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Social benefits of living in the metaverse: The relationships among social presence, supportive interaction, social self-efficacy, and feelings of loneliness

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ABSTRACT

In the context of South Korea, the present study investigated the social benefits of utilizing the two popular metaverse platforms, Roblox and Zepeto. Focusing on young generations, millennials and Generation Z, it examined if enhanced social presence in the metaverse facilitates supportive interactions among young users, and if their active engagement in supportive interactions in the metaverse reduces their feelings of loneliness through enhanced social self-efficacy. A structural equation modeling with 300 cases of young Koreans yielded the following results. First, the social presence young users experienced in the metaverse platform significantly predicted the amount of supportive interactions they engaged in the metaverse. Second, the amount of supportive interactions in the metaverse positively predicted users' perception of social self-efficacy. Finally, social self-efficacy mediated the relationship between the amount of supportive interactions in the metaverse and young people's feelings of loneliness. The findings of this study provide implications on how to design features and services in the metaverse to maximize its social benefits to young users.

1. Introduction

Technological advancement has shifted the ways we interact with others around us. The "metaverse" is a persistent virtual space where users can enjoy various social, economic, and leisure activities as an extension of their offline life. With the prolonged social distancing and lockdowns caused by the COVID-19 pandemic, more people are finding ways to spend time and fulfill social needs while staying at home. Positioning themselves as the metaverse, online gaming and social media platforms with massive numbers of users are attracting new people with unique virtual experiences and thrilling social events.

Especially, younger generations, like Generation Z and millennials[1] are spending more time on social platforms. Millennials use social media for about 2 h and 38 min per day. Generation Z spends about 2 h and 55 min per day on social media. (World Economic Forum, 2019). They also occupy the largest portion of the population in the metaverse. Roblox, one of the largest user-generated games sites, is built on the concept of "metaverse," and about 83% of its users are below 25 years of age (Statista, 2021). Fortnite, the world's most popular online game platform has a core demographic with ages between 14 and 24 (Wilson, 2021). Given the dramatic shifts in behaviors, attitudes, and lifestyles of younger generations, research efforts have been made to understand the potential impacts of their reliance on new virtual platforms for social activities.

With the potential to deliver enhanced realism and presence, the metaverse can be another promising venue that fulfills the social needs of young people left by the decline of public events and social interactions. The exchange of social support has been studied as the key mechanism behind the observation that social interactions contribute to psychological well-being throughout a person's lifespan (e.g.,Chu, Saucier, & Hafner, 2010; Cohen & Wills, 1985). Empirical evidence suggests that supportive interactions online also enhance the

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[1] Millennials and Generation z are the cohort born between 1981 and 2012. The cutoff point between the two generations is 1997. Members of the millennial generation are born between 1981 and 1996, whereas those in Generation Z are born between 1997 and 2012. Retrieved from Pew Research Center, https://www.pewresearch.org/fact-tank/2019/01/17/where-millennials-end-and-generation-z-begins/.

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psychological well-being of users (e.g., Oh, Ozkaya, & LaRose, 2014; Shaw & Gant, 2004). However, there are few studies that directly examine the social outcomes of young people's use of the metaverse, and the mechanisms through which their social interactions in the metaverse lead to various psychological outcomes.

Among the various possible outcomes, the present study focuses on the development of social self-efficacy. Social self-efficacy is the perceived competence in one's own social skills. We believe that the metaverse platforms provide users with various unique opportunities to develop social skills and thereby enhance self-confidence in offline communication and relationship maintenance. The cognitive-social learning model of social-skill training insists that social skill training requires several processes involving knowing, modeling, role playing, and reinforcing (Ladd & Mize, 1983). The services and activities in the recent metaverse platforms can facilitate the learning process as users can practice their social skills in a safe virtual environment by engaging in collective problem solving with other users and accumulating experiences of supporting one another. Moreover, an enhanced sense of social presence in the metaverse, would further facilitate supportive interactions among users and the co-learning of positive social skills.

Focusing on young people, Generation Z and millennials, in South Korea, the present study attempts to understand Korean young people's uses and outcomes of using metaverse platforms. In particular, this study examines whether young Koreans socially benefit from logging onto the virtual world, a sub-category of the metaverse that allows massive users to lively interact with each other in a virtual space. We also test if enhanced social realism (i.e., social presence) in the virtual world facilitates supportive interactions among users. Generation Z and millennials are often identified as the loneliest generations (Twenge, Spitzberg, & Campbell, 2019). Their mental health has been significantly worsening since the outbreak of COVID-19 (OECD, 2021). This study tests if their supportive interactions in the metaverse enhance social self-efficacy and reduce feelings of loneliness. We also explore if the enhanced perception of social presence in the metaverse facilitates such processes. The findings of this study contribute to accumulating the body of knowledge on the social benefits of the metaverse and how young generations are utilizing and benefitting from the metaverse during the COVID-19 pandemic.

2. Literature review

2.1. The metaverse and virtual worlds

The term metaverse was first introduced in a novel "Snow Crash" published in 1992 (Stephenson, 1992). Despite its ever-fast growing popularity, there has been a lack of clarity regarding the definition and boundary of this term. It consists of the prefix "meta," which means "beyond" and the stem "verse" from the term "universe." It is an infinite digital space that exists as a simulated extension of the physical world.

Although there is no solid definition of the metaverse, the typologies from the Acceleration Studies Foundation can be a useful reference when classifying different services and features of the metaverse (Smart, Cascio, & Paffendorf, 2007). Originally, Smart and others (2007) envisioned four ways in which the metaverse interacts with the real world and benefits users. First, *augmented reality* refers to technologies that provide interactive information and services available in one's physical environment in real time. Second, *lifelogging* is an intimate and augmented metaverse platform that allow users to record and share their everyday activities and experiences. Third, *mirror worlds* are virtual spaces constructed based on the reflection of the physical world, in which users receive information and services in connection with their offline activities. Lastly, *virtual worlds* are social platforms where massive numbers of users create their own avatars and play in a virtual space that has its own social, economic, and political systems.

Among those four types of services, this study focuses on the social benefits of engaging in social interactions in the virtual space of the metaverse. Therefore, the category 'virtual worlds' is more relevant to the context of this study. The virtual world can be defined as a simulated environment that is persistent and shared, where many humans or software agents can virtually interact with each other, act and react to things, phenomena, and the environment in real time (Nevelsteen, 2018). The present study posits that virtual worlds can facilitate supportive interactions and provide social benefits to young people by blending virtual social activities with other forms of offline activities and creating shared experiences among its millions of users across the world (Murdock, 2020). In particular, the capability of virtual world platforms that deliver a strong sense of social presence to users would foster positive social interactions among users, which then would strengthen their social competence and decrease their feelings of loneliness.

2.2. Social presence in the metaverse

Presence is one of the representative features that define the metaverse and virtual worlds. It is the perception of non-mediation that the user of a medium experiences, as the result of an interaction between the characteristics of the user, the medium, the content, the technology, and other users (Lombard & Ditton, 1997). In particular, the immersive technologies in virtual worlds are designed to promote social interaction and serve the social needs of the users (Cole & Griffiths, 2007). Therefore, social presence, the sense of being together with another, should be an important driver of user engagement in the virtual social environment with many social actors (Biocca, Harms, & Burgoon, 2003). Without social presence, other users are merely perceived as artificial objects rather than as living social beings (Lee, Peng, Jin, & Yan, 2006).

The present study utilizes the conceptualization of social presence that Lee (2004) articulated. In his explication, social presence is a psychological perception of virtual social actors as being vividly simulated in sensory or non-sensory ways. He denies the idea that social presence is driven by the technology or richness of the medium. Instead, he believes that it is determined by the quality of interaction that the user experiences. People experience social presence in a virtual environment by processing the social cues of others, simulating 'other minds,' and presuming the intentionality of others (Biocca et al., 2003).

Compared to the text-based communication platforms (i.e., social media, online community etc.), the 3D virtual environment in the metaverse can provide a unique communication opportunity to the users through the heightened sense of social presence. According to van der Land, Schouten, van den Hooff, and Feldberg (2011), the 3D environments in virtual worlds provide vivid visual cues to the users about their surroundings. The users can enrich their communication experience in the metaverse by moving across different settings and manipulating the space. Moreover, the avatar-mediated communication in the metaverse can generate rich communication cues concurrently such as appearance, gesture, and behavior (van der Land et al., 2011). The sense of co-existence and the experience of cue-rich communication in the metaverse would make the users perceive social presence such that other users are physically present in the same environment (Short, Williams, & Christie, 1976). This social illusion then facilitates positive interactions among the users, by prompting individual's motivation to maintain a good impression and gain social approval from other users (Lee & Park, 2014). Thus, this study treats the enhanced sense of social presence as one of the essential mechanisms that promote supportive interactions among the users in the metaverse.

Empirical studies have reported that playing with friends increases social presence (e.g., Choi & Kwak, 2017; Ravaja et al., 2006). For instance, playing a video game with a friend elicited a stronger sense of presence and more positive emotions than playing with a stranger or alone (Ravaja et al., 2006). Another study also found that communicating with multiple players, compared to a single player, enhances the sense of social presence (Choi & Kwak, 2017). Having more friends in a metaverse platform, therefore, would presumably be positively associated with feeling a stronger sense of presence in the metaverse as users

with more friends would naturally have more opportunities to interact with multiple friends in the metaverse.

Hypothesis 1. The number of friends young people have in the metaverse would be positively associated with their sense of social presence in the metaverse.

The present study also speculates that the amount of time people spent in the metaverse would positively influence their sense of social presence. A study that compared the social presence of computer-mediated interactions with face-to-face interactions suggests that social presence among interactants in a computer-mediated environment is increasingly enhanced as the amount of interaction increases (Francescato et al., 2006). In the field of education, the volume and duration of interaction positively influenced social presence (e.g., Poquet et al., 2018; Tu & Corry, 2004). Thus, it is reasonable to assume that spending more time in the metaverse would positively predict users' sense of social presence.

Hypothesis 2. The amount of time young people spent in the metaverse would be positively associated with their sense of social presence in the metaverse.

In the communication literature, it has been suggested that the quality of social interactions in a mediated environment is largely determined by the psychological connections that users perceive from other users in the environment (Biocca et al., 2003). The present study further expects that feelings of social presence in the metaverse would produce positive social outcomes by facilitating supportive interactions among users in the metaverse. The next section discusses the importance and the determinants of engaging in supportive interactions in the metaverse.

2.3. Supportive interaction in metaverse

The virtual environment in the metaverse provides the users with a unique communication opportunity to seek and provide social support. Social support is a multidimensional construct comprised of supportive behaviors and appraisals (Vaux, 1988). The outcomes of supportive interaction encompass all of the positive resources that an individual can derive from his or her interpersonal relationships (Cohen & Hoberman, 1983). These resources inform individuals that they are being loved, their values are being respected, and they are in close mutual relationship with others (Cobb, 1976). Social support has been closely linked with positive psychological outcomes such as happiness, life satisfaction, and self-esteem (e.g., Chu et al., 2010; Oh et al., 2014; Schaefer, Coyne, & Lazarus, 1981), whereas the feelings of social isolation have been associated with negative outcomes such as the development of cardiovascular diseases, mental illnesses, and increased mortality (e.g., Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Leigh-Hunt et al., 2017; Wesselmann & Williams, 2017).

Interpersonal communication is one of the key functions that the Internet serves (Valkenburg & Peter, 2008). Internet-based social platforms have contributed to expanding and deepening social networks and facilitate the exchange of social support among users. Many researchers have suggested that online communication boosts social support and social connection (Ahn & Shin, 2013; Deters & Mehl, 2013; Oh & LaRose, 2016; Shaw & Gant, 2004) and thus benefits people who have deficits in offline social skills (Boyd, 2014). Studies conducted in the context of virtual worlds, have also revealed the advantages of virtual platforms in facilitating supportive interactions among users who lack in offline interactions such as older adults (e.g., Siriaraya, Ang, & Bobrowicz, 2014), LGBT (e.g., Acena & Freeman, 2021) and those with disabilities (e.g., Gilbert, Murphy, Krueger, Ludwig, & Efron, 2013).

The most valuable asset of the virtual social platforms lies in its ability to facilitate the strong and emotionally invested friendships among users (Cole & Griffiths, 2007). Fundamentally, communicating with a wide variety of people is the key benefit that computer-mediated communication provides (Valkenburg & Peter, 2008). Avatar-mediated communication in the virtual environment can produce several benefits over the existing forms of communication. First, compared to text-based communication, avatar-mediated communication in the metaverse affords more ways to nonverbally exchange concerns and supports through gestures, behaviors, and facial expressions that are similar to face-to-face communication (Antonijevic, 2008; Takano & Tsunoda, 2019, July). The users can also engage in proxemic interactions with other users to express supportive emotions and intimacy (Green--Hamann, Campbell, Eichhorn, & Sherblom, 2011). Lastly, being immersed in the highly interactive and vivid environment designed for various types of social activities, the users can feel social presence and emotional connection with other users (van der Land et al., 2011; Short et al., 1976), which are the crucial mechanisms of effective communication in the mediated environment (Biocca et al., 2003).

Given the relational nature of social support (Cobb, 1976), the amount of supportive interaction would be closely associated with the size of social network. According to House and Kahn (1985), the exchange of social support is largely determined by one's quantity and quality of social relationships. With a larger social network, the user has more opportunities to engage in positive interactions with other users within the network (Oh et al., 2014). This study, therefore, posits a positive association between the size of social network (i.e., number of friends) in the metaverse and the amount of supportive interactions in which people engage in the metaverse.

Hypothesis 3. The number of friends people have in the metaverse is positively associated with the amount of supportive interactions in which they engage in the metaverse.

This study also predicts that the amount of time that people spend in the metaverse positively influences the amount of supportive interactions in which people engage in the metaverse. Because exchanging support requires some investment of time, energy, and material resources (House, 1987), spending more time in the metaverse would be positively associated with the amount of supportive interactions in which people engage in the metaverse.

Hypothesis 4. The amount of time people spent in the metaverse is positively associated with the amount of supportive interaction in which they engage in the metaverse.

Since social presence largely determines the quality of social interaction in the virtual environment (Biocca et al., 2003), this study examines if the sense of social presence mediates the effect of the time people spend in the metaverse and how the number of friends in the metaverse influences the amount of supportive interaction in which people engage in the metaverse. First, we test the link between social presence and supportive interaction in the metaverse. Existing studies revealed positive relationships between social presence and various forms of communication, as well as relationship outcomes (e.g., Fogg & Tseng, 1999; Lee et al., 2006; Remesal & Colomina, 2013). Thus, we propose the following hypothesis about the effect of social presence on the amount of supportive interaction in which people engage in the metaverse.

Hypothesis 5. The sense of social presence in the metaverse would be positively associated with the amount of supportive interaction in which they engage in the metaverse.

Then, we test if social presence plays a mediating role that carries the effect of the playing time and the number of friends in the metaverse to the amount of supportive interaction in which users engage in the metaverse. The existing evidence indirectly supports this claim by demonstrating the mediating role of social presence in predicting the quality and the quantity of social interactions and social relationships in various mediated environments (e.g., Jin, 2010; Kim, Park, & Sundar, 2013; Kim & Song, 2016). For example, in Jin's (2010) experiment, interdependent people were more likely to engage in the parasocial

interactions with their avatar in the 3D virtual environment through the enhanced sense of social presence. However, given no prior research that directly informs us about the mediating role of social presence in the metaverse, we propose the following research question to test our speculation.

Research Question 1. Does social presence mediate the effect of the amount of time people spend in the metaverse and the number of friends that they have in the metaverse on the amount of supportive interaction in which people engage in the metaverse?

2.4. Psychological outcomes of supportive interaction in the metaverse

2.4.1. Feelings of loneliness

The prominent outcomes of engaging in positive social interactions in the metaverse are likely to be the enhanced relational satisfaction and reduced feelings of loneliness. Affective touch that occurs through avatars in the metaverse would enhance the sense of social presence, promote supportive interactions, and thereby enhance social connections among the users (Della Longa, Valori, & Farroni, 2022). Studies have reported the benefits of utilizing the virtual environment for building social relationships and reducing feelings of loneliness (e.g., Antunes et al., 2017; Martončik & Lokša, 2016; Lewis, Trojovsky, & Jameson, 2021).

Loneliness as a psychological concept reflects a perceived lack of satisfying social relationships, in terms of their quantity or quality, accompanied by feelings of discomfort and distress (Peplau, 1988). Simply, it is a perception of social isolation (Hawkley & Cacioppo, 2010). Although loneliness is a common human experience, frequent feelings of loneliness have been closely associated with negative outcomes for physical and mental health (Hawkley & Cacioppo, 2010).

Social support is a strong preventer of loneliness and depression (Liu, Gou, & Zuo, 2016; Wang, Mann, Lloyd-Evans, Ma, & Johnson, 2018). Intuitively, it is obvious that receiving sufficient social support from others would reduce feelings of loneliness. Empirical studies have also demonstrated that the more support people perceive from their social relationships, the less lonely they feel (e.g., He, Zhou, Li, Cao, & Guan, 2014; Larose, Guay, & Boivin, 2002).

Some studies conducted in the context of a mediated environment, such as online games, communities, and social media suggest that the computer-mediated social support can produce effects that are comparable to the traditional face-to-face support (e.g., Cummings, Butler, & Kraut, 2002; Depping, Johanson, & Mandryk, 2018; Oh et al., 2014; Shaw & Gant, 2004; Trepte, Reinecke, & Juechems, 2012). For example, Trepte et al. (2012) found that the perception of social capital, the concept that encompasses the exchange of social support, in online games positively predicted people's evaluation of offline social support. Depping et al. (2018) also found that social capital in online game reduces the feelings of loneliness and increases the satisfaction from relatedness. Therefore, we hypothesize that the amount of supportive interaction in the metaverse would negatively predict users' overall feelings of loneliness.

Hypothesis 6. The amount of supportive interaction in which people engage in the metaverse is negatively associated with their feelings of loneliness in their daily life.

The relationship between social support in a mediated-environment and loneliness is often influenced by the quality of social relationships and social support in real life. Studies in various mediated environments have suggested that the perception of social support in a mediated environment brings about positive psychological outcomes only when it facilitates offline social relationships (e.g., Benoit & DiTommaso, 2020; Longman, O'Connor, & Obst, 2009). Otherwise, an excessive reliance on online social relationships may lead to negative psychological outcomes such as online addiction and enhanced loneliness (Twenge et al., 2019). The present study claims that supportive interactions in the metaverse would reduce users' feelings of loneliness by improving their confidence in interpersonal communication and social relationships, namely social self-efficacy.

2.4.2. Social self-efficacy

Social self-efficacy is one's perceived competence in initiating social contact and developing new relationships (Gecas, 1989). Originally, Bandura, Freeman, and Lightsey (1999) proposed self-efficacy, to mean an optimistic self-belief in one's capability and opportunity of successfully accomplishing goals and generating desirable outcomes. Social self-efficacy captures the social aspect of self-efficacy. The present study regards social self-efficacy as the mediator between supportive interaction in metaverse and loneliness.

The metaverse provides new opportunities for people to develop social skills by participating in various types of social activities and/or problem-solving games. In Roblox, for example, friends cooperate as they play different kinds of games together. In Zepeto, friends visit certain venues and take photos or videos together as they normally do when hanging out together. Avatar-based interactions in these platforms are more social, synchronous, and intensive than in previous social media platforms (i.e., Facebook, Instagram) built based on self-exposure, liking, and sharing.

Supportive interaction people engage in the metaverse and social self-efficacy would be positively associated with each other for the following reasons. First, humans enhance competence in various social situations and new relationships as they accumulate experiences of interacting with others who have different points of view (Gecas, 1989). Allowing interactions among participants that transcend generational and regional boundaries, virtual worlds of the metaverse provide opportunities to build relationships with new people and enhance social self-efficacy. Studies have revealed that having more communication partners online enhances social competence (e.g., Valkenburg & Peter, 2008). Second, as a belief in one's own ability, the main source of self-efficacy is the experience of mastery (Bandura et al., 1999). Having more opportunities to practice social skills and engage in positive social interactions increases social competence (Hetherington, Parke, Gauvain, & Locke, 1999). Virtual space is a safe place where people can experience various social situations and expand the horizon of relationships with different people (Ducheneaut & Moore, 2005). Finally, through their avatar, people in the metaverse can engage in various forms of verbal and nonverbal communication that are more vivid and salient than the existing text-based asynchronous forms of communication (Antonijevic, 2008). This avatar-based interaction can facilitate learning through the enhanced sense of social presence (Peterson, 2006). By modeling, practicing, and accumulating successful experiences of exchanging social support in the metaverse, people would learn and become more confident in utilizing offline social connections and creating a social environment that is favorable to themselves. Hypothesis 6 reflects such reasoning.

Hypothesis 7. The amount of supportive interaction in which people engage in the metaverse is positively associated with their perception of social self-efficacy in their social relationships.

Finally, an enhanced sense of social self-efficacy is expected to reduce feelings of loneliness. Loneliness has been associated with negative experiences and feelings about one's interpersonal relationships (de Jong-Gierveld, 1987). Lonely people tend to evaluate themselves as being less interpersonally competent compared to those who are not lonely (Jones, Hobbs, & Hockenbury, 1982; Spitzberg & Canary, 1985). Empirical studies have established the positive relationship between social self-efficacy and reduced feelings of loneliness (e.g., Tsai, Wang, & Wei, 2017; Wei, Russell, & Zakalik, 2005). For example, a longitudinal study with college students found a negative relationship between perceived social self-efficacy and loneliness (Wei et al., 2005). Another study also found that poor social skills are associated with enhanced loneliness (Segrin & Flora, 2000). The present study,

therefore, hypothesizes that perceiving a greater level of social self-efficacy would reduce one's feelings of loneliness.

Hypothesis 8. The perception of social self-efficacy in social relationships is negatively associated with the feelings of loneliness in daily life.

We then examine if social self-efficacy mediates the relationship between the amount of supportive interaction in the metaverse and the feelings of loneliness. We believe that the amount of supportive interaction people engage in the metaverse would decrease the feelings of loneliness, to the extent that the user who enhances their perception of social self-efficacy internalizes experiences of supportive interactions as an enhancement of social competence. According to the optimal matching model of social support, social support is useful when it matches the situation faced by the receiver (Cutrona & Russell, 1990). Providing unmatched support can produce unintended outcomes such as feeling incompetent or becoming overly dependent on the provider (Beehr, Bowling, & Bennett, 2010; Bolger, Zuckerman, & Kessler, 2000; Vangelisti, 2009). Existing studies also suggest that supportive interaction in the mediated environment should function to enhance users' competence in offline social relationship (e.g., Benoit & DiTommaso, 2020; Longman et al., 2009). These claims indirectly support the mediating role of social self-efficacy between the amount of supportive interaction and the feelings of loneliness. Given the lack of empirical evidence, however, we use the following research question to address our claim.

Research Question 2. Does social self-efficacy mediate the effect of the amount of supportive interaction in which people engage in the metaverse on their feelings of loneliness in daily life?

2.5. Proposed model

Based on 8 hypotheses and 2 research questions, we propose the research model that examines the mechanisms through which people's use of the new metaverse platforms leads to positive social experiences and outcomes. Fig. 1 illustrates all the relationships we address in this study.

3. Method

3.1. Participants

This study conducted an online survey through a research panel of the Korean research company, Macromill Embrain.[2] The company sent an invitation mail to its online panel aged between 10 and 41 years old who has an account on either Roblox or Zepeto. Among the 1004 respondents who initially provided informed consent and agreed to participate in the study, only 360 fully completed the survey (response rate = 35.9%). After dropping 60 cases that had insincere responses, 300 cases were finally used for the analysis. Among 300 participants, 166 had an account in Zepeto and 201 had an account in Roblox. About 48% had 5 or fewer friends in the metaverse. On average, participants spent their time in either Roblox or Zepeto for about 2 h every day. Their age ranged from 15 to 40 years old (*Mean* = 28.8, *SD* = 8.89), and 63.0% were females. No identifiable information was collected to protect the respondents' privacy rights. More information about the participants is provided in Table 1.

3.2. Measures

The number of friends in the metaverse was measured by directly asking participants how many friends they have in either Zepeto or Roblox (*Mean* = 20.2, *SD* = 38.4). Because it has a standard deviation that is much larger than other variables, the scale was standardized to the z-score to make the variance comparable to other variables.

The amount of time spent in the metaverse was measured by directly asking participants how many hours, on average, they spent on either Zepeto or Roblox during the last week (*Mean* = 1.90, *SD* = 1.44).

Social presence was measured with 5 items drawn from Makransky, Lilleholt, and Aaby (2017), with a 7-point scale ranging from not at all (1) to very much (7). Example items are "I felt like I was in the presence of another person in Zepeto/Roblox," and "I felt that the people Zepeto/Roblox were aware of my presence." (*Mean* = 3.97, *SD* = 1.38, *Cronbach's Alpha* = .919).

The measure of *supportive interaction* was drawn from Oh et al. (2014). We asked participants how often they have exchanged nine types of support during their social interaction in metaverse: (1) giving advice, (2) showing empathy, (3) validating thought, (4) complimenting, (5) teaching something new, (6) inviting to a new party (7) sharing information, (8) encouraging, and (9) inviting to an event. They were first asked how often they have provided each type of support to other metaverse users (provided support, PS), and then asked how often they have received those supports from others (received support, RS). It was measured with a 7-point scale ranging from (1) never to (7) very often. The two-factor structure of supportive interaction was confirmed with a confirmatory factor analysis using the Lavaan package (version 0.6–9) in R (version 4.1.1). After dropping one item from the provided support, the CFA result showed a reasonable fit, x^2 (118) = 462.632, p = .000, CFI = 0.925, TLI = 0.914, RMSEA = 0.099, SRMR = 0.041. In order to enter them in the structural equation model, provided support (PS) and received support (RS) were constructed as observed variables by summing 8 and 9 items, respectively. The scores reflected the unstandardized factor loadings of individual items (PS: *M* = 4.36, *SD* = 1.24, *Cronbach's Alpha* = .927; RS: *M* = 4.40, *SD* = 1.24, *Cronbach's Alpha* = .953).

Social self-efficacy was measured with 8 items drawn from the social self-efficacy scale developed by Muris (2001). It defines social self-efficacy as the perceived capability for maintaining peer relationships and being assertive. Individual items were measured with 7-point scale ranged from not at all (1) to very much (7) (*M* = 4.46, *SD* = 1.20, *Cronbach's Alpha* = .937).

Loneliness was measured with 3 items drawn from the short scale of loneliness developed by Hughes, Waite, Hawkley, and Cacioppo (2004). Individual items were measured with the 7-point scale ranged from not at all (1) to very much (7) (*M* = 3.32, *SD* = 1.50, *Cronbach's Alpha* = .897).

3.3. Measurement model (CFA)

Before fitting the structural equation model, we performed a confirmatory factor analysis using the Lavaan package (version 0.6–9) in R (version 4.1.1). A first-order CFA with four latent constructs was performed to validate the factor structure of the entered latent variables. The result yielded a good fit, x^2 (129) = 331.688, p = .000, CFI = 0.952, TLI = 0.943, RMSEA = 0.072, SRMR = 0.043. Table 2 shows the descriptive information, factor loadings, standard errors, and Cronbach's alpha coefficients of all the latent constructs entered in the model.

3.4. Model specification (SEM)

To test 8 hypotheses and 2 research questions, structural equation modeling (SEM) was performed with the covariance matrix using the maximum likelihood estimates of the Lavaan package (version 0.6–9) in

[2] More information about the research company is available at https://embrain.com/eng/.

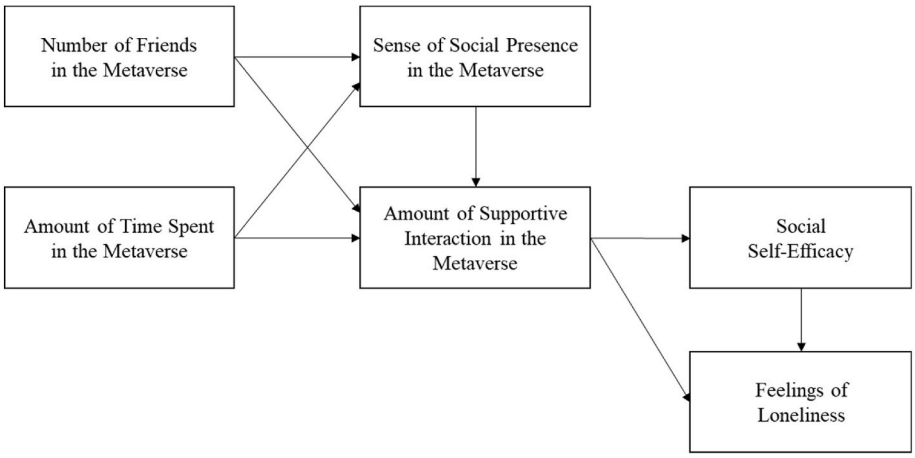

Fig. 1. Research model.

Table 1
Demographic information and metaverse usage of participants.

	n	%
Gender		
Male	111	37.0
Female	189	63.0
Age (*Mean* = 28.8, *SD* = 8.89)		
15-19	77	25.7
20-29	64	21.3
30-39	133	44.3
40-49	26	8.7
Metaverse platform		
Zepeto only	99	33.0
Roblox only	134	44.7
Both	67	22.3
Number of friends in metaverse (*Mean* = 20.2, *SD* = 38.4)		
5 or below	143	47.7
6 - 10	56	18.7
11 -50	78	26.0
51 or more	23	7.7
Hours spent in metaverse (*Mean* = 1.90, *SD* = 1.44)		
1 h or less	160	53.3
2-4	122	40.7
5 or more	18	6.0
Total	300	100

R (version 4.1.1). Age and sex, the exogenous control variables, were all linked to the six main variables.[3] The six variables – the number of friends in the metaverse, the amount of time spent in the metaverse, social presence, supportive interaction, social self-efficacy, and loneliness – served as endogenous variables. In total, eight direct paths addressing 8 hypotheses were tested. Also, three indirect paths were examined to answer the 2 research questions. Fig. 2 depicts the result of SEM with standardized coefficients of the hypothesized paths and their statistical significances.

The hypothesized model showed a good model fit, x^2 (206) = 468.342, p = .000, CFI = 0.940, TLI = 0.926, RMSEA = 0.065, SRMR = 0.052. The multicollinearity problem or the normality issue was not found in the data.

Test for Group Indifference. Before testing the hypotheses, we performed a multigroup analysis to confirm that the factor structure and the hypothesized relationships are not influenced by the type of metaverse platforms. We divided the data into two groups based on the platform that the participants used more frequently (Roblox vs. Zepeto). Table 3 shows the result of the chi-square difference test between the baseline CFA model and the constrained CFA model, where all the factor loadings and intercepts are constrained to be equal across the two groups. The chi-square difference test yield no significant difference between the two groups ($x^2\triangle$ = 34.337, p = .19), suggesting indifference in the factor structure between the two platforms.

The multigroup SEM also showed indifference in loadings, regression coefficients, and intercepts between two groups ($x^2\triangle$ = 63.818, p = .11). Table 4 shows the result of the chi-square difference tests between the baseline model and the constrained model.

4. Result

Hypotheses 1-2 addressed the antecedents of perceiving social presence in the metaverse. Hypothesis 1 predicted the positive relationship between the number of friends in the metaverse and the sense of social presence users perceive in the metaverse. This hypothesis was supported (β = .269, p = .000). Having more friends was positively associated with perceiving the greater level of social presence in the metaverse. Hypothesis 2, proposing a positive relationship between the amount of time spent in the metaverse and the sense of presence, was also supported (β = .171, p = .003). The more time people spent in the metaverse, the greater they felt social presence in the metaverse.

Hypotheses 3–5 proposed factors associated with the amount of supportive interactions users engage in the metaverse. As for hypothesis 3, which proposed a positive association between the number of friends in the metaverse and the amount of supportive interaction, the path was statistically significant (β = 0.171, p = .000), suggesting a significant and positive relationship. However, hypothesis 4 regarding the relationship between the amount of time spent on the metaverse and the amount of supportive interaction engaged in the metaverse was not supported (β = .055, p = .237). The path between social presence and supportive interaction was statistically significant, supporting hypothesis 5 (β = 0.643, p = .000). In sum, having more friends and perceiving the greater sense of presence both positively influenced the amount of supportive interaction in which people engage in the metaverse. The mere usage time, however, was not associated with users' engagement of supportive interaction in the metaverse.

Research question 1 explored if social presence mediates the effect of the time spent in the metaverse and the influence of the number of friends in the metaverse on the amount of supportive interaction in the metaverse. The indirect effect was verified with a bootstrap analysis using 5000 samples and the 95-percentile confidence interval. The result indicates that social presence significantly mediates the effect of both the time spent on the metaverse (b = 0.109, SE = 0.045, p < .05, *95% CI* [0.030, 0.211]) and the number of friends in the metaverse (b = 0.211, SE = 0.059, p < .001, 95% *CI* [0.116, 0.348]) on the amount of

[3] To simplify the presentation of the model, exogenous variables and their paths to other variables are not shown in the model (Fig. 2).

Table 2
Descriptive information, factor loadings, and reliability of the main variables.

Items	Mean	SD	Factor Loading	Alpha
Social Presence	3.97	1.38		.919
I felt like I was in the presence of another person in Zepeto/Roblox.	3.92	1.58	.88	
I felt that the people in Zepeto/Roblox were aware of my presence.	4.10	1.55	.79	
The people in Zepeto/Roblox appeared to be sentient (conscious and alive) to me.	3.77	1.63	.83	
In Zepeto/Roblox, I sometimes feel like I was working directly with another person.	3.89	1.66	.86	
I had a sense that I was interacting with other people in Zepeto/Roblox, rather than a computer simulation	4.20	1.52	.81	
Social Support Provided (PS)				.927
Giving advice	4.09	1.59	.81	
Showing empathy	4.60	1.47	.81	
Validating thought.	4.53	1.44	.80	
Complimenting	4.69	1.49	.81	
Teaching something new	4.17	1.58	.74	
Sharing information	4.28	1.51	.77	
Encouraging,	4.65	1.46	.84	
Inviting to an event	3.89	1.62	.70	
Social Support Received (RS)				.953
Giving advice	4.28	1.48	.83	
Showing empathy	4.51	1.48	.89	
Validating thought.	4.33	1.44	.89	
Complimenting	4.49	1.43	.86	
Teaching something new	4.62	1.37	.76	
Inviting to a new party	4.08	1.51	.79	
Sharing information	4.57	1.46	.81	
Encouraging,	4.48	1.46	.89	
Inviting to an event	4.31	1.47	.77	
Social Self-Efficacy	4.46	1.20		.937
I can express my opinions when others disagree with me.	4.35	1.43	.79	
I can easily become friends with other.	4.39	1.46	.84	
I can have a chat with an unfamiliar person.	4.22	1.51	.79	
I can work in harmony with other people.	4.73	1.42	.83	
I can tell others that they are doing something that I don't like.	4.37	1.35	.81	
I can tell a funny event to a group of people.	4.34	1.44	.82	
I have been successful in staying friends with other people.	4.57	1.38	.89	
I have been successful in preventing quarrels with other people.	4.71	1.41	.74	
Loneliness	3.32	1.50		.897
I often feel that I lack companionship.	3.62	1.70	.81	
I feel left out from others.	2.97	1.57	.83	
I feel isolated from other people.	3.36	1.68	.95	

supportive interaction in which users engaged in the metaverse.

As for hypotheses 6–7, the paths from supportive interaction to social self-efficacy ($\beta = 0.471$, $p = .000$) and loneliness ($\beta = 0.180$, $p = .012$) were both statistically significant. This result supports hypothesis 7. However, contrary to expectation, the direction of the path from supportive interaction to loneliness was positive. The more people engaged in supportive interaction in the metaverse, the greater they felt loneliness in daily life. Thus, hypothesis 6 was not supported.

Finally, the effect of participants' social self-efficacy was significantly and negatively associated with the feelings of loneliness ($\beta = -0.277$, $p = .000$). The greater people perceived confidence in their social skills, the less they felt loneliness in their social relationships. Hypothesis 8 was, therefore, supported.

To address research question 2, regarding the role of social self-efficacy as the mediator between supportive interaction and loneliness, the indirect effect was tested with a bootstrap analysis using 5000 samples and the 95-percentile confidence interval. The result suggests that social self-efficacy significantly mediates the relationship between the amount of supportive interaction in which people engage in the metaverse and their feelings of loneliness in everyday life ($b = -.158$, $SE = 0.056$, $p < .01$, *95% CI* [-0.282, −0.058]).

5. Discussion

With the prolonged social distancing caused by the COVID-19 pandemic, people have actively sought for the contact-free ways to connect and communicate with others. As a virtual 3D social platform, the metaverse is enjoying considerable attention from the academic literature and the business world with its great potential to bring massive numbers of people together. In the present study, we tested the mechanism through which young people's social activities in the metaverse enhance their social self-efficacy and decrease their feelings of loneliness. Focusing on the perception of social presence and the amount of supportive interactions in which they engaged in the metaverse, we proposed eight hypotheses and two research questions to examine the relationships among the amount of time young people spend in the metaverse, the number of friends they meet in the metaverse, the amount of supportive interaction in which they engage in the metaverse, their perception of social self-efficacy, and the feelings of loneliness. The result of SEM yielded some intriguing and important findings.

First, the number of friends young people have and the amount of time they spent on the metaverse platform positively influenced their sense of social presence in the virtual environment of the metaverse. This result is not surprising given the existing studies that suggest the importance of having close friends and spending more time in a virtual space to experience social presence (e.g., Choi & Kwak, 2017; Francescato et al., 2006; Poquet et al., 2018; Ravaja et al., 2006; Tu & Corry, 2004). Because social presence is evoked by processing social cues of others and their 'minds,' engaging in cue-rich communication with more familiar other users in the metaverse would help young people envision themselves being together with other users in the same virtual environment. This enhanced sense of co-existence in the physically identifiable virtual space would make users' social experience in the metaverse more engaging and enjoyable.

Furthermore, the number of friends young people interacted with in the metaverse was significantly associated with the amount of supportive interactions in which they engaged in the metaverse. The mere amount of time young people spent in the metaverse, however, failed to predict the amount of supportive interactions they had with others on the metaverse platform. This finding corroborates the existing claim that the mere intensity or usage variables are insufficient to predict outcomes of utilizing new media (Oh et al., 2014). Not all activities in the virtual space are social, and not every user in the metaverse is spending time exchanging support with other users. Future studies attempting to address social outcomes of utilizing virtual platforms should identify the type of activity or the nature of interaction users engage in those platforms.

The social presence young people felt in the virtual space of the metaverse significantly mediated the effect of the number of friends and the amount of time they spent on the platform on the amount of supportive interaction they engaged in that platform. Previous studies have highlighted the role of social presence in predicting various communication outcomes such as perceived credibility (e.g., Fogg & Tseng, 1999), learning (e.g., Oztok, Zingaro, Makos, Brett, & Hewitt, 2015), and relationship satisfaction (e.g., Richardson & Swan, 2003). The findings from this study further shed light on the significance of social presence in determining the valence of interactions people engage in the metaverse. People become motivated to manage their impression and coordinate their communication only when the impression they make to others are relevant to the fulfillment of their salient goals (Leary & Kowalski, 1990). Because social presence stimulates individual's need for social approval (Lee & Park, 2014), it is very likely that the

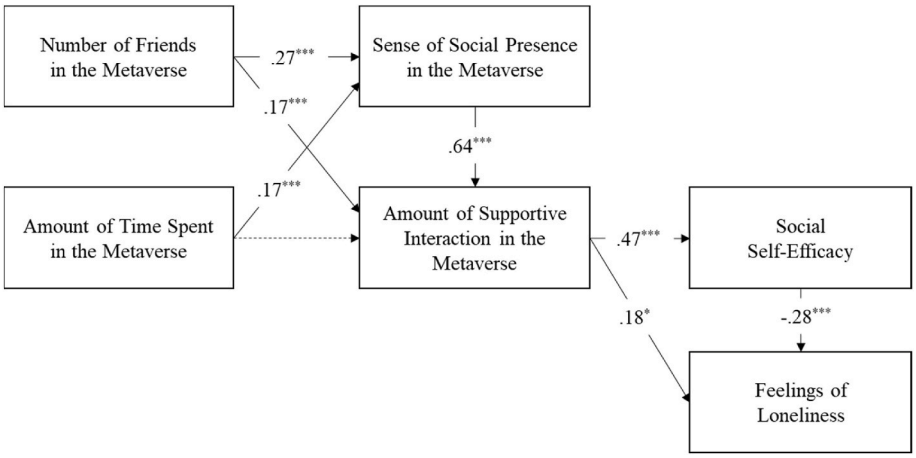

Fig. 2. Result of structural equation modeling.

Table 3
Result of multi-group confirmatory factor analysis (CFA).

	DF	AIC	BIC	x^2	$x^2\triangle$	Df△	p
Baseline Model	258	15,642	16,086	538.36			
Constrained Model	272	15,636	16,029	560.85	22.493	14	0.069

Table 4
Result of multi-group structural equation modeling (SEM).

	DF	AIC	BIC	x^2	$x^2\triangle$	Df△	p
Baseline Model	384	20,070	20,685	751.01			
Constrained Model	436	20,032	20,454	817.31	66.291	52	0.087

heightened sense of social presence people perceive in the metaverse made their relationship goal more vivid and thereby facilitate supportive communication among users.

The immersive technologies in the metaverse platforms are designed to promote social interactions in creative ways. For example, Roblox, currently the most popular metaverse platform among Generation Z, allows its users to join numerous different games and events with their friends, as young people normally do when they hang out together (Hill, 2021). In Zepeto, another popular virtual-social platform in South Korea, users navigate different maps with a personalized 3D avatar that is very much like their own face. Zepeto provides services that resemble existing social media activities such as taking and sharing photos and videos.[4] Social dynamics created within different games make users encounter complex social situations and communicate with others at micro (game-level) and macro levels (world-level) (Szell & Thurner, 2012). In these multi-layered social situations that are almost identical to the real-world, users would feel a strong sense of social presence, the sense of being together with other users in the virtual environment. Without social presence, users would hardly engage in in-depth communication with other users (Lee et al., 2006). Although the two metaverse platforms, Roblox and Zepeto, were originally designed with different elements to attract users, they all functioned to enhance social presence, which then promoted the process and the amount of supportive interactions users engaged in with other users in the virtual worlds.

The amount of supportive interaction in the metaverse was positively associated with young people's perception of social self-efficacy. Positive experiences of interacting with other users in the metaverse enhanced their self-confidence in forming social relationships with others in daily life. Humans enhance social self-efficacy through accumulating successful social experiences (Bandura et al., 1999; Gecas, 1989; Hetherington et al., 1999). Thus, it is very likely that exchanging various types of social support with other users in the metaverse helped young people gain a sense of mastery in developing positive social relationships, which has been the key source of social self-efficacy (Bandura et al., 1999). Moreover, by operating their avatar, young users can experience various forms of supportive interactions involving verbal and nonverbal communication that are closer to the real-world situation than the text-based interactions are (Antonijevic, 2008). This live communication experience may facilitate the learning of social skills (Peterson, 2006). The finding from this study further adds to our existing knowledge by suggesting that the virtual platforms in the metaverse do have the potential to socially benefit young generations not just by becoming a new venue of virtual social interaction, but also by improving their' competence in managing offline social relationship.

Furthermore, social self-efficacy mediated the effect of the supportive interactions in which people engaged in the metaverse and their feelings of loneliness. Contrary to expectation, the amount of supportive interaction in the metaverse positively predicted young people's feelings of loneliness in daily life. Given the non-significant correlation between supportive interaction and loneliness ($r = 0.043$, $p = .46$), the positive and significant relationship found in the model is perhaps attributable to social self-efficacy.[5] After accounting for the covariance of supportive interaction and social-self-efficacy, the nature of relationship between supportive interaction and loneliness became positive, suggesting that

[4] Naver Z. (2021). https://www.naverz-corp.com.

[5] The correlation coefficient between supportive interaction and loneliness turned to positive and significant ($r = 0.131$, $p = .023$) after entering social self-efficacy as a covariate.

the more people exchanged support with others in the metaverse, the greater they felt loneliness in their daily life. Existing studies have revealed the undesirable outcomes of unwanted or unmatched supports such as becoming overly dependent on support providers, feeling embarrassed, and perceiving oneself as incompetent (Beehr et al., 2010; Bolger et al., 2000; Vangelisti, 2009). These outcomes are likely to intervene in the process of gaining self-confidence in social relationships. Although we were not able to specify the exact reason for the unexpected relationship between supportive interaction and loneliness, it is likely that some types of supportive interactions in the metaverse are not beneficial to young people. Future studies should examine the exact types of social supports users exchange in the metaverse, and their psychosocial outcomes.

The path between supportive interaction and loneliness turned negative when it was mediated by social self-efficacy. Enhanced social self-efficacy through supportive interactions in the metaverse indeed reduced people's feelings of loneliness. This finding supports the existing claim that social support in a mediated environment leads to some positive psychological outcomes only when it functions to enhance users' competence in offline social relationships (e.g., Benoit & DiTommaso, 2020; Longman et al., 2009). Despite its importance, the concept of social self-efficacy has seldom been introduced in the context of communication and discussed as a determinant or outcome of social interactions across different mediated environments. Future research should explore specific conditions and activities in the virtual environment that not just facilitate supportive interactions among users but also contribute to improving their self-efficacy in managing offline social relationships.

5.1. Theoretical implications

Findings from this study partially answer the question of what the social benefits of metaverse platforms are. First, the present study found that people are more likely to engage in positive social interactions in the metaverse when they have a vivid perception of the presence of other users in the same virtual space. Advancement has been made in the theoretical literature on computer-mediated social support that uses 2D platforms in which communication occurs through text and images (e.g., Ahn & Shin, 2013; Deters & Mehl, 2013; Shaw & Gant, 2004). What this study adds to the existing literature on social support is an examination of how the avatar-mediated activities in 3D virtual spaces can have even greater potential to enhance users' sense of social presence than the existing platforms (i.e., social media, online communities). Social presence, we claim, is the crucial driver that fosters supportive communications among users and thereby benefits them socially in the metaverse.

Second, while existing studies have emphasized the positive aspects or outcomes of computer-mediated social support (e.g., Oh et al., 2014; Shaw & Gant, 2004; Trepte et al., 2012), this study rather claims that supportive interactions among users in virtual space can increase those users' feelings of loneliness if they fail to enhance their social competence in managing offline relationships. The metaverse provides vivid social environments for individuals and our results highlight the need to further investigate the types of services, activities, and interactions that can be employed within those environments to promote users' competence in managing social relationships.

5.2. Practical implications

Findings of this study further suggest that platform designers and developers should embed more features and services that enhance the social presence of the users. Bringing offline friends together in the metaverse might be one way to encourage more frequent visits and possibly strengthen users' active engagement, but simply increasing the number of daily logins does not necessarily guarantee that result. Since social presence is the key element that promotes supportive interactions and maintains a positive user community, the addition of features and actions that users can employ to engage with one another positively would be an effective way of improving the quality of their social experiences in the metaverse.

Moreover, this study highlights the potential of metaverse platforms for the learning of social skills and enhancing social competence. Recently, counselors and psychotherapists are seeking opportunities in digital platforms to implement social interventions (e.g., social-skills training, interpersonal psychotherapy) and digital therapeutics (DTx) for people who are facing difficulties in everyday interpersonal relationships. This study provides evidence that avatar-mediated interventions in a 3D metaverse platform may have an advantage over previous text-based programs in facilitating positive interactions and enhancing social self-efficacy via enhanced social presence of the participants. They can model, practice, and accumulate successful social experiences in a safe and favorable environment that is real and vivid, which is the basic foundation for training social skills and building social confidence.

6. Conclusion

As a "meta" concept that encompasses a wide range of ever-growing massive virtual-social platforms, the term metaverse is now the most popular buzzword in the media industry and academia. Focusing on the two metaverse platforms that are popular in South Korea, the present study explored the social outcomes of utilizing the metaverse and the mechanism through which young generations, millennials and Generation Z, socially benefit from their activities in a virtual environment. In this study, the social presence young people experienced in the metaverse was the key driver that facilitated their engagement in supportive interactions with other users in the virtual environment. Social self-efficacy then was the bridge that linked young people's virtually mediated experience of social interaction with the reduced feelings of loneliness in everyday life. The metaverse is becoming the next playground for young generations. More research is warranted to advance our understanding of how we should utilize this new platform to help young people develop positive social relationships and maximize the benefits from those relationships.

Credit

Hyun Jung Oh: Conceptualization, Methodology, Writing- Original draft. **Junghwan Kim:** Funding acquisition, Project administration. **Jeongheon JC Chang:** Conceptualization, Methodology, Writing - Review & editing. **Nohil Park:** Conceptualization, Writing - Review & editing. **Sangrok Lee:** Writing- Original draft, Investigation, Software, Correspondence.

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Declaration of competing interest

None.

Data availability

Data will be made available on request.

Appendix A. Pearson's Zero-Order Correlation Matrix among Main Variables

	1	2	3	4	5	6	7	8
1. Sex	1							
2. Age	−.004	1						
3. N of Friends in Metaverse	−.061	−.137*	1					
4. Time Spent in Metaverse	.017	−.088	.291**	1				
5. Social Presence	−.080	.189**	.282**	.178**	1			
6. Supportive Interaction	.037	.141*	.375**	.186**	.644**	1		
7. Social Self-efficacy	.031	.233**	.230**	.008	.322**	.472**	1	
8. Loneliness	−.012	.026	.015	.044	.185**	.043	−.152**	1

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