**Metacognitions about online gaming mediate the effect of attachment patterns on Internet Gaming Disorder: Evidence from a cross-cultural validation of the Metacognitions about Online Gaming Scale (MOGS) Hebrew version - a 6-month prospective study**

Yaniv Efrati**a\***, and Marcantonio M. Spadab

a Bar-Ilan University, Faculty of Education, Ramat Gan, Israel.

b Division of Psychology, School of Applied Sciences, London South Bank University, London, UK.

**Abstract**

The use of the Metacognitions about Online Gaming Scale (MOGS) has been linked with online gaming disorders. In our study, we evaluated the psychometric properties of the MOGS, including its factor structure, reliability, and predictive validity among Israeli adolescents in a six-month prospective study. We also examined the usefulness of the MOGS as a theoretical model and a mediate of the following: the effect of attachment patterns on Internet Gaming Disorder (IGD), the preference for online social interactions, and the motives for online gaming. The study population included 1,056 Israeli adolescents (610 males and 446 females, M = 15.77, standard deviation (SD) = 1.43) with an age range of 13–18 years. The participants completed the Hebrew-translated version of the attachment style MOGS on the following: IGD, preference for online social interactions, emotion regulation, and motives for online gaming. The analyses indicated that the factorial structure of the Hebrew MOGS comprised the expected two factors in T1 and T2 (a six-month follow-up). We also found that positive and negative metacognitions significantly mediated the effect of attachment styles on IGD, the preference for online social interactions, and the motives for online gaming. The findings provide evidence that the Hebrew MOGS among Israeli adolescents appears psychometrically appropriate for use by researchers and practitioners dealing with the prevention and treatment of online gaming disorders.

**1. Introduction**

Internet Gaming Disorder (IGD) is defined by a persistent and recurrent pattern of excessive and uncontrollable Internet gaming, which results in a cluster of cognitive and behavioral symptoms, impaired daily functioning, and significant psychological distress (American Psychiatric Association, 2013; World Health Organization, 2019). Adolescents are particularly vulnerable to IGD (Yu et al., 2022; Lampropoulou et al., 2022; Rosendo-Rios, Trott, & Shukla, 2022). The prevalence of IGD among adolescents ranges between 7% and 15% (Pontes et al., 2019); other studies suggest a global prevalence that ranges from 2.47% to 3.05% (Pan et al., 2020; Stevens et al., 2021). By gender, research suggests that IGD is rifer among male children and young adults: 19% of boys and 7.8% of girls are classified as having IGD (Newport Academy, 2021). With gaming industry revenues expected to reach more than $200 billion globally by 2023 (Statista, 2021), IGD may become even more widespread within this vulnerable population, warranting immediate attention. In Israel, a recent study indicates that 30% of all adolescents self-perceived as having IGD (Efrati & Spada, 2022). This alarmingly high prevalence of IGD self-awareness among adolescence, accompanied with the heightened IGD rate, underscores the long-lasting need to identify IGD’s risk factors and provide reliable and valid assessment tools and early interventions in high-risk adolescents. (Lampropoulou et al., 2022). Responding to such a need, the present study aimed to validate the use of Metacognitions about Online Gaming Scale (MOGS; Spada & Caselli, 2017) among adolescents for future investigations.

**1.1. Metacognitions and IGD**

Metacognition refers to thinking about one’s thinking and can be defined as any stable knowledge about one’s own cognitive system and strategies that may have an impact on the regulation of cognition, the awareness of the current state of cognition, and the appraisal of the meaning of cognitive affective states (Wells & Matthews, 1996). According to Wells and Matthews’ metacognitive model of psychological distress (Wells & Matthews, 1994; 1996), metacognitions are involved in the activation of maladaptive coping strategies that exacerbate the negative affect. This, in turn, increases the likelihood of engaging in addictive behaviors as an escapism and “last resort” for achieving cognitive affective self-regulation (Spada, Caselli, Nikcevic, & Wells, 2015). As metacognitions may vary across disorders (Casale et al., 2021), Spada and Caselli (2017) drew researchers’ attention away from generic metacognitions (i.e., common beliefs about cognitive affective experiences such as “I need to control my mind at all times”) to specific metacognitions involved in IGD by developing the MOGS. Metacognitions about online gaming are theorized to guide cognitive appraisal and coping styles and (dis)regulate behaviors during the pre- and post-engagement phases toward external triggers (e.g., exposure to online gaming). Two types of metacognitions have been identified in the literature: positive and negative. Positive metacognitions relate to the benefits of engaging in coping strategies for controlling cognitive affective experiences (e.g., “Online gaming helps me to control my negative thoughts”) and are linked to the activation of such coping strategies. Negative metacognitions are judgments relating to the perceived control over adopted coping strategies and the resultant cognitive affective states (e.g., “I continue to play despite I think it would be better to stop”). The ubiquitous role of both positive and negative metacognitions in addictive behaviors has been widely evidenced across numerous studies (e.g., Spada et al., 2015; Hamonniere & Varescon, 2018). As shown by subsequent studies, these specific metacognitions about online gaming have stronger associations with IGD (e.g., 0.45–0.75; Akbari et al., 2021; Nazligül, & Süsen, 2021; Dang et al., 2022; Gandolfi, Soyturk, & Ferdig, 2021) compared to generic metacognitions (e.g., 0.12–0.33; Aydın et al., 2020; Zhang et al., 2020; Efrati et al., 2021).

**1.2. Gaming motives**

Motivation is a key predictor of IGD, which turns the enjoyable use of online gaming into excessive use, negatively impacting quality of life (Mills et al., 2018). Examining gaming motives is a crucial step in understanding how gaming can become an addictive behavior (Akbari et al., 2021; Lafrenière, Verner-Filion, & Vallerand, 2012; King & Delfabbro, 2009; Moudiab & Spada, 2019; Marino et al., 2020). Demetrovics and colleagues (2011), using exploratory factor analysis, identified seven different motives for gaming: forming social connections, escaping from reality, competing with others, coping with distress, developing skills, engaging with fantasy worlds, enjoying recreation, and building relations. In another study, social motives, immersion, and achievement were introduced as three main components of problematic gaming behavior; achievement motivation is related to the development of power, domination, rivalry, provocation, and similar motives. Social motives lead to goals such as making friends, helping others, self-disclosure, getting support, and teamwork. Immersion is related to searching and finding hidden or mysterious things, fantasy, and interest in role-playing and escaping from the real world and its problems (Yee, 2006). These gaming motives appear to be key determinants of IGD (Wang, & Cheng, 2022). Therefore, the first aim of the current study, to examine metacognitions about online gaming, should be explored as a potential connection to gaming motives.

**1.3 Emotion regulation strategies**

Another connection could exist between metacognitions about online gaming and emotion regulation strategies in adolescents. Over the past few decades, there has been increased recognition that learning how to manage or regulate emotions in a socially appropriate and adaptive manner (Matthews, Webb, & Sheppes, 2021) is important for healthy psychological development (Cole, Michel, & Teti, 1994; Morris, Silk, Steinberg, Myers, & Robinson, 2007; Southam-Gerow & Kendall, 2002). Emotion regulation involves intrinsic and extrinsic processes that move toward goal accomplishment (Thompson, 1994). These can be conscious or unconscious, automatic, or effortful (Cole et al., 1994; Gross & Thompson, 2007; Thompson, 1994) based on the development of skills and strategies for monitoring, evaluating, and modifying emotional reactions. There are two main emotion regulation strategies: 1) cognitive reappraisal, a cognitive change strategy that redefines a potentially emotion-eliciting situation in a way that changes its emotional impact; and 2) expressive suppression, a form of response modulation that attempts to inhibit ongoing emotion-expressive behavior (Gullone & Taffe, 2012). Emotion regulation has been found to have a therapeutic role in treating negative health behaviors such as IGD (Wu et al., 2020), substance use disorder (Cavicchioli et al., 2019), and gambling (Rogier & Velotti, 2018). Evidence also suggests that poor emotion regulation, that is, excessive use of suppression and less frequent use of reappraisal, may be a significant predictor of IGD. Recently, Yen et al. (2018) found that a group diagnosed with IGD had significantly lower cognitive reappraisal strategies and greater expressive suppression strategies than the control group, and that cognitive reappraisal negatively predicts IGD and expressive suppression positively predicts IGD.

Moreover, an application of Caplan’s cognitive behavioral model of problematic Internet use (Caplan, 2010; Haagasma et al., 2013) demonstrated that preference for online social interaction (POSI) plays a role in worsening the negative consequences of problematic gaming both directly and via mood regulation (Haagasma et al., 2013). In addition, Marino et al. (2020) found in a study on 543 Italian gamers that POSI correlated with positive and negative metacognitions about online gaming and IGD. Therefore, the second aim of the current study is to examine adolescents with difficulties in cognitive emotion regulation (reappraisal and suppression) and POSI and determine the association, if any, with metacognitions about online gaming or IGD.

**1.4 Attachment orientations**

Attachment orientations are shaped during infancy through intimate interactions with caregivers (see Mikulincer & Shaver, 2016 for a detailed account). When a caregiver provides support and ensures that an infant’s needs (e.g., for comfort and security) are consistently satisfied, the infant develops a secure bond toward the attachment figure (i.e., attachment security), which is characterized by a view of the self as lovable and others as dependable. Secure people are more socially engaged and tend to develop healthy ties with family members, friends, and romantic partners.

At times, however, parental support is inadequate, and as a result, infants may develop insecure attachment orientations that are classified along two dimensions: attachment anxiety and avoidance (Brennan, Clark, & Shaver, 1998; Collins & Allard, 2004). When an infant’s needs are not sufficiently met by caregivers and the availability of support and care is uncertain, fear of abandonment and rejection may develop. Individuals with this type of attachment orientation are said to be anxiously attached and are characterized by an unfulfilled hunger for affection regardless of the amount of affection they receive (Birnbaum, Reis, Mikulincer, Gillath, & Orpaz, 2006). When an infant experiences cold and distanced caregiving, they are likely to develop attachment avoidance orientation, viewing others as untrustworthy and undependable. These individuals prefer to emotionally distance themselves from intimate relationships (Smith, Murphy, & Coats, 1999).

In previous research, the links between attachment orientations and IGD have been shown to be weak or to show no direct association between parental attachment and IGD (e.g., King & Delfabbro, 2017; Throuvala, Janikian, Griffiths, Rennoldson, & Kuss, 2019; Teng, Griffiths, Nie, Xiang, & Guo, 2020). However, most research has suggested that perceived insecure attachments (e.g., lower trust, lower levels of communication, and higher levels of alienation), including parental attachment, are more prevalent among individuals with IGD (Estevez, Jauregui, & Lopez-Gonzalez, 2019; Schneider, King, & Delfabbro, 2017; Wang, Ho, Chan, & Tse, 2015; Zhu, Zhang, Yu, & Bao, 2015).Consequently , it seems that attachment insecurity, which is linked to various social dysfunctions, high levels of psychological distress, and emotion dysregulation, creates a predisposition for MOGS and IGD. Therefore, the third aim of the current study is to examine whether attachment insecurities should be explored as having a possible correlation to the MOGS and IGD.

**1.5 The current study**

Given the limited research that focuses on adolescence and the MOGS, especially 6-month prospective studies, the current research has two aims: 1) to evaluate the psychometric properties of the MOGS, including its factor structure, reliability, and predictive validity among Israeli adolescents utilizing a 6-month prospective study; and 2) to examine MOGS as a theoretical model that mediates the effect of attachment patterns on IGD, the POSIs, and the motives for online gaming. Specifically, the study examines two questions: First, is the factorial structure of the Hebrew MOGS comprised of two factors? Second, do metacognitions mediate the effect of attachment patterns on IGD, the POSIs, and the motives for online gaming?

**2. Method**

**2.1 Participants**

The study population consisted of 1,056 Jewish Israeli adolescents from the general community (610 males and 446 females), and ages ranged from 13 to 18 (M = 15.77, SD = 1.43). All participants were enrolled in the eighth (n = 133; 12.7%), ninth (n = 161; 15.4%), 10th (n = 225; 21.5%), 11th (n = 270; 25.8%), and 12th (n = 259; 24.7%) grades. Most (96.8%) were native Israelis. Socioeconomically, the students described their level as being very bad (0.3%), bad (2.2%), good (58%), and very good (39.5%). In terms of religious affiliation, the sample consisted of 507 (48%) self-reported individuals, of which 223 (21.1%) considered themselves traditional, 252 (23.9%) secular, and 74 (7%) ultra-Orthodox. Participants had the opportunity to mark multiple genres and game types, and they indicated the following preferences: Massively Multiplayer Online Role-playing Game (n =543; 51%), First-Person Shooter (n = 358; 34%), Role-playing Game (n = 241; 23%), and Multiplayer Online Battle Arena (n = 308; 29%).

**2.2 Measures**

**2.2.1 Sociodemographic variables**. Adolescents reported their age (13–18), biological sex (male, female), religiosity (traditional, secular, religious, ultra-Orthodox), immigration status (Israeli, immigrant), and socioeconomic status (SES; divided into the categories of very good, good, bad, and very bad).

**2.2.2 Preference for Online Social Interactions.** The preference for online social interactions (POSI) subscale was translated to Hebrew for this study via a back-to-back translation procedure (from English to Hebrew and back) of the Generalized Problematic Internet Use Scale 2 (GPIUS2; Caplan, 2010); the GPIUS2 was used to assess the POSIs. The subscale comprises three items (e.g., “Online social interaction is more comfortable for me than face-to-face interaction”). Participants were asked to rate the extent to which they agreed with each item on an 8-point scale (ranging from 1= “definitely disagree” to 8 = “definitely agree”). Cronbach's alpha for the scale in the present study was 0.86 (T1) and .89 (T2). Items were averaged to obtain a total score, with higher scores representing higher levels of POSI.

**2.2.3 Internet Gaming Disorder.** The severity of IGD and its detrimental effects over a 12-month period were assessed using a version of the nine-item short form of the Internet Gaming Disorder Scale (Pontes & Griffiths, 2015) based on the nine IGD items defined in the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (2013). Items were translated into Hebrew by Efrati et al., (2021). Responses are rated on a 5-point scale (ranging from 1 = never to 5 = very often). Responses were averaged, and higher scores represent a higher IGD severity. In this study, Cronbach’s alpha was .86 (T1) and .89 (T2).

**2.2.4 The Metacognitions about Online Gaming Scale.** This study used the MOGS (Spada & Caselli, 2017) to assess positive and negative metacognitions about online gaming. Like POSI, the MOGS was translated by a back-to-back translation procedure (from English to Hebrew and back). The scale has two factors, each of which is assessed by six items; “positive metacognitions about online gaming” (P-MOG) refers to the usefulness of online gaming as a cognitive affective self-regulatory strategy (e.g., “Online gaming helps me to control my negative thoughts”), and “negative metacognitions about online gaming” (N-MOG) refers to the uncontrollability and dangers of online gaming and online gaming-related thoughts (e.g., “I have no control over how much time I play”). Participants were asked to rate the extent of their agreement to each statement on a 4-point scale (ranging from 1 = “do not agree” to 4 = “agree very much”). Items were added to obtain a score for both positive and negative metacognitions. Higher scores represent higher levels of metacognitions. Cronbach’s alpha for the positive and negative subscales in the present study were .85 (T1) and .85 (T2) for positive metacognitions and .88 (T1) and .91 (T2) for negative metacognitions.

**2.2.5 The Motives for Online Gaming Questionnaire.** To assess a range of motives for online gaming, the Motives for Online Gaming Questionnaire (Demetrovics et al., 2011) was used. Items were translated from English to Hebrew by three independent psychologists and back translated in English by a bilingual expert in the field. Participants were asked to rate the frequency of each of the 27 items over the last 12 months on a 5-point scale (ranging from 1 = “never” to 5 = “almost always/always”). The scale comprised seven motivational dimensions: 1) social (four items; e.g., “because gaming gives me company”; Cronbach’s alpha was .82 (T1) and .84 (T2); 2) escape (four items; e.g., “because gaming helps me escape reality”; Cronbach’s alpha was .88 (T1) and .88 (T2); 3) competition (4 items; e.g., “because it is good to feel that I am better than others”; Cronbach’s alpha was .82 (T1) and .82 (T2); 4) skill development (4 items; e.g., “because it improves my coordination skills”; Cronbach’s alpha was 0.81 (T1) and .83 (T2); 5) coping (4 items; e.g., “because gaming helps me get into a better mood”; Cronbach’s alpha was 0.88 (T1) and .89 (T2); 6) fantasy (4 items; e.g., “because I can do things that I am unable to do or not allowed to do in real life”; Cronbach’s alpha was 0.84 (T1) and .86 (T2); and 7) recreation (3 items; e.g., “because it is entertaining”; Cronbach’s alpha was 0.81 (T1) and .80 (T2). Items were averaged to obtain seven separate scores for each motivational dimension, and higher scores represented higher levels of each motive.

**2.2.6 The Emotion Regulation Questionnaire for Children and Adolescents**: Developed by Gullone and Taffe (2012), the Emotion Regulation Questionnaire for Children and Adolescents (ERQ–CA) was based on the ERQ questionnaire (Gross & John, 2003). The questionnaire contains 10-item scales for assessing the emotion regulation strategies of cognitive reappraisal (CR) and expressive suppression (ES); CR consists of six items and ES consists of four. Items are rated on a 5-point Likert response scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating greater use of the corresponding ER strategy. Examples of such statements include “When I want to feel happier, I think about something different” (Item 1), and “I control my feelings by not showing them” (Item 6). We used the Hebrew version (Efrati & Amichai-Hamburger, 2020). Cronbach’s alpha was .79 (T1) and .81 (T2) for reappraisal and .74 (T1) and .75 (T2) for suppression.

**2.2.7 Attachment Style Classification Questionnaire** (Finzi et al., 1996; Finzi et al., 2000). This questionnaire is an adaptation for children of the Hebrew version (Mikulincer et al., 1990) of Hazan and Shaver's (1987) questionnaire for the classification of attachment styles in adults. The questionnaire contains 15 items divided into three factors, which copied Ainsworth’s (1970) three attachment patterns: secure (e.g., “I usually believe that others who are close to me will not leave me”), anxious/ambivalent (e.g., “I’m sometimes afraid that no one really loves me”), and avoidant (e.g., “I find it uncomfortable and get annoyed when someone tries to get too close to me”). The participants were asked to read each item and to rate the extent to which the item described themselves on a 5-point scale, with scores ranging from 1 (not at all) to 5 (very much). Cronbach’s alpha was .82 (T1) and .82 (T2) for attachment anxiety and .72 (T1) and .74 (T2) for attachment avoidance.

**2.3 Procedure**

The study was presented to participants as a research project on metacognitions about online gaming in Jewish adolescents from various regions of Israel (eastern, central, southern, or northern parts of Israel). The participants constituted a convenience sample recruited from a variety of sources such as postings on bulletin boards and in online forums. Questionnaires were uploaded to Qualtrics, an online platform for questionnaires, and distributed by several research assistants. Parents of adolescents who agreed to participate in the study were contacted via email and/or phone and were asked to review the questionnaires and sign an informed parental consent form, which was sent back to the research assistants by email. Upon agreement, a link to the online survey was sent to the participants, who were assured anonymity. Participants were then asked to complete the survey in private in a quiet room in their home. Following receipt of a signed consent form, questionnaires were presented in random order. All questionnaires were in Hebrew, Israel’s native language. Finally, an online debriefing took place and participants were thanked for their participation. Participants were sampled twice, once in a baseline assessment and at a 6-month follow-up measurement. The procedure was approved by the Institutional Review Board.

**3. Data analysis.** In the first section of the results, we set out to validate the Hebrew version of the Metacognitions about Online Gaming Scale (MOGS; Spada & Caselli, 2017). To do so, we employed Exploratory Graph Analysis (EGA; Golino et al., 2020) using *EGAnet* R package – a network psychometrics method that uses undirected network models for the assessment of psychometric properties of questionnaires. EGA was used to verify the number of or factors using graphical lasso (Friedman et al., 2008) and the items that are associated with each factor. Network loadings, which are roughly equivalent to factor loadings, are reported using *net.loads()*, with suggested general effect size guidelines for network loadings of 0.15 for small, 0.25 for moderate, and 0.35 for large (Christensen & Golino, 2021). Next, to examine the stability of the EGA and therefore of the underlying construct of the Hebrew-MOGS, we followed the analysis with Bootstrap Exploratory Graph Analysis with 5,000 resampling cycles. We also assessed the stability of each of the 12 items using the *itemStability()* function with a minimum cut-point of 75% stability. We corroborated the results of the EGA with a Confirmatory Factor Analysis (CFA) with maximum likelihood estimation with robust standard errors and a mean- and variance- adjusted test statistic (MLMVS; i.e. the Satterthwaite approach) using *lavaan* Structural Equation Modeling (SEM) R package. model fit was estimated by Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). CFI and TLI > .90 and RMSEA and SRMR < .07 are acceptable. We finalized the first section by a test-retest reliability of the Hebrew-MOGS over a period of 6 months by intraclass correlation coefficient (ICC ≥ 0.50 as acceptable; Koo & Li, 2016) using the *irr* R package, and with convergence validity that was tested by bivariate correlations between MOGS and internet gaming disorder (IGD), preference for online social interactions, motives for online gaming (social, escape, competition, coping, skill development, fantasy, recreation), and emotion regulation strategies (suppression, reappraisal). All measures were taken from T1.

The second part of the results began with a descriptive examination of the Hebrew-MOGS facets (i.e. negative and positive metacognitions about online gaming) followed by an Mahalanobis-Minimum Covariance Determinant (MMCD) test for detecting multivariate outliers in the main study measures (i.e. metacognitions, attachment patterns [anxiety, avoidance], internet gaming disorder, preference for online social interactions, and motives for online gaming). The analyses detected 159 multivariate outliers. Accordingly, we employed robust analyses to avoid the possible bias of analyzing data with multiple outliers. Specifically, we examined whether negative and positive metacognitions about online gaming mediate the effect of attachment pattern that are crystalized in early years of life on internet gaming disorder, preference for online social interactions, and motives for online gaming. To ensure directionality, attachment patterns and metacognitions were taken from T1 (given that attachment patterns were found develop in early years and remain moderately stable over time), and internet gaming disorder, preference for online social interactions, and motives for online gaming from T2 (i.e. 6-month follow-up). To do so, we estimated hierarchical robust regression models with an MM-estimator in which we (i) predicted whether metacognitions are predicted by attachment patterns, and (ii) whether metacognitions predict internet gaming disorder, preference for online social interactions, and motives for online gaming while controlling for attachment patterns. In these models, we also controlled for adolescents’ gender, age, religiosity, and socio-economic status. Models were estimated with the *rlm()* function of the *MASS* R package; Causal Mediation Analyses were then used to appraise the significance of the indirect paths from attachment patterns via metacognitions to internet gaming disorder, preference for online social interactions, and motives for online gaming. Significance was estimated using bias-corrected and accelerated (BCa) confidence intervals with 1,000 Monte Carlo draws. In the final step, we conducted sensitivity analyses for each significant indirect path to assess its sensitivity for possible unobserved confounding variables.

**4. Results**

**4.1 Part I: Validation of the Hebrew-MOGS version**

The EGAs network results are presented in Figure 1 and network loadings in Table 1. The analyses indicated that the factorial structure of the Hebrew-MOGS comprised the expected two factors in T1 and T2 (6-month follow-up): items 1-6 were loaded on one network consisted of negative metacognitions about online gaming, and items 7-12 on a second network consisted of positive metacognitions about online gaming. When estimating the stability of the EGAs by bootstrapping with 5,000 resampling cycles, the analysis indicated exceptionally high stability: SE = .014, with CI for the number of factors ranging from 1.97 to 2.03 at T1, and SE = 0 at T2. Accordingly, 99.98% and 100% of the samples drawn produced a 2-factor solution (with 0.02% producing a 3-factor solution at T1). As can be seen in Figure 2, all items had 100% stability across all resampling cycles. A confirmatory factor analysis (CFA) that was used to corroborate the EGA solution, verify the factorial structure in each time point, *χ2*(42.46) = 239.27, *p* < .01, *CFI* = .94, *TLI* = .93, *RMSEA* = .066 (90% confidence interval [CI] of .06, .073), *SRMR* = .046 for T1, *χ2*(38.34) = 195.89, *p* < .01, *CFI* = .95, *TLI* = .93, *RMSEA* = .062 (90% confidence interval [CI] of .056, .069), *SRMR* = .045 for 6-month follow-up. The CFA is presented in Figure 3. Finally, a test-retest reliability showed high consistency over a period of 6 months, *ICC* = .585, 95% CI of .544, .623. Description information regarding the metacognition clusters is presented in Figure 4.

Table 2 presents bivariate correlations between metacognitions and internet gaming disorder (IGD), preference for online social interactions, motives for online gaming (social, escape, competition, coping, skill development, fantasy, recreation), and emotion regulation strategies (suppression, reappraisal) for examining convergence validity. As expected, the analyses indicated positive and significant correlations between metacognitions and all related measures. In keeping with predictions, weak correlations were found with emotion regulation strategies, moderate correlations with preference for online social interactions and motives for online gaming, and strong correlations with IGD.

**4.2 Part II: Do metacognitions mediate the effect of attachment patterns on IGD, preference for online social interactions, motives for online gaming?**

**4.2.1 Attachment patterns ⇒ Metacognitions.** Results are presented in Table 3a. Regarding the covariates, the analyses revealed that boys had significantly higher negative and positive metacognitions about online gaming than girls, older and/or more religious adolescents had fewer positive metacognitions about online gaming, and adolescents with higher SES had more negative metacognitions about online gaming than adolescents with lower SES.

4.2.2 **Metacognitions ⇒ IGD, preference for online social interactions, and motives for online gaming, controlling for attachment patterns.** Results are presented in Table 3b. The analyses indicated that after controlling for attachment patters, the higher adolescents’ negative and/or positive metacognitions about online gaming, the higher their IGD, preference for online social interactions, and motives for online gaming (except for recreation that was only associated with positive metacognitions). Regarding the covariates, the analyses revealed that older adolescents had higher motivation for social benefits of gaming, boys had higher motivation for competition and recreation than girls, and religious adolescents had less IGD, and lower motivation for social, escape, coping fantasy and recreation as compared with secular adolescents. Finally, regarding attachment patterns, the analyses revealed that attachment anxiety was linked with higher motivation to escape and less to compete; attachment avoidance was associated with higher IGD, preference for online social interactions, and motivations to escape, cope, develop skills, and create a fantasy online world.

4.2.3 **Indirect paths and sensitivity analyses.** Results are summarized in Table 4 and Figure 5. The analyses indicated that positive and negative metacognitions significantly mediated the effect of attachment anxiety on IGD, preference for online social interactions, and motives for online gaming (apart from negative metacognitions that did not mediate the effect of anxiety on motivation for recreation). These mediation paths accounted for much of the effect of attachment anxiety such that the indirect effect via negative metacognitions accounted for 69.12%, in average, of the total effect (average sensitivity of 0.23), and via positive metacognitions an average of 69.95% of the total effect (average sensitivity of 0.24). In fact, attachment anxiety was only directly associated with more motivation to escape and less motivation for competition after accounting for metacognitions.

Regarding attachment avoidance, the analyses revealed that similarly to attachment anxiety, positive and negative metacognitions significantly mediated the effect of attachment avoidance on IGD, preference for online social interactions, and motives for online gaming (apart from negative metacognitions that did not mediate the effect of avoidance on motivation for recreation). Unlike anxiety, these mediation paths did not account for much of the effect of attachment avoidance such that the indirect effect via negative metacognitions accounted for only 30.12%, in average, of the total effect (average sensitivity of 0.23), and via positive metacognitions an average of only 30.36% of the total effect (average sensitivity of 0.24). In fact, attachment avoidance was directly associated with most of the measures even after accounting for metacognitions. Specifically, it was directly linked with more IGD and preference for online social interactions, and higher motivations to escape, cope, develop skills and create a fantasy online world.

**5. Discussion**

Metacognitions about online gaming was highlighted as the key factor that could contribute to problematic behavior throughout adolescence (Akbari et al., 2020). However, metacognitions about online gaming among adolescence is still limited. In the current study, we focused on key factors that might evaluate the psychometric properties of the MOGS, including its factor structure; reliability; predictive validity, attachment style; IGD; POSIs; emotion regulation; and motives for online gaming. To do so, we conducted a large-scale prospective study involving 1,056 Jewish Israeli adolescents from the general population. We were able to examine the contribution of the MOGS as a mediate of the effect of attachment patterns on IGD, POSIs, and motives for online gaming.

Overall, we corroborated the results of the EGA with a CFA of the MOGS, suggesting that metacognitions about online gaming can be optimally measured by the Hebrew MOGS within a two-factor latent construct: “negative metacognitions” and “positive metacognitions.” These results are in line with the study in Spada and Caselli’s (2017) work on the development of the MOGS. Cronbach's alpha coefficients for all factors and the total score were good at the 6-month follow-up (ranging from 0.85 to 0.91) and in line with the original self-report measure development (Spada & Caselli, 2017).

In keeping with convergence validity predictions, adolescents reported on positive and significant correlations between metacognitions and all related measures as part of the psychometric properties of the MOGS. Moreover, as we expected, we found weak correlations with emotion regulation strategies, moderate correlations with preferences for online social interactions and motives for online gaming, and strong correlations with IGD. This finding is in line with previous research that shows strong correlations with IGD; specifically, negative metacognitions (Marino et al., 2020; Akbari et al., 2020) reflects the beliefs that adolescences hold regarding their lack of control over gaming. These types of beliefs, possibly activated during or after playing, may lead to continued playing to reduce the negative effect with the paradoxical effect of increasing it (Marino & Spada, 2017).

We hypothesized that metacognitions mediate the effect of attachment patterns on IGD, POSIs, and motives for online gaming. Unsurprisingly, and in keeping with the hypothesis, boys had significantly higher negative and positive metacognitions about online gaming than girls, older and/or more religious adolescents had fewer positive metacognitions about online gaming, and adolescents with higher SES had more negative metacognitions about online gaming than adolescents with lower SES. This finding is in line with research findings that boys show higher levels of metacognitions (Dang et al., 2022). Results were also in line with recent research that young age (Efrati et al., 2021) and less religious affiliation (Efrati & Spada, 2022) indicate more IGD (which may explain the fewer positive metacognitions). In addition, in contrast to our finding about SES, a recent study did not find correlations between SES and metacognitions (Marino et al., 2019). One possibility could be the use of generic metacognition (MCQ). Another reason is the difference between problematic Facebook use, which, according to our study, is utilized less by adolescents compared to IGD. Moreover, adolescents with higher SES were found to be more at risk for addictive behavior on the Internet and gaming (Petruzelka et al., 2020; Toker, & Baturay, 2016), possibly due to more awareness (parents' education or school prevention programs) of problematic behavior regarding online gaming, which may lead to more negative metacognitions about online gaming.

Aside from the correlation between metacognitions about online gaming and other measures, in the current study we examined this correlation after controlling for attachment patterns. Results indicated that the higher an adolescent’s negative and/or positive metacognitions about online gaming, the more severe their IGD, the greater their POSIs and motives for online gaming. These findings correspond with previous studies on adolescence and gamers indicating metacognitions about online gaming and IGD (Dang et al., 2022; Akbari et al., 2021), POSIs, and motives for online gaming (Marino et al., 2020). Specifically, the current study also focused on demographic aspects and revealed that older adolescents had higher motivation for the social benefits of gaming, which may be related to their affinity for technology as “digital natives” (Andreassen et al., 2016) and to the developmental tasks of this older age period (personal goals vs life optimization; Freund & Baltes, 1998). In addition, we found that boys had a higher motivation for competition and recreation than girls. Demetrovics et al. (2011) found this result on a Hungarian sample of 3,818 participants; in contrast, our study found that females had a higher motivation for recreation than males. One explanation is age difference: ages 14 to 17 scored the lowest for recreation (Demetrovics et al., 2011). In addition, religious adolescents experienced less incidence of IGD and lower motivation for social, escape, coping fantasy, and recreation as compared with secular adolescents. A previous study on Israeli adolescence indicates a lower prevalence of IGD for religious adolescents compared to secular adolescents (Efrati & Spada, 2022), but we were unable to find research that indicated differences by religion on the motivation of Internet gaming. Future research is needed in this area. Finally, regarding attachment patterns, an anxiety attachment style is typical of adolescence who strive for closeness, support, affection, and love but lack the conviction that they will be able to meet their goals and fear rejection. Thus, higher motivation to escape and less to compete may serve as a substitute for those adolescents who harbor attachment anxiety. For different reasons, adolescents who indicate attachment avoidance may be seeking compensation for a lack of warmth, closeness, and intimacy in their lives. Research has shown that pornographic usage serves as compensation for avoidance attachment and loneliness (Efrati & Amichai-Hamburger, 2019). Therefore, it is not surprising that attachment avoidance was associated with a higher rate of IGD, a POSIs, and motivations to escape, cope, develop skills, and create a fantasy online world.

Consistent with previous research (Casale, Caplan, & Fioravanti, 2016; Casale, Musicò, & Spada, 2021; Marino et al., 2019), metacognitions play a mediating role in the relationships between potential risk factors and problematic technological behavior in general. Our findings indicate that positive and negative metacognitions significantly mediated the effect of attachment anxiety and avoidance for IGD, POSI, and motives for online gaming. It is likely that anxiety may guide children toward threat monitoring, focusing attention on signals of separation and danger, and engaging in cognitive processes like rumination (Malik, Wells, & Wittkowski, 2015). From this perspective, anxious children should be more likely to develop both positive metacognitions about the usefulness of perseverative thinking and negative beliefs about thought uncontrollability and danger (Caselli et al., 2017). Conversely, children with high levels of attachment avoidance should be more prone to engage in thought suppression (natural threat repressing) and focus their attention on denying the need for closeness. In terms of metacognitive knowledge,

avoidant styles may guide children to believe that thoughts and emotions are dangerous and uncontrollable and thus to perceive the need to control thoughts (Caselli et al., 2017; Moss, Erskine, Albery, Allen, & Georgiou, 2015). In both cases, the activation of maladaptive metacognitions seems to be associated with higher levels of IGD, POSI, and motives for online gaming.

Although our main premises were supported, the study has several limitations. The study is correlational in nature and so precludes conclusions regarding causal processes. Although we employed a prospective assessment of metacognitions and, therefore, can appraise the directionality of the associations, caution is warranted when implementing the current findings into interventions. In addition, the research population was comprised of Jewish Israeli adolescence. Future studies should examine other adolescent and diverse ethnic and cultural populations to ascertain the replicability and generalization of the findings.

Despite the limitations of the current study, we view this research as an important step in understanding the dynamics of metacognitions in the development of IGD among adolescents. Based on our findings, therapy has the potential to deliver more focused help to adolescents with a disposition toward IGD. It is important to increase therapists’ awareness of the benefits of considering the role of metacognitions when dealing with IGD symptoms and adding a cognitive approach to individual therapy for adolescents experiencing IGD.

Table 1

Network loadings of the Hebrew-MOGS version based on EGAs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Time 1 | | Time 2 (6-month follow-up) | |
|  | Negative | Positive | Negative | Positive |
| MOGS1 | 0.19 |  | 0.22 |  |
| MOGS2 | 0.34 |  | 0.31 |  |
| MOGS3 | 0.38 |  | 0.39 |  |
| MOGS4 | 0.33 |  | 0.36 |  |
| MOGS5 | 0.34 |  | 0.35 |  |
| MOGS6 | 0.28 |  | 0.31 |  |
| MOGS7 |  | 0.22 |  | 0.25 |
| MOGS8 |  | 0.40 |  | 0.38 |
| MOGS9 |  | 0.38 |  | 0.40 |
| MOGS10 |  | 0.34 |  | 0.34 |
| MOGS11 |  | 0.42 |  | 0.39 |
| MOGS12 |  | 0.21 |  | 0.26 |
| Cronbach’s α | 0.83 | 0.88 | 0.85 | 0.90 |

Note. General effect size guidelines for network loadings are 0.15 for small, 0.25 for moderate, and 0.35 for large.

Table 2

*Means, standard deviations, and correlations with confidence intervals*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | *M* | *SD* | Negative  metacognitions | | Positive  metacognitions | |
| Expressive suppression | 2.72 | 0.82 | .21\*\* | | .25\*\* | |
|  |  |  | [.15, .27] | | [.20, .31] | |
|  |  |  |  | |  | |
| Cognitive reappraisal | 3.12 | 0.72 | .09\*\* | | .20\*\* | |
|  |  |  | [.03, .15] | | [.14, .26] | |
|  |  |  |  | |  | |
| Internet Gaming Disorder (IGD) | 2.00 | 0.76 | .75\*\* | | .57\*\* | |
|  |  |  | [.72, .77] | | [.52, .61] | |
|  |  |  |  | |  | |
| Preference for Online Social Interactions | 2.56 | 1.75 | .51\*\* | | .40\*\* | |
|  |  |  | [.46, .55] | | [.35, .45] | |
| Motives for online gaming |  |  |  | |  | |
| Social | 1.99 | 0.94 | .44\*\* | | .52\*\* | |
|  |  |  | [.39, .49] | | [.47, .56] | |
|  |  |  |  | |  | |
| Escape | 1.89 | 0.94 | .57\*\* | | .61\*\* | |
|  |  |  | [.53, .61] | | [.57, .64] | |
|  |  |  |  | |  | |
| Competition | 2.38 | 1.04 | .44\*\* | | .43\*\* | |
|  |  |  | [.39, .49] | | [.38, .47] | |
|  |  |  |  | |  | |
| Coping | 2.12 | 0.93 | .51\*\* | | .69\*\* | |
|  |  |  | [.46, .55] | | [.66, .72] | |
|  |  |  |  | |  | |
| Skill development | 2.08 | 1.06 | .32\*\* | | .49\*\* | |
|  |  |  | [.27, .38] | | [.45, .54] | |
|  |  |  |  | |  | |
| Fantasy | 1.84 | 0.96 | .49\*\* | | .46\*\* | |
|  |  |  | [.44, .53] | | [.41, .51] | |
|  |  |  |  | |  | |
| Recreation | 3.30 | 1.15 | .21\*\* | | .38\*\* | |
|  |  |  | [.15, .26] | | [.33, .43] | |
|  |  |  |  | |  | |
| M SD |  | | 1.80 | 0.60 | 2.10 | 0.72 |

*Note.* *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). \* indicates *p* < .05. \*\* indicates *p* < .01.

Chart, radar chart

Description automatically generated

Figure 1. EGA results at T1 (A) and T2 (i.e. 6-month follow-up; B). The factorial structure of the Hebrew-MOGS comprised the expected 2-factors of negative and positive metacognitions.

A picture containing chart

Description automatically generated

Figure 2. Item stability at T1 (upper panel) and 6-month follow-up (bottom panel). Stability below 75% is poor.

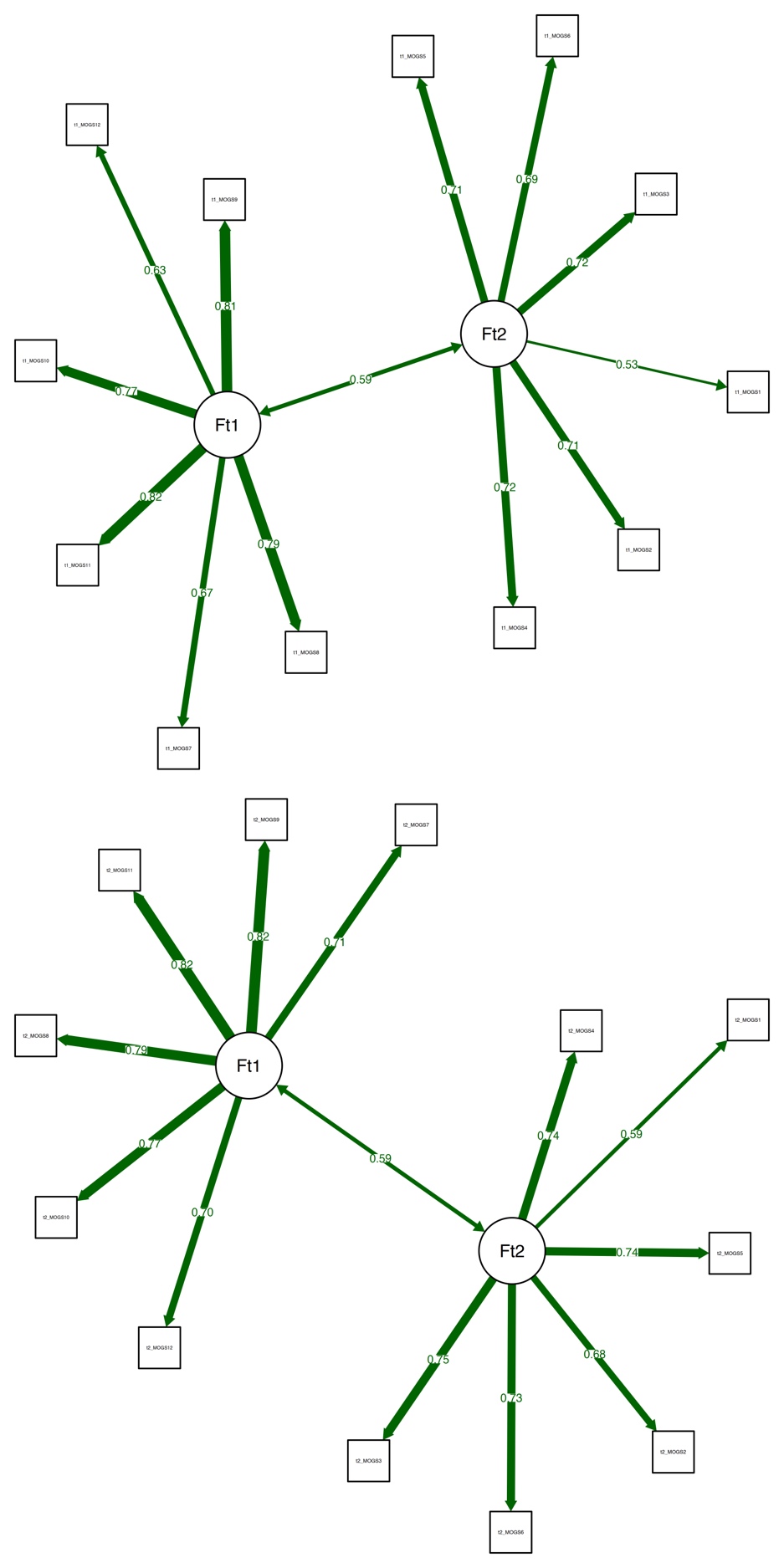


Figure 3. The final CFA at T1 (upper panel) and 6-month follow-up (bottom panel).

Chart, histogram

Description automatically generated

Figure 4. Distribution of Hebrew-MOGS cluster scores at T1 (A, C) and follow-up (B, D). Vertical blue lines refer to the mean sample score. The thick black distribution presents the expected normal distribution.

Diagram

Description automatically generatedFigure 5. Summary of the Causal Mediation Analysis. \* *p* < .05, \*\* *p* < .01, \*\*\* *p* < .001. IGD = internet gaming disorder, POSI = preference for online social interactions.

**References**

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors*, *30*(2), 252.‏

Casale, S., Musicò, A., & Spada, M. M. (2021). A systematic review of metacognitions in Internet Gaming Disorder and problematic Internet, smartphone and social networking sites use. *Clinical Psychology & Psychotherapy*, *28*(6), 1494-1508.‏

Christensen, A. P., & Golino, H. (2021). On the equivalency of factor and network loadings. *Behavior Research Methods*, *53*(4), 1563-1580.

Freund, A. M., & Baltes, P. B. (1998). Selection, optimization, and compensation as strategies of life management: correlations with subjective indicators of successful aging. *Psychology and aging*, *13*(4), 531.‏

Friedman, J., Hastie, T., & Tibshirani, R. (2008). Sparse inverse covariance estimation with the graphical lasso. *Biostatistics*, *9*(3), 432-441.

Gandolfi, E., Soyturk, I., & Ferdig, R. E. (2021). Evaluating US gamers’ metacognitions about digital entertainment: Validation of Metacognition about Online Gaming Scale in the US context. *Journal of Affective Disorders*, *295*, 954-959.‏

Golino, H., Shi, D., Christensen, A. P., Garrido, L. E., Nieto, M. D., Sadana, R., Thiyagarajan, J. A., & Martinez-Molina, A. (2020). Investigating the performance of exploratory graph analysis and traditional techniques to identify the number of latent factors: A simulation and tutorial. *Psychological Methods*, *25*(3), 292.

Marino, C., Canale, N., Vieno, A., Caselli, G., Scacchi, L., & Spada, M. M. (2020). Social anxiety and Internet gaming disorder: The role of motives and metacognitions. *Journal of Behavioral Addictions*, *9*(3), 617-628.‏

Petruzelka, B., Vacek, J., Gavurova, B., Kubak, M., Gabrhelik, R., Rogalewicz, V., & Bartak, M. (2020). Interaction of socioeconomic status with risky internet use, gambling and substance use in adolescents from a structurally disadvantaged region in Central Europe. *International journal of environmental research and public health*, *17*(13), 4803.‏

Rosendo-Rios, V., Trott, S., & Shukla, P. (2022). Systematic literature review online gaming addiction among children and young adults: A framework and research agenda. *Addictive Behaviors*, 107238.‏

Toker, S., & Baturay, M. H. (2016). Antecedents and consequences of game addiction. *Computers in Human Behavior*, *55*, 668-679.‏

Wang, H. Y., & Cheng, C. (2022). The Associations Between Gaming Motivation and Internet Gaming Disorder: Systematic Review and Meta-analysis. *JMIR Mental Health*, *9*(2), e23700.‏