical techniques which would be better placed to explore directions of causality, such as cross-lagged panel modelling. However due to aforementioned delays, we adjusted plans and decided to use two time points instead. This was in some ways disappointing, one of the main drawbacks of research in this area is the lack of experimental or longitudinal design, whilst this project was still longitudinal, we were unable to explore direction of causality in depth.

Data collection

The original intention had been to collect data in person, however due to COVID-19 we pivoted to an online questionnaire format. This had benefits in eliminating manual data entry, however, did involve the use of a complicated survey software and data protection considerations, which were also time consuming. At both time points there was also considerable disruption of usual practices within schools. Due to time constraints the study was set as a homework task rather than an in-lesson activity, which contributed significantly to our lower-than-expected sample size.

I also feel that the questionnaire design we settled on contributed to sample size. Due to the project including questions pertaining to three different thesis projects, it was lengthy, taking

15-25 minutes to complete. There was considerable drop out observed through each stage of the questionnaire. This in particular has taught me that it is important to balance the desire to use detailed measures, with a realistic view on participant motivation to complete a survey.

Various internal pressures also meant that we had to be very organised in sending out materials to meet our agreed timelines. I found this part of the research particularly stressful, juggling different expectations and working with collaborators who were facing significant challenges themselves. I think this made me realise the extent of the stresses that can come with managing a research project, and the very large volume of emails that such things generate. I have learned the value of creating a clear timeline for such projects, and the value of clear and concise email communication.

Statistical Analyses

I had some previous experience of statistical analysis prior to the beginning this project, but this had mostly been using SPSS and R, for undergraduate and masters' projects respectively. Our statistics teaching from the course had used JASP, which I found useful and accessible. I decided to use JASP as I had become comfortable with it through the teaching, and had decided on using regression analyses, which did not require a more complex software like R.

I had initially assumed I might be using structural equation modelling, the broader technique under which cross-lagged panel modelling falls. I spent a lot of time watching YouTube tutorials and looking into courses I could access that would help me to learn these techniques. I think my anxiety about statistical analyses meant that I tried to start preparing before I had settled on which analyses I would actually use. In future I will carefully look at my data and speak with collaborators before trying to begin learning any sort of analysis.

I did a considerable amount of reading on regression analyses, particularly their assumptions, mostly using Andy Field's 'Discovering Statistics using R.' This alongside support from

Marc meant that conducting the analyses was not too challenging, and I found myself enjoying this part of the project. It felt like the culmination of a lot of hard work to collect the data.

Further reflections

I am usually someone who is well organised and completes projects in good time before a deadline. The thesis has tested my ability to do this more than anything I have previously attempted. Undertaken over three years, whilst also completing placements and attending lectures, I feel that it has gradually grown into something I have experienced as constantly in the back of my mind. I experienced some relief when I had completed data analysis and could begin the process of writing the paper. Despite this, I experienced more self-doubt and feelings of being out of my depth than previously, lacking confidence in what I had written. I think several factors led to this, difficulties meeting with Marc in person (due to COVID-19) combined with my tendency to 'go it alone' and avoid asking for help meant I was often left feeling quite overwhelmed and isolated. I have considered how different my experience might have been had I been involved in a joint project. I have learned that I must try to be honest with supervisors and collaborators in future when I feel out of my depth, and that asking for help doesn't mean that I am incompetent. When I did ask for help and arrange more regular meetings with Marc these were helpful and left me feeling more in control.

Despite feeling somewhat isolated at times, I have had absolutely invaluable support from several of my fellow trainees. They have helped me to retain a sense of fun and healthy perspective on the task of completing the DClinPsy. They have also been incredibly normalising of the difficulties I have faced and built up my confidence when I felt out of my depth. Since beginning the course I have been determined to maintain a healthy work-life balance, remembering that although I am passionate about clinical psychology, it is my job, not my entire life. Spending time with like-minded trainees has been an important part of this.

I have also found that taking up a new hobby has been incredibly helpful in maintaining perspective on completing the thesis. In summer of 2021 I started playing the tabletop roleplay game 'Dungeons and Dragons' (D&D). I found my new hobby incredibly absorbing, a source of escapism and a creative outlet, as well as a weekly social event to look forwards to. There is a small amount of research to suggest that D&D may be beneficial for players wellbeing (Sargent, 2014; Henrich & Worthington, 2021) with players describing feelings of belongingness, role experimentation and the ability to interact with one's own emotional experience in creative ways. Certainly, my personal experience of D&D has been one of increased positive emotion, immersion, and connection to both new friends and old ones. I have even become involved with a charity aiming to host tabletop roleplaying games for people experiencing various challenges such as homelessness and addiction. My experience reviewing literature in the field of gaming has given me a good overview and starting point for considering how outcomes associated with tabletop roleplaying games might be evaluated.

In this reflection I have discussed many challenges of undertaking this piece of work. I have often wondered how different my experience would have been if the COVID-19 pandemic had not occurred when it did. I feel that most of the difficulties I experienced were exaggerated by the experience of social isolation, decreased enjoyment, anxiety, and disruption of everyday life that it caused. I find myself feeling immensely grateful to be approaching submission at a time when COVID-19 is no longer dominating our daily lives. I feel proud, both of myself, and all of my fellow trainees for completing this piece of work during such a challenging time in our lives.

Conclusions

I have found undertaking this project interesting, challenging, and exciting at times. I am aware that the field of digital technologies will continue to develop at a rapid pace but am

now more used to the overwhelming amount of literature generated, and the fact that change is the norm. I feel that this project has solidified my view that nuanced perspectives on technology use are valuable, and that the more I learn about this field, the more complicated it appears. I hope this research will become part of a move towards considering gaming as a social technology, alongside social media. I feel that this research has also helped me to better understand young people's relationships with SM and highlighted the importance of the online world when working clinically.

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Appendices

Appendix 1: Information sheets for participants and parents

CLINICAL, EDUCATIONAL & HEALTH PSYCHOLOGY

PARTICIPANT INFORMATION SHEET FOR YOUNG PEOPLE

Social media use in young people

Would you help us with our research?

We are researchers and clinical psychologists at University College London and would like to ask you to help us by taking part in a research study. Please read this information sheet carefully, talk to other people about it if you would like, and ask any questions before you decide.
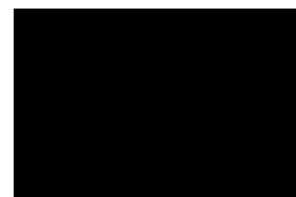
Why are we doing this study?
Social media use is common in young people. The purpose of our research is to increase our understanding of how young people use social media and how young people's social media use is related to their wellbeing. We will also look at whether social media use impacts upon young people's learning by asking for your permission for your school to share your grades with us. If you agree to this, your school will share your school grades with us. We are particularly interested in the relationship between social media use and wellbeing during Covid-19 since young people's usual routine has changed.

Who is invited to take part in this study?

We are inviting students to participate from across year groups between Year 7 and Year 12 at ▮▮▮▮▮▮▮▮▮

What will happen if I take part?

1. If you and your parents/carers agree to you taking part, you will be asked to complete a series of questionnaires online. You must complete the questionnaire within one month of receiving the link to the questionnaire if you wish to take part. The questionnaires will take you about 30 minutes to complete. You can contact members of our research team by telephone or email in case you have any questions. If your parents/carers do not agree to you taking part, you will not be sent the link to the online questionnaires.

2. If you agree, we will also contact you in 3-6 months' time and again in 12-18 months' time and ask you to complete the same questionnaires again, so that we can explore how social media use might change as the Covid-19 situation changes, and can begin to see whether social media use now affects mental health and wellbeing later. At all three stages of the study, we will ask you whether you agree to take part. <u>You do not have to agree to take part in the study at any stage.</u>

The questionnaires will ask you about:

- Your age, school year, gender and ethnicity.

- Your sleep, leisure and study habits and time spent with family.

- Your social media and digital screen use, including time spent on apps/websites and your reasons for use

- Your social networks and social relationships.

- Your emotional wellbeing (anxiety and depression symptoms).

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UCL REC approval ID number:

Do I have to take part?

No! It is up to you whether you take part. If you do not want to take part that is fine, and your decision won't affect your education or anything else in any way. You can stop taking part at any time during the study and don't have to say why. We have also informed your parents/carers about the study and asked them if they have any objection to you taking part. You don't have to take part even if your parents/carers agree. If you wish to remove your data from the study, please contact Dr Marc Tibber (Principal Researcher) up to one month following data collection at each stage of the study (contact details below).

What happens to information you collect about me?

- Nobody except the researchers will have access to the information we collect about you and what you tell us.
- Your information will be labelled with a number code which can't identify you. Your name and contact details will be kept separately from the information you provide and will only be used in order to contact you in 3-6 and 12-18 months' time if you agree. We will ask you again at these times whether you agree to participate in the study.
- When we finish the research we will write a report about the study and our findings. We hope to publish these in scientific journals so that other researchers and professionals can benefit from what we have learnt too.
- We will share all anonymous data from the study with Dr Emma Silver, which can then be requested by your school. Your school won't be able to identify you from this data.
- Your name and other information that might make it possible for people to guess who you are will not appear anywhere in the data or the report of the study.
- Your anonymous information will be kept for up to 10 years as it might be needed to help with future research.

Your safety and wellbeing If we have concerns about your safety/wellbeing from your questionnaire answers, this information will be shared with Dr Emma Silver, who may arrange for a member of the research team to contact you.

What are the benefits of taking part?

Your participation will be very important in helping us to understand more about young people's social media use, particularly during Covid-19. We would like to use the findings from this research to develop an intervention to support young people to use social media in ways that supports their wellbeing.

Data Protection privacy notice

UCL's Data Protection Officer is Alexandra Potts and she can be contacted at data-protection@ucl.ac.uk. You can read UCL's privacy notice at: https://www.ucl.ac.uk/legal-services/privacy/participants-health-and-care-research-privacy-notice and details of your rights at: https://ico.org.uk/for-organisations/data-protection-reform/overview-of-the-gdpr/individuals-rights/

All questionnaires will be completed online on the RedCAP (Research Data Collection Service) web-based survey tool, which is General Data Protection Regulation (GDPR) compliant.

Are there any risks in taking part in this study?

There should not be any risks with this study. However, sometimes answering questions about wellbeing can remind people of difficult experiences they've had. These might be things that happened in the past, or things happening now.

If you find answering any if the questions upsetting, you can speak with one of the researchers during or after the study. We can then make sure that you have the support that you need. For example, we can arrange for you to speak with a wellbeing officer from your school, or a Clinical Psychologist from our research team.

If I have any questions, who can I ask?
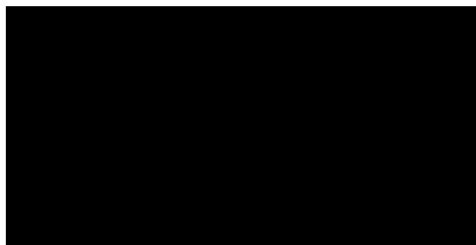
If you have any questions, please contact us:
Dr Marc Tibber (Principal Researcher)
m.tibber@ucl.ac.uk

Dr Emma Silver

SMQT YP Information Sheet (Version 4) 01 04 2020
UCL REC approval ID number:

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PARTICIPANT INFORMATION SHEET FOR PARENTS/CARERS

Study title: Social media use in young people in the context of COVID-19

What is this study? We are inviting your child to take part in a research study that is investigating young people's digital screen and social media use, and how this is related to their mental health and academic attainment. We are particularly interested in how this may have changed as a result of COVID-19, e.g. time away from school. Before you decide if you agree to your child taking part in the study, it is important that you understand why the research is being done and what it will involve. Please read this information sheet carefully.

Why are we doing this study? Researchers have become interested in both the positive and negative consequences of young people using social media, with controversy concerning whether social media use exposes young people to harm or helps them to develop relationships. Furthermore, it has been suggested that social media use may impact upon young people's learning and academic achievement. However, much of the research until now has only looked at overall levels of use, i.e. how many hours per day young people use social media, rather than how young people use social media. In this study, we want to explore how different ways of

using social media impact on young people's mental health and wellbeing, as well as whether or not it has any impact on academic performance. We are also interested in how these effects change over time, as well as the relationship between young people's social media use and their emotional wellbeing in the context of COVID-19 given associated changes to young people's routines. It is hoped that the information we gather from this study will help us design resources to help young people use social media in a way that maximises its positive effects and minimizes it negative effects.

Why has my child been invited to take part? Your child has been invited to take part because they are a student attending one of our collaborating schools

Does my child have to take part? No. Taking part is completely voluntary. The nature of the study will be explained to them in a separate age-appropriate participation information sheet and they will be given two weeks to read through it and contact a member of the research team to ask any questions they might have about the study. If you would like we can also arrange a time to speak to you or your child by phone about the study. If they would like to participate they will be sent an online link where they will be asked to consent / assent to take part in the study before being directed to the questionnaires. Your child is free to stop taking part at any time during the study without giving a reason. As their parent/carer, you are also free to decide whether or not they should take part in the study. ***Unless we hear from you within two weeks, we will assume that you are happy for them to participate (if they choose to).*** To opt-out with respect to their participation, please contact us by completing and emailing the attached opt-out form. If you choose to opt-out with respect to your child's participation, your child will not be sent the link to the online questionnaire. If you or your child decide not to take part, or to stop taking part at any point, this will not affect the education or care they receive, now or in the future.

What will my child have to do if they decide to take part? Your child will complete some questionnaires online via the RedCAP (Research Data Collection Service) web based survey tool, which is compliant with General Data Protection Regulation (GDPR). If your child agrees to take part, after being sent a link to the questionnaires, they will have one month within which to complete these. We anticipate that the questionnaires will take your child approximately 30 minutes to complete. Before assenting/consenting to participate they will be asked to contact a member of the research team by email if they require any support with completing the questionnaires or to answer any questions they might have.

The questionnaires will ask your child about:
• Their age, school year, gender and ethnicity.
• Sleep, leisure and study habits and time spent with family.
• Their social media and digital screen use, including time spent on apps/websites

and their reasons for use.

• Their social networks and social relationships

• Their emotional wellbeing/mental health (anxiety and depression symptoms).

To investigate whether social media use impacts upon young people's learning and academic attainment, we will also ask you and your child for your permission to access your child's exam grades from school. If you and your child agree to this, your child's school will share your child's exam grades with us. After they have completed the questionnaires, your child will be provided with a number of educational resources about social media, mental health and emotional wellbeing, which have been developed by the researchers in collaboration with their school. These resources will be made available to all students regardless of their participation in the study.

As part of the study, your child will be asked to complete the questionnaires again in 3-6 months' time. If you and your child agree, you will also be contacted in 12-18 months' time to ask whether you consent to your child completing the original questionnaires again as part of a 'follow-up' study. This will enable us to explore how the relationship between social media use and mental health and wellbeing might change as the COVID-19 situation develops, and will enable us to begin to understand whether current social media use impacts on mental health and wellbeing in the future, i.e. whether one might truly cause the other. At all three time points of the study, your child will be asked whether or not they wish to participate and will be able to refuse participation in the study even if you consent to their taking part. If you do not wish for

you or your child to be contacted in the future for this purpose, please let us know using the opt-out form. Please note, that by allowing us to contact you for this express purpose in the future, you are in no way consenting to ongoing contact, only for the follow-up study. In addition, you will be able to withdraw participation from this at a later date also. If you wish to withdraw your child's data from the study, you or your child should contact Dr Marc Tibber (contact details below) within one month following data collection at each stage of the study to remove their data.

Are there any risks in taking part in this study? There are no major risks to your child in taking part in this study. However, if for any reason your child experiences any emotional discomfort or distress by answering any of the questions, they will have the opportunity to speak with a clinical member of the team (a qualified or trainee clinical

psychologist) in order to discuss this further and think about whether any further support is needed. Questionnaires about mental health and emotional wellbeing that will be used in the study are used in standard routine research and clinical practice.

Are there any benefits to taking part? Your child's participation in the study will be very important in helping us to understand more about young people's social media use, its relation to mental health, and more specifically, in the context of social isolating. The hope is that the findings of the study will be published in professional and academic journals in order to help inform the work of other researchers, clinicians and educators. However, your child's anonymity will be preserved, and no identifiable information will be included in any published materials. The study is being undertaken in partnership with the school's wellbeing programme and all findings from the study will also be shared with the school to help the school consider how best to manage social media use amongst its pupils. We would also like to use the findings from this research to develop resources and interventions to support young people to use social media in ways that supports their wellbeing. As part of the study, your child will be provided with educational resources on social media and mental health, contributing to the school's ongoing wellbeing program.

Who is organising and funding the research? This research is being undertaken by participating schools in collaboration with the research department of Clinical, Educational and Health Psychology at University College London. The project is not externally funded. However, a small amount of funding has been given by the department within UCL as part of a fund that helps finance trainee research. The research will contribute to the doctoral thesis of two training clinical psychologists within the department who are funded by the NHS.

Who has reviewed the research? The research has been reviewed by the UCL Research Ethics Committee.

What happens to information you collect about my child? All the information you and your child provide will be treated as confidential and will be stored securely on the UCL network and will be accessible only to members of the research team. Any identifiable data will stored separately from the questionnaire response data, and will only be accessed by members of the research team in order to invite your child to

contact your child if there are concerns about their safety and/or wellbeing on the basis of their questionnaire responses, or if they indicate on the questionnaire that they would like to schedule a meeting with a clinical member of the research team to discuss any concerns they might have about their mental health or wellbeing.

The anonymised data from the study will be shared with Dr Emma Silver (contact details below), who will share this data with the schools if this is requested. Anonymised data may be shared with other researchers at UCL or other institutions, to help answer further research questions, but they will never be given your child's name, contact details or any other identifiable information. Once names and contact details are no longer required for the research project, they will be deleted, and all data will then become fully anonymised.

We will keep a digital record of your child's anonymous information for up to 10 years, as it may be required for future research. All information will be destroyed once it is no longer required for research purposes. If you or your child decide that they want to stop taking part in the study their information can be removed if this is requested within one month following data collection.

What will happen to the findings of the study? When the study is finished, the findings will be written up and presented as part of Clinical Psychology doctoral theses and as scientific articles to be published in peer-reviewed journals or conference abstracts. A summary of the findings will be shared with parents / guardians, young people, and the schools that took part. We think it is important to inform you about the information we found out and what will happen next. As mentioned above, it will not be possible to identify your child from findings in these publications.

What if there is a problem during the study? If you wish to raise a complaint then please contact Dr Marc Tibber (the Principal Investigator for the study) at m.tibber@ucl.ac.uk. If you feel that your complaint has not been handled to your satisfaction, you can contact the Chair of the UCL Research Ethics Committee at ethics@ucl.ac.uk. If something happens to your child during or following their participation in the project that you think may be linked to taking part, please contact the Principal Investigator.

Thank you for taking the time to read this information and to consider participation in the study.

Local Data Protection Privacy Notice: The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at data-protection@ucl.ac.uk. This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice: For participants in health and care research studies, click here. The information that is required to be provided to participants under data protection legislation (GDPR and DPA 2018) is provided across both the 'local' and 'general' privacy notices. The lawful basis that will be used to process your personal data are: 'Public task' for personal data and' Research purposes' for special category data. UCL will keep identifiable information about you for three months after the study has finished. To safeguard your rights, we will use the minimum personally-identifiable information possible. If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at data-protection@ucl.ac.uk

Research Contact:	Dr Marc Tibber (Principal Investigator for the study). m.tibber@ucl.ac.uk
Address:	Research Department of Clinical, Educational and Health Psychology, University College London, Gower Street, London, WC1E 6BT
School Contacts:	Dr Emma Silver (Consultant Clinical Psychologist & Director of Wellbeing at ███████████████████████

Please note: While UCL systems are secure and updated regularly, UCL cannot ensure the security of external email systems, by using email communication you are accepting of these potential risks. If you would like more information on this please ask and more details can be provided before you send on any confidential data

Appendix 2: parental opt out and consent form

PARTICIPANT OPT-OUT FORM: PARENT/CARER

Please ONLY complete this form and email it to maya.bowri.18@ucl.ac.uk or ghiselle.green.18@ucl.ac.uk if, after you have read the Information Sheet, you DO NOT consent for your child to participate.

Title of Study: Social media use in young people in the context of COVID-19.

Department: Clinical, Educational and Health Psychology, University College London (UCL).

Researcher(s): Maya Bowri (maya.bowri.18@ucl.ac.uk); Ghiselle Green (ghiselle.green.18@ucl.ac.uk)

Principal Researcher: Dr Marc Tibber, Lecturer in Clinical Psychology (m.tibber@ucl.ac.uk)

School Contacts: ██████████████████████████████

██████████████████████████████

UCL Data Protection Officer: ████████████ (data-protection@ucl.ac.uk)

This study has been approved by the UCL Research Ethics Committee

Project ID number: 17383/001

Thank you for considering to allow your child to take part in this research. If you have any questions arising from the Information Sheet, please contact a member of the research team (details above) before you decide whether to allow your child to participate. Your child will automatically have the opportunity to take part in the research unless you complete this opt-out form. However, your child will also be provided with a separate (age-appropriate) information sheet and given opportunities to contact the

research team to ask questions before they are asked whether they would like to participate.

I confirm that I understand that by initialling a box below, I *withdraw* consent for my child to participate in that part of the study. I understand that it will be assumed that unticked/non-initialled boxes mean that I consent to my child participating in that part of the study. I also understand that if I do not return this form or contact the research team, I consent to my child participating in all sections of the study.

		Initial Box
1.	I do <u>not</u> consent to my child participating in any part of the study.	
2.	I do <u>not</u> agree to me or my child being contacted in 3-6 months' time as part of the study.	
3.	I do <u>not</u> agree to me or my child being contacted in 12-18 months' time as part of the study.	
4.	I do <u>not</u> consent to my child's academic grades for the relevant year being accessed as part of the research.	

Name of young person:

_____

Name of school:

_____

Parent / Guardian Name:

_____

Date:

_____

Contact for further information:

Contact: Dr Marc Tibber (Chief Investigator for the study)
Address: Research Department of Clinical, Educational and Health Psychology, University College London, Gower Street, London, WC1E 6BT
Email: marc.tibber@ucl.ac.uk

Please note: *While UCL systems are secure and updated regularly, UCL cannot ensure the security of external email systems, by using email communication you are accepting of these potential risks. If you would like more information on this please ask and more details can be provided before you send on any confidential data.*

Appendix 3: Letter of ethical approval

UCL RESEARCH ETHICS COMMITTEE
OFFICE FOR THE VICE PROVOST RESEARCH

2nd June 2020

Dr Marc Tibber
Research Department of Clinical, Educational and Health Psychology
UCL

Cc: Ghiselle Green & Maya Bowri, Trainee Clinical Psychologists, UCL Research Department of Clinical, Educational and Health Psychology

Dear Dr Tibber

Notification of Ethics Approval with Provisos
Project ID/Title: 17383/001: The impact of social media on young people's mental health in the context of the COVID-19 pandemic: testing a preliminary model and exploring patterns of use.

Further to your satisfactory responses to the Committee's comments, I am pleased to confirm in my capacity as Chair of the UCL Research Ethics Committee (REC) that your study has been ethically approved by the UCL REC until **1st September 2021.**

In view of the fast developments of the pandemic, the numerous projects being initiated and the constantly changing framework, please provide us with regular updates **every 3 months (with the 1st report due on 2nd September)** regarding the ethical aspects of your project and the specific problems (if any) that you have encountered. At the end of the study, as part of the final report you have to submit to the UCL REC, please include alongside a brief outline of the research outcomes, any experiences which would be valuable for informing the fast-track COVID review process, and in turn subsequent fast-tracked studies.

Ethical approval is also subject to the following conditions:

Notification of Amendments to the Research
You must seek Chair's approval for proposed amendments (to include extensions to the duration of the project) to the research for which this approval has been given. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing an 'Amendment Approval Request Form'
http://ethics.grad.ucl.ac.uk/responsibilities.php

Adverse Event Reporting – Serious and Non-Serious
It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator (ethics@ucl.ac.uk) immediately the incident occurs. Where the adverse

Office of the Vice Provost Research, 2 Taviton Street
University College London
Tel: +44 (0)20 7679 8717
Email: ethics@ucl.ac.uk
http://ethics.grad.ucl.ac.uk/

incident is unexpected and serious, the Joint Chairs will decide whether the study should be terminated pending the opinion of an independent expert. For non-serious adverse events the Joint Chairs of the Ethics Committee should again be notified via the Ethics Committee Administrator within ten days of the incident occurring and provide a full written report that should include any amendments to the participant information sheet and study protocol. The Joint Chairs will confirm that the incident is non-serious and report to the Committee at the next meeting. The final view of the Committee will be communicated to you.

Final Report
At the end of the data collection element of your research we ask that you submit a very brief report (1-2 paragraphs will suffice) which includes in particular issues relating to the ethical implications of the research i.e. issues obtaining consent, participants withdrawing from the research, confidentiality, protection of participants from physical and mental harm etc.
In addition, please:
- ensure that you follow all relevant guidance as laid out in UCL's Code of Conduct for Research: https://www.ucl.ac.uk/srs/file/579
- note that you are required to adhere to all research data/records management and storage procedures agreed as part of your application. This will be expected even after completion of the study.

With best wishes for the research.

Yours sincerely
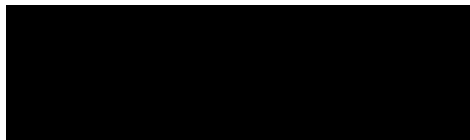
Professor Michael Heinrich
Joint Chair, UCL Research Ethics Committee

Appendix 4: Study Questionnaires

Questionnaire

Thank you for agreeing to take part in the study. This questionnaire takes about 30 minutes to complete. There are no right or wrong answers. Please contact a member of the research team if you have any questions or if anything is not clear.

For the multiple-choice questions, please select the answer that describes you the best.

1.1.   What is your name? _____

1.2.   What is your date of birth? _____

1.3.   What year group are you in?
[ ] Year 7
[ ] Year 9
[ ] Year 10
[ ] Year 12

1.4.   Are you attending school at the moment (i.e. since schools closed on Friday 20th March)?
[ ] Yes
[ ] No
[ ] Remotely

1.5.   What gender were you assigned at birth?
[ ] Male
[ ] Female
[ ] Prefer not to say

1.6.   What gender do you self-identify as now?
[ ] Male
[ ] Female
[ ] Other (please specify:_____)
[ ] Prefer not to say

1.7.   What is your ethnicity? (Please choose one)
[ ] White (British; Irish; Any Other White Background)
[ ] Mixed (White and Black Caribbean; White and Black African; White and Asian; Any Other Mixed Background)
[ ] Asian or Asian British (Chinese; Indian; Pakistani; Bangladesh; Any Other Asian Background)
[ ] Black or Black British (Caribbean; African; Any Other Black Background)
[ ] Any Other Ethnic Group
[ ] Prefer not to say

1.8.   On a weekday (Monday-Friday) how many hours do you typically spend…?
[ ] Sleeping per night
[ ] Studying or doing school-related activity during the day
[ ] Exercising during the day
[ ] Spending time with family (face-to-face) during the day

2.   Digital Screen Use

We would like to ask you some questions about your digital screen use, including your use of social media, video-gaming, video chatting and messaging apps.

2.1. In the past week, on an average weekday (i.e. Monday to Friday), approximately how much time <u>per day</u> have you spent using messaging apps (e.g. WhatsApp and Messenger)?

[ ] Less than 10 minutes
[ ] 10-30 minutes
[ ] 31-60 minutes
[ ] 1-2 hours
[ ] 3-5 hours
[ ] More than 5 hours

2.2. In the past week, on an average weekday (i.e. Monday to Friday), approximately how much time <u>per day</u> have you spent using video chatting apps (e.g. House Party and Skype)?

[ ] Less than 10 minutes
[ ] 10-30 minutes
[ ] 31-60 minutes
[ ] 1-2 hours
[ ] 3-5 hours
[ ] More than 5 hours

2.3 In the past week, on an average weekday (i.e. Monday to Friday), approximately how much time <u>per day</u> have you spent gaming? *Note: this includes standard computer games as well as virtual social worlds (e.g. Second Life) and virtual game worlds (e.g. Fortnite, Minecraft, World of Warcraft).*

[ ] Less than 10 minutes
[ ] 10-30 minutes
[ ] 31-60 minutes
[ ] 1-2 hours
[ ] 3-5 hours
[ ] More than 5 hours

2.4 Did this include multiplayer gaming (i.e. playing with others over the internet?)

[ ] Yes
[ ] No

2.5. Do you use social media? *Note: We are defining social media broadly to include social networking sites (like Facebook and Instagram), blogs and microblog sites (like Tumblr and Twitter) and content communities (like YouTube).*

[ ] Yes → please continue to 2.6
[ ] No → please can you tell us why not before continuing to 3.1

_____
_____
_____
_____
_____

2.6. Which top three social media sites / apps do you use? Please state up to three. If you only use one or two, please just name those and leave other spaces blank.

1. _____ 2. _____ 3.
_____

2.7. How many social media sites / apps do you use in total? [ ]

2.8. In the past week, on average, approximately how much time <u>per day</u> have you spent using social media sites?
> [ ] Less than 10 minutes
> [ ] 10-30 minutes
> [ ] 31-60 minutes
> [ ] 1-2 hours
> [ ] 3-5 hours
> [ ] More than 5 hours

For each statement below, please select the answer that describes you the best.

2.9. When comparing yourself to others on social media, to what extent do you focus on people who are better off than you?	Not at all	Very little	Somewhat	Quite a bit	A great deal
2.10. When comparing yourself to others on social media, to what extent do you focus on people who are worse off than you?	Not at all	Very little	Somewhat	Quite a bit	A great deal
2.11. When comparing yourself to others <u>offline</u> (i.e. <u>not</u> on social media but in day-to-day interactions), to what extent do you focus on people who are better off than you?	Not at all	Very little	Somewhat	Quite a bit	A great deal
2.12. When comparing yourself to others offline (i.e. not on social media but in day-to-day interactions), to what extent do you focus on people who are worse off than you?	Not at all	Very little	Somewhat	Quite a bit	A great deal

3. Social Relationships

Please circle the answer that shows how much you agree or disagree with the following statements:

3.1. There are people who I interact with on social media who I trust to help solve my problems.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.2. There are people who I interact with on social media who I can turn to for advice about making important decisions.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.3. There is no one I interact with on social media that I feel comfortable talking to about my personal problems.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.4. When I feel lonely, there are several people on social media who I can talk to.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.5. If I needed to borrow some money, I know there are people who I interact with on social media that I could turn to.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.6. Interacting with people on social media makes me interested in things that happen outside of my community.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.7. Interacting with people on social media makes me want to try new things.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.8. Talking with people on social media makes me curious about other places in the world.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.9. Talking with people on social media makes me feel part of a larger community.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
3.10. Interacting with people on social media makes me feel connected to the bigger picture.	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree

3. Emotional Wellbeing

For each statement below, please select the answer that describes you the best. Your answers will remain confidential, although we may need to speak to you about your answers if we feel concerned about them. If you experience any discomfort, distress or negative feelings by answering these questions and wish to discuss this, please contact a member of the research team.

	Never	Sometimes	Often	Always
4.1. I feel sad or empty.	Never	Sometimes	Often	Always
4.2. Nothing is much fun anymore.	Never	Sometimes	Often	Always
4.3. I have trouble sleeping.	Never	Sometimes	Often	Always
4.4. I have problems with my appetite.	Never	Sometimes	Often	Always
4.5. I have no energy for things.	Never	Sometimes	Often	Always
4.6 I am tired a lot.	Never	Sometimes	Often	Always
4.7. I cannot think clearly.	Never	Sometimes	Often	Always
4.8. I feel worthless.	Never	Sometimes	Often	Always
4.9. I feel like I don't want to move.	Never	Sometimes	Often	Always
4.10. I feel restless.	Never	Sometimes	Often	Always
4.11. I worry about things.	Never	Sometimes	Often	Always
4.12. I worry that something awful will happen to someone in my family.	Never	Sometimes	Often	Always
4.13. I worry that bad things will happen to me.	Never	Sometimes	Often	Always
4.14. I worry that something bad will happen to me.	Never	Sometimes	Often	Always

4.15. I worry about what is going to happen.	Never	Sometimes	Often	Always
4.16. I think about death.	Never	Sometimes	Often	Always

4.17. If after having completed this questionnaire you are concerned about your safety or mental wellbeing, or someone else's safety or mental wellbeing, and would like to access further help or talk to a mental health professional, please tick yes and a member of the research team will contact you.

[ ] Yes

[ ] No

Appendix 5: Tables presenting regression analyses of MDD regressed on GM and SM use analysed as ordinal variables.

Regression of MDD score onto social media use at T1, with SM use analysed as an ordinal variable. Significant values are shown in bold.

Social media use			
	Coefficient	CIs	p value
10 – 30 minutes	-0.01	-0.81, 0.79	0.989
31 – 60 minutes	0.50	-0.29, 1.28	0.211
1-2 hours	**1.01**	**0.25, 1.78**	**0.010**
3-5 hours	**1.16**	**0.32, 2.00**	**0.007**
More than 5 hours	**1.75**	**0.69, 2.80**	**0.001**

Regression of T2 MDD score onto social media use at T1, with SM use analysed as an ordinal variable. Significant values are shown in bold.

Social media use			
	Coefficient	CIs	p value
10 – 30 minutes	0.834	0.754, 2.422	0.296
31 – 60 minutes	1.325	0.263, 2.912	0.100

1-2 hours	1.164	0.354, 2.682	0.350
3-5 hours	1.338	0.235, 2.911	0.094
More than 5 hours	**2.175**	**0.417, 3.934**	**0.016**

Regression of MDD score onto GM use at T1, with GM use analysed as an ordinal variable. Significant values are shown in bold.

Gaming use			
	Coefficient	CIs	p value
10 – 30 minutes	-0.063	-0.483. 0.356	0.766
31 – 60 minutes	0.044	-0.437, 0.526	0.856
1-2 hours	0.486	-0.050, 1.021	0.075
3-5 hours	0.527	-0.541, 1.595	0.331
More than 5 hours	**1.752**	**-0.683, 2.819**	**0.001**

Regression of T2 MDD score onto GM use at T1, with GM use analysed as an ordinal variable. Significant values are shown in bold.

Gaming use			
	Coefficient	CIs	p value
10 – 30 minutes	0.035	-0.837,0.906	0.937
31 – 60 minutes	0.007	-0.976, 0.989	0.989
1-2 hours	0.389	-0.674, 1.452	0.466

3-5 hours	-0.217	-1.555, 1.121	0.746
More than 5 hours	**2.685**	**0.430, 4.940**	**0.021**

Appendix 6: Tables presenting full univariate and multivariate models for SM, GM, and depression at T1.

Table presenting full univariate and multivariate models of MDD score regressed on SM use at T1. Significant values are shown in bold.

	Basic Univariate model			Multivariate model with demographic variables as covariates			Multivariate model with gaming use as covariate		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value
Social media use	**0.393**	**0.263, 0.524**	**<0.001**	**0.420**	**0.275, 0.564**	**<0.001**	**0.371**	**0.236, 0.506**	**<0.001**
Gaming Use				-	-	-	0.082	-0.041, 0.205	0.192
Demographics									
Age	0.076	-0.024, 0.175	0.134	-0.041	-0.143, 0.061	0.430	-	-	-
Gender (Male)	-0.075	-0.437, 0.287	0.682	-0.067	-0.350, 0.327	0.947	-	-	-
Gender (Other)	1.320	-0.798, 3.437	0.220	1.177	-0.768, 3.030	0.241	-	-	-

Table presenting full univariate and multivariate models of MDD score regressed on GM use at T1. Significant values shown in bold

	Basic Univariate model			Multivariate model with demographic variables as covariates			Multivariate model with gaming use as covariate		
Predictor	Coefficient	CIs	p value	Coefficient	CIs	p value	Coefficient	CIs	p value
Gaming use	**0.248**	**0.081, 0.414**	**0.004**	**0.275**	**0.104, 0.445**	**0.002**	0.115	-0.050, 0.279	0.169
Social media use				-	-	-	**0.378**	**0.200, 0.566**	**<.001**
Demographics									
Age	0.045	-0.083, 0.173	0.489	0.019	-0.109, 0.147	0.772	-	-	-
Gender (Male)	-0.163	-0.603, 0.277	0.464	-0.283	-0.728, 0.162	0.210	-	-	-
Gender (Other)	1.310	-0.944, 3.564	0.252	1.427	-0.741, 3.595	0.195	-	-	-

Acknowledgements

Firstly, thank you to Marc Tibber, my research supervisor, who has been engaged, passionate and supportive throughout the last three years. Also, thanks to my external supervisor Emma Silver, without whom this research could not have taken place.

Secondly, but no less importantly thank you to Alex, for support both emotional and practical, up to and including 'pro bono Excel wizardry'. You deserve a medal and possibly a sainthood for putting up with me over the last six months.

Thanks Mum and Dad, you're the reason I got this far. I'm fantastically lucky to have parents like you. Also, thanks to Conchita the neighbourhood cat for being a semi-reliable source of joy when I was in the depths of a lockdown and a thesis.

Finally, but very, very importantly, thanks to the VLBs. Every one of you has been extremely valuable throughout this process, your chaos, sarcasm, affection, and irreverence have quite literally kept me going.