**"I have no control over how much time I play"**

**The Metacognitions about Online Gaming Scale: Evidence from a cross-cultural validation among Israeli adolescents**

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**Abstract**

In the current study we evaluated the psychometric properties of the Metacognitions about Online Gaming Scale (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 mediator of 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 translated Hebrew version of the MOGS and measures on attachment style, 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 at 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 IGD.

**Keywords:** emotion regulation; Internet Gaming Disorder; metacognitions; motives for online gaming.

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**1. Introduction**

Internet Gaming Disorder (IGD) is a persistent and recurrent pattern of excessive and uncontrollable internet gaming, resulting in a cluster of cognitive and behavioral symptoms, impaired daily functioning, and significant psychological distress (American Psychiatric Association, 2013; World Health Organization, 2019; [Király,](https://www.sciencedirect.com/science/article/pii/S2352154622001103?via%3Dihub" \l "!) Potenza, and [Demetrovics](https://www.sciencedirect.com/science/article/pii/S2352154622001103?via%3Dihub#!), 2022). Adolescents are particularly vulnerable to IGD (Yu, Mo, Zhang, Li, & Lau, 2022; Lampropoulou, Siomos, Floros, & Christodoulou, 2022; Rosendo-Rios, Trott, & Shukla, 2022). The prevalence of IGD among adolescents ranges between 7% and 15% (Pontes et al., 2021). Other studies suggest a global prevalence that ranges from 2.47% to 3.05% (Pan et al., 2020; Stevens et al., 2021). Research suggests that IGD is rife among both genders but that boys and young men, with a rate of 19%, are at greater risk than girls and young women, whose rate of IGD is at 7.8% (Yu, Mo, Zhang, Li, & Lau, 2021). With gaming industry revenues expected to reach above $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 indicated that 30% of the adolescents surveyed self-perceived as having IGD (Efrati & Spada, 2022). This alarmingly high prevalence of IGD self-awareness among adolescents, accompanied by the high IGD rates, underscores the long-standing 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). Engaging with these objectives, the purpose of this study was to test the validity of Spada and Caselli’s (2017) “Metacognitions about Online Gaming Scale” (MOGS) for use in prospective studies on adolescents.

**1.1. Metacognitions and IGD**

Metacognition refers to “thinking about one’s own thinking.” Any belief about one’s cognitive system can affect cognition management, self-awareness, and our evaluation of the significance of cognitive-affective states is metacognition (Wells & Matthews, 1996). Metacognitions play a key role in developing maladaptive coping strategies (e.g., extended thinking, monitoring for threat, thought suppression, and maladaptive behaviors) that aggravate negative emotional states (Wells & Matthews, 1994; 1996).  As a result, adolescents are at higher risk of engaging in addictive behaviors to avoid adverse life situations and self-regulate their cognitive and emotional states (Spada, Caselli, Nikcevic, & Wells, 2015). Recent studies found that unhelpful metacognitions may be associated with a wide range of psychological disorders: emotion dysregulation (Mansueto et al., 2022), eating disorders (Palmieri et al., 2021), and numerous [psychopathologies](https://www.cambridge.org/core/journals/european-psychiatry/article/dysfunctional-metacognition-across-psychopathologies-a-metaanalytic-review/3EB4D6C4B21547750252ED1C85FD88A2) (Sun et al., 2017). As metacognitions may vary across disorders (Casale et al., 2021), Spada and Caselli (2017) drew researchers’ attention away from generic metacognitions (i.e., generic beliefs about cognitive-affective experiences such as “I need to control my mind at all times”) to specific metacognitions concerning 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) (Dang et al., 2022).

Metacognitions broadly take two forms (Spada & Caselli, 2017): 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 control my negative thoughts”) and are linked to activating such coping strategies. Negative metacognitions are judgments about perceived control over adopted coping strategies and the resulting cognitive-affective states (e.g., “I continue to play despite I think it would be better to stop”). These types of metacognitions may hamper attempts at self-regulation and contribute to an escalation of psychological distress. The ubiquitous role of positive and negative metacognitions in addictive behaviors has been widely evidenced across numerous studies over the last 20 years (e.g., Spada et al., 2015; Hamonniere & Varescon, 2018). As shown by subsequent studies, 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**

Adolescents’ motives for gaming, which can transform a healthy recreational activity into a pathological addiction, are significant predictors of IGD (Mills et al., 2018). Scholars agree that understanding the motives for gaming is central to understanding the phenomenon of gaming addiction (Akbari et al., 2021; Lafrenière, Verner-Filion, & Vallerand, 2012; King & Delfabbro, 2009; Moudiab & Spada, 2019; Marino et al., 2020). Demetrovics et al. (2011) identified seven motives for gaming using exploratory factor analysis. These are forming social connections, escaping from reality, competing with others, coping with distress, developing skills, engaging with fantasy worlds, enjoying recreation, and building relations. Yee (2006) added social motives, immersion, and achievement. Achievement concerns motives related to power, domination, rivalry, provocation and the like. Social motives relate to forming friendships, helping others, self-disclosure, getting support, and teamwork. Immersion concerns engaging with fantasy worlds and role-playing to escape the real world and its problems (Yee, 2006). These gaming motives appear to be critical determinants of IGD (Wang, & Cheng, 2022). Therefore, the first aim of this study, to examine metacognitions about online gaming, should be explored as a potential connection to gaming motives.

**1.3 Emotion regulation strategies**

Another connection, between metacognitions about online gaming and emotion regulation strategies in adolescents may exist. Scholars concerned with healthy psychological development have increasingly recognized the importance of developing socially appropriate and adaptive skills to manage or regulate emotions (Matthews, Webb, & Sheppes, 2021; Cole, Michel, & Teti, 1994; Morris, Silk, Steinberg, Myers, & Robinson, 2007; Southam-Gerow & Kendall, 2002). Emotion regulation requires intrinsic and extrinsic processes that move a person toward goal accomplishment (Thompson, 1994). These can be conscious and require effort or unconscious and automatic or ‘effortless’ (Cole et al., 1994; Gross & Thompson, 2007; Thompson, 1994). Two principal emotion regulation strategies exist. The first is cognitive reappraisal, which concerns the redefinition of situations giving rise to emotional responses such that the emotional impact is changed. The second is expressive suppression which is an inhibition of ongoing emotion-expressive behavior (Gullone & Taffe, 2012). Within the framework of the Self-Regulatory Executive Function model (S-REF; Wells, 2011; Wells and Matthews, 1994, 1996), a recent study suggested that difficulties in emotion regulation could be related to the presence of unhelpful metacognitions and repetitive negative thinking patterns (see Mansueto et al., 2022(. Emotion regulation has a therapeutic role in treating harmful behaviors such as IGD (Wu et al., 2020), substance use (Cavicchioli et al., 2019), and gambling addiction (Rogier & Velotti, 2018). Evidence also suggests that poor emotion regulation, excessive use of suppression, and less frequent reappraisal may be significant predictors 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 predicted IGD and expressive suppression positively predicted IGD.

Furthermore, Caplan’s (2010) cognitive-behavioral model of internet addiction has been used to show how a preference for online social interaction (POSI) can aggravate the adverse effects of disordered gaming both directly and indirectly through emotion 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 this study was to examine adolescents exhibiting difficulties with cognitive emotion regulation (reappraisal and suppression) and POSI and determine the association, if any, with metacognitions about online gaming and IGD.

**1.4 Attachment orientations**

Attachment orientations are formed in infancy in response to interactions with primary caregivers (see Mikulincer & Shaver, 2016). Infants develop secure bonds with attachment figures (i.e., attachment security) when the latter provide support and satisfy the infants’ needs (e.g., for comfort and security). Infants whose needs are satisfied develop a view of themselves as loveable and grow to see others as dependable. Individuals with a secure attachment style are more sociable and develop well-adjusted relationships with family, friends, and romantic partners.

Where parental support is inadequate, infants may develop insecure attachment styles that are divided into anxious and avoidant styles (Brennan, Clark, & Shaver, 1998; Collins & Allard, 2004). When caregivers fail to satisfy an infant’s needs, and support and care is wanting or erratic, children may develop a fear of abandonment and rejection. Anxiously attached individuals are characterized by an unfulfilled need for affection incommensurate with the amount of affection they actually receive (Birnbaum, Reis, Mikulincer, Gillath, & Orpaz, 2006). Cold and distant caregiving can cause infants to develop an avoidant attachment style and to view others as untrustworthy and undependable. Individuals with this attachment style tend to emotionally distance themselves from intimate relationships (Smith, Murphy, & Coats, 1999).

The links between attachment orientations and IGD have been shown to be weak or to have no direct association in some studies (e.g., King & Delfabbro, 2017; Throuvala, Janikian, Griffiths, Rennoldson, & Kuss, 2019; Teng, Griffiths, Nie, Xiang, & Guo, 2020). However, other studies suggest that perceived insecure attachments (e.g., lower trust, lower levels of communication, and higher levels of alienation), including parental attachment, are associated 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, linked to various social dysfunctions, high levels of psychological distress, and emotion dysregulation, may create a predisposition for metacognitions about online gaming and IGD. Therefore, the third aim of this study was 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 dearth of research on adolescents and MOGS, particularly 6-month prospective studies, this project had two goals: 1) to investigate the psychometric features of the MOGS, including factor structure, reliability, and predictive validity among Israeli adolescents in the form of a 6-month prospective study; and 2) to examine the MOGS as a theoretical model that mediates the effect of attachment patterns on IGD, the POSIs, and motives for online gaming.

**2. Method**

**2.1 Participants**

The study population comprised 1,056 Israeli Jewish adolescents from the general community (610 males and 446 females), with ages ranging 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 participants described their levels 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 religious 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 (MMORPG; n=543; 51%), First-Person Shooter (FPS; n= 358; 34%), Role-Playing Game (RPG; n= 241; 23%); Multiplayer Online Battle Arena (MOBA; n=308; 29%).

**2.2 Measures**

**2.2.1 Sociodemographic variables**

Adolescents provided information about their age (13-18), biological sex (male, female), level of religiosity (traditional, secular, religious, ultra-Orthodox), immigration status (Israeli, immigrant), and financial position (SES; divided into the categories of “very good,” “good,” “bad,” and “very bad”).

**2.2.2 Preference for Online Social Interactions**

The POSI of the Generalized Problematic Internet Use Scale 2 (GPIUS2; Caplan, 2010) was translated into Hebrew and back-verified. The subscale consists of three items (for example – “Online social interaction is more comfortable for me than face-to-face interaction”). Participants rated their agreement with each statement out of eight (1= “absolutely disagree” to 8= “certainly agree”). Cronbach’s alpha for the scale in this study was 0.86 (T1) and.89 (T2). A total score was calculated by averaging the items. Higher values signify higher degrees of POSI.

**2.2.3 IGD**

The severity of IGD and its detrimental effects over 12 months 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 graded on a 5-point scale (1 = never; 5 = very often). Cronbach’s alpha for the scale in this study was 0.86 (T1) and.89 (T2). We also computed a total IGD score, and used the cut-off of 36 (from 45) to appraised the possible presence of IGD. A mean score was produced for all items and higher scores signified greater IGD severity. We found that 2.17% (n=23) at T1, and 1.89% (n=20) at T2 of our participants reported IGD. **2.2.4 The Metacognitions about Online Gaming Scale**

The MOGS (Spada & Caselli, 2017) was used to measure positive and negative metacognitions about online gaming. The MOGS, like the POSI, was translated into Hebrew and back-verified. The scale is divided into two factors, each of which is measured by six items: “positive metacognitions about online gaming” (P-MOG) relates to the effectiveness of online gaming as a strategy for cognitive-affective self-regulation (e.g., “Online gaming helps me to control my negative thoughts”), and “negative metacognitions about online gaming” (N-MOG) pertains to a lack of control and the dangers of online gaming and thoughts about online gaming   (e.g., “I have no control over how much time I play”). Participants then scored the extent to which they agreed with each statement (ranging from 1 = “do not agree” to 4 = “agree very much”). The Cronbach’s alpha for the scale was 0.85 (T1) and 0.85 (T2) for positive metacognitions and 0.88 (T1) and 0.91 (T2) for negative metacognitions. A total score was calculated by averaging the items, with higher scores signifying higher degrees of metacognition.

**2.2.5 The Motives for Online Gaming Questionnaire**

Motives for online gaming were assessed using the Motives for Online Gaming Questionnaire (Demetrovics et al., 2011). Items were translated from English to Hebrew by three independent psychologists and verified by back-translation into Hebrew by a bilingual expert in the field. Participants scored 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”). Seven motivational dimensions characterized the scale: 1) social (four items; e.g., “because gaming gives me company”; Cronbach’s alpha was 0.82 (T1) and 0.84 (T2); 2) escape (four items; e.g., “because gaming helps me escape reality”; Cronbach’s alpha was 0.88 (T1) and 0.88 (T2); 3) competition (4 items; e.g., “because it is good to feel that I am better than others”; Cronbach’s alpha was 0.82 (T1) and 0.82 (T2); 4) skill development (4 items; e.g., “because it improves my coordination skills”; Cronbach’s alpha was 0.81 (T1) and 0.83 (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 0.80 (T2). Items were averaged to obtain seven scores for each motivational dimension. 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 (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. A 5-point Likert response scale was used to measure responses (1 = strongly disagree, 5 = strongly agree). Higher scores indicate more frequent use of each emotion regulation 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 0.79 (T1) and 0.81 (T2) for reappraisal and 0.74 (T1) and 0.75 (T2) for suppression.

**2.2.7 Attachment Style Classification Questionnaire**

This questionnaire (Finzi et al., 1996; Finzi et al., 2000) 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 were based on 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 0.72 (T1) and 0.74 (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). Recruiting was done through bulletin boards and online forums. Research assistants used the online questionnaire platform Qualtrics to distribute the questionnaires. The research assistants contacted parents of adolescents who expressed interest and asked them to review the questionnaires and provide informed parental consent if they agreed. A link to the online survey was then sent to participants. Anonymity was guaranteed and participants were reassured of such. Participants were required to perform the survey at home and in private. Upon receipt of a signed informed consent form, questionnaires were presented randomly. All questionnaires were in Hebrew. Finally, an online debriefing took place, and participants were thanked for their participation. Participants were sampled twice in a baseline assessment and at a 6-month follow-up measurement. The Institutional Review Board approved the procedure.

**3. Data analysis**

In the first section of the results, we set out to validate the Hebrew version of the 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 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 IGD, preference for online social interactions, motives for online gaming, and emotion regulation strategies. 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], IGD, 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 IGD, 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 IGD, 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 IGD, 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 socioeconomic 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 IGD, 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 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). All items had 100% stability across all resampling cycles. A 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. 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 2.

Table 2 presents bivariate correlations between metacognitions and 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 Attachment patterns and Metacognitions**

Results are presented in Table 3a. The analyses indicated that the higher participants’ attachment insecurity (i.e. anxiety and/or avoidance), the higher the negative and positive metacognitions about online gaming. 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.

**4.2.1 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 patterns, 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.

**4.2.2** **Indirect paths and sensitivity analyses**

Results are summarized in Table 4 and Figure 3. 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 have been highlighted as a critical factor that could contribute to problematic behavior throughout adolescence (Akbari et al., 2021). However, knowledge of metacognitions about online gaming among adolescents is still limited. We focused on factors that could account for the psychometric properties of the MOGS. These were factor structure, reliability, and predictive validity. To do so, we conducted a large-scale prospective study involving 1,056 Israeli Jewish adolescents from the general population. We were able to examine the contribution of the MOGS as a mediator of the effects 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 the Hebrew MOGS can optimally measure metacognitions about online gaming within a two-factor latent construct: “negative metacognitions” and “positive metacognitions.” These results align 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 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., 2021) reflect adolescents’ beliefs regarding their lack of control over gaming. These beliefs, possibly activated during or after playing, may lead to continued gaming to reduce negative affect with the paradoxical effect of increasing it (Marino & Spada, 2017).

Consistent with studies on IGD prevalence among adolescents, we found that 2.17% (n=23) at T1, and 1.89% (n=20) at T2 of our participants reported IGD. A systematic review by Paulus et al., (2018) found a median IGD prevalence of 5.5% and a median of 2.0% for population-based studies. However, research shows that the prevalence of IGD has been increasing, especially among adolescents in recent years (8.8%; Gao et al., 2022). A possible explanation for our findings is that more than half of our sample reported being religious. In a religious society like Israel, where the majority of the population os geographically concentrated in dense residential neighborhoods, children and adolescents are educated in institutions that are under constant supervision, and the experience of mobility and access to technology is very limited (Rosenberg, Blondheim, & Katz, 2019).

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 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 lower religiosity (Efrati & Spada, 2022) indicate more IGD (which may explain the fewer positive metacognitions). In contrast to our findings 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 metacognitions (Metacognitions Questionnaire; Wells, & Cartwright-Hatton, 2004) tools. Another reason is the difference between problematic Facebook use which is less common in adolescents than online gaming. 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, we examined this correlation in this study 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, and the greater their POSIs and motives for online gaming. These findings correspond with previous studies on adolescents and gamers indicating correlation between 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. It 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 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 in 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 had a lower incidence of IGD and lower motivation for social, escape, coping fantasy, and recreation than secular adolescents. A previous study on Israeli adolescents indicates a lower prevalence of IGD for religious adolescents than secular adolescents (Efrati & Spada, 2022), but we could not find research indicating differences by religion in the motivation of Internet gaming. Future research is needed in this area. Finally, regarding attachment patterns, an anxious attachment style is typical of adolescents who seek 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 pornography use compensates for avoiding attachment and loneliness (Efrati & Amichai-Hamburger, 2019). Therefore, it is unsurprising that attachment avoidance was associated with a higher rate of IGD, a POSIs, and motivations to escape, cope, develop skills, and create an online fantasy world.

Consistent with previous research (Casale, Caplan, & Fioravanti, 2016; Casale, Musicò, & Spada, 2021; Marino et al., 2019), metacognitions were found to mediate the relationship 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. As a result of their childhood experiences, anxious adolescents are oriented toward danger monitoring, tend to focus on perceived signs of abandonment and threat, and are prone to rumination (Malik, Wells, & Wittkowski, 2015). Anxiety in adolescents is likely to result in a belief that perseverative thinking is valuable and negative beliefs about thought uncontrollability and danger (Caselli et al., 2017). Conversely, adolescents characterised by attachment avoidance tend towards thought suppression, repressing natural threats, and denying their need for closeness. Avoidant-style adolescents may believe in the danger and uncontrollability of thoughts and emotions and attempt to mitigate this danger by controlling their thoughts (Caselli et al., 2017; Moss, Erskine, Albery, Allen, & Georgiou, 2015).

Maladaptive metacognitions resulting from anxious attachment appear to be associated with higher levels of IGD, POSI, and motives for online gaming. These findings are consistent with an overview of the literature (Mansueto et al., 2019) which suggested that the exposure to early adverse experiences (e.g., childhood abuse, childhood neglect) might be associated with unhelpful metacognitions and that these metacognitions may mediate the association between early adverse experiences and poor psychological health.

Our findings indicate that Metacognitive Therapy (Wells, 2009) interventions may be of benefit in the treatment of IGD. These interventions focus on the restructuring of unhelpful metacognitions together with the interruption of maldaptive forms of self-regulation, such as worry, rumination and desire thinking. Some studies habe shown the benefits of Metacognitive Therapy in the treatment of addictive behaviours, for example Alcohol Use Disorder (Caselli et al., 2018).

Although our main premises were supported, the study has several limitations. The study is correlational, 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 Israeli Jewish adolescents. Future studies should examine other diverse ethnic and cultural adolescent populations to ascertain the replicability and generalization of the findings. Directions for future research will also have to include the determination as to whether metacognitions change during treatment or whether they predict treatment outcomes. Further comparions between of metacognitions and other constructs (e.g., personality traits, affective states, etc.) in predicting IGD would we of value to investigate.

Despite the limitations of this study, we view its findings as an important step towards understanding the dynamics of metacognitions in the development of IGD in adolescents. Based on our findings, therapy has the potential to deliver more focused help to adolescents with a disposition toward IGD. It is crucial to increase therapists’ awareness of the benefits of considering the role of metacognitions when dealing with IGD symptoms and adding cognitive approaches 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 (T1) | Positive  Metacognitions (T1) | Negative  Metacognitions (T2) | Positive  Metacognitions (T2) |
| Expressive suppression (T1) | 2.72 | 0.82 | .21\*\* | .25\*\* | .18\*\* | .27\*\* |
|  |  |  | [.15, .27] | [.20, .31] | [.12, .23] | [.22, .33] |
|  |  |  |  |  |  |  |
| Cognitive reappraisal (T1) | 3.12 | 0.72 | .09\*\* | .20\*\* | .07\* | .18\*\* |
|  |  |  | [.03, .15] | [.14, .26] | [.00, .13] | [.12, .23] |
|  |  |  |  |  |  |  |
| Internet Gaming Disorder (IGD) (T1) | 17.98 | 6.87 | .75\*\* | .57\*\* | .57\*\* | .46\*\* |
|  |  |  | [.72, .77] | [.52, .61] | [.53, .61] | [.41, .50] |
|  |  |  |  |  |  |  |
| Preference for Online Social Interactions (T1) | 2.56 | 1.75 | .51\*\* | .40\*\* | .38\*\* | .32\*\* |
|  |  |  | [.46, .55] | [.35, .45] | [.33, .43] | [.26, .37] |
| Motives for online gaming (T1) |  |  |  |  |  |  |
| Social | 1.99 | 0.94 | .44\*\* | .52\*\* | .33\*\* | .39\*\* |
|  |  |  | [.39, .49] | [.47, .56] | [.27, .38] | [.34, .44] |
|  |  |  |  |  |  |  |
| Escape | 1.89 | 0.94 | .57\*\* | .61\*\* | .45\*\* | .48\*\* |
|  |  |  | [.53, .61] | [.57, .64] | [.40, .49] | [.43, .52] |
|  |  |  |  |  |  |  |
| Competition | 2.38 | 1.04 | .44\*\* | .43\*\* | .33\*\* | .30\*\* |
|  |  |  | [.39, .49] | [.38, .47] | [.27, .38] | [.25, .36] |
|  |  |  |  |  |  |  |
| Coping | 2.12 | 0.93 | .51\*\* | .69\*\* | .37\*\* | .53\*\* |
|  |  |  | [.46, .55] | [.66, .72] | [.32, .42] | [.48, .57] |
|  |  |  |  |  |  |  |
| Skill development | 2.08 | 1.06 | .32\*\* | .49\*\* | .24\*\* | .37\*\* |
|  |  |  | [.27, .38] | [.45, .54] | [.18, .29] | [.32, .43] |
|  |  |  |  |  |  |  |
| Fantasy | 1.84 | 0.96 | .49\*\* | .46\*\* | .37\*\* | .39\*\* |
|  |  |  | [.44, .53] | [.41, .51] | [.31, .42] | [.33, .44] |
|  |  |  |  |  |  |  |
| Recreation | 3.30 | 1.15 | .21\*\* | .38\*\* | .13\*\* | .34\*\* |
|  |  |  | [.15, .26] | [.33, .43] | [.07, .18] | [.29, .39] |
|  |  |  |  |  |  |  |
| Expressive suppression (T2) | 2.73 | 0.83 | .18\*\* | .21\*\* | .29\*\* | .34\*\* |
|  |  |  | [.12, .24] | [.16, .27] | [.23, .34] | [.29, .40] |
|  |  |  |  |  |  |  |
| Cognitive reappraisal (T2) | 3.13 | 0.76 | .07\* | .16\*\* | .13\*\* | .26\*\* |
|  |  |  | [.01, .13] | [.10, .22] | [.07, .19] | [.20, .31] |
|  |  |  |  |  |  |  |
| Internet Gaming Disorder (IGD) (T2) | 18.0 | 7.22 | .55\*\* | .40\*\* | .78\*\* | .56\*\* |
|  |  |  | [.51, .59] | [.34, .45] | [.76, .80] | [.52, .60] |
|  |  |  |  |  |  |  |
| Preference for Online Social Interactions (T2) | 2.69 | 1.81 | .39\*\* | .28\*\* | .56\*\* | .41\*\* |
|  |  |  | [.33, .44] | [.22, .33] | [.51, .60] | [.36, .46] |
| Motives for online gaming (T2) |  |  |  |  |  |  |
| Social | 2.01 | 0.94 | .34\*\* | .38\*\* | .48\*\* | .49\*\* |
|  |  |  | [.29, .39] | [.33, .43] | [.43, .52] | [.45, .54] |
|  |  |  |  |  |  |  |
| Escape | 2.02 | 1.00 | .39\*\* | .41\*\* | .58\*\* | .64\*\* |
|  |  |  | [.34, .44] | [.36, .46] | [.53, .61] | [.60, .68] |
|  |  |  |  |  |  |  |
| Competition | 2.34 | 1.02 | .32\*\* | .30\*\* | .47\*\* | .44\*\* |
|  |  |  | [.26, .37] | [.25, .36] | [.42, .51] | [.39, .49] |
|  |  |  |  |  |  |  |
| Coping | 2.17 | 0.94 | .38\*\* | .47\*\* | .54\*\* | .71\*\* |
|  |  |  | [.33, .43] | [.42, .52] | [.49, .58] | [.68, .74] |
|  |  |  |  |  |  |  |
| Skill development | 2.15 | 1.03 | .23\*\* | .33\*\* | .37\*\* | .49\*\* |
|  |  |  | [.18, .29] | [.28, .39] | [.32, .42] | [.44, .53] |
|  |  |  |  |  |  |  |
| Fantasy | 1.91 | 0.97 | .34\*\* | .33\*\* | .52\*\* | .50\*\* |
|  |  |  | [.29, .39] | [.27, .38] | [.47, .56] | [.46, .55] |
|  |  |  |  |  |  |  |
| Recreation | 3.25 | 1.15 | .13\*\* | .31\*\* | .21\*\* | .46\*\* |
|  |  |  | [.07, .19] | [.25, .36] | [.15, .26] | [.41, .51] |
|  |  |  |  |  |  |  |
| *M (SD)* |  |  | 1.80 (0.60) | 2.10 (0.72) | 1.79 (0.62) | 2.13 (0.74) |

*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.

Table 3a

*Robust MM-estimator coefficients for predicting metacognitions by attachment patterns.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Negative metacognitions** | | | | **Positive metacognitions** | | | |
| *Predictors* | *Estimates* | *CI* | *p* | *Estimates* | | *CI* | *p* |
| (Intercept) | 1.13 | 0.74 – 1.51 | **<0.001** | 2.04 | | 1.54 – 2.53 | **<0.001** |
| Attachment anxiety | 0.19 | 0.15 – 0.23 | **<0.001** | 0.22 | | 0.16 – 0.28 | **<0.001** |
| Attachment avoidance | 0.14 | 0.08 – 0.19 | **<0.001** | 0.13 | | 0.06 – 0.19 | **<0.001** |
| Gender | -0.12 | -0.19 – -0.05 | **0.001** | -0.26 | | -0.35 – -0.17 | **<0.001** |
| Age | -0.01 | -0.03 – 0.01 | 0.401 | -0.03 | | -0.06 – -0.00 | **0.045** |
| Religiosity | -0.02 | -0.05 – 0.02 | 0.424 | -0.06 | | -0.11 – -0.02 | **0.010** |
| SES | 0.09 | 0.03 – 0.15 | **0.006** | 0.07 | | -0.01 – 0.15 | 0.097 |
| *R-squared* | 17.11% | | | | 14.14% | | | |

Note. SES = socio-economic status; CI = 95% confidence intervals for the regression coefficients.

Table 3b

*Robust MM-estimator coefficients for IGD, preference for online social interactions, and motives for online gaming by metacognitions while controlling for attachment patterns.*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **IGD** | | | **POSI** | | | **Social motivation** | | |
| *Predictors* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* |
| (Intercept) | -0.00 | -0.44 – 0.44 | 0.998 | -1.41 | -2.58 – -0.24 | **0.018** | 0.45 | -0.17 – 1.07 | 0.151 |
| Negative metacognitions | 0.61 | 0.54 – 0.69 | **<0.001** | 0.99 | 0.79 – 1.20 | **<0.001** | 0.34 | 0.23 – 0.44 | **<0.001** |
| Positive metacognitions | 0.16 | 0.10 – 0.23 | **<0.001** | 0.19 | 0.03 – 0.36 | **0.022** | 0.35 | 0.26 – 0.43 | **<0.001** |
| Attachment anxiety | 0.03 | -0.01 – 0.08 | 0.167 | 0.06 | -0.07 – 0.20 | 0.354 | -0.04 | -0.11 – 0.03 | 0.251 |
| Attachment avoidance | 0.11 | 0.06 – 0.17 | **<0.001** | 0.36 | 0.20 – 0.51 | **<0.001** | 0.02 | -0.07 – 0.10 | 0.708 |
| Gender | -0.07 | -0.14 – 0.01 | 0.084 | -0.02 | -0.23 – 0.18 | 0.824 | -0.08 | -0.19 – 0.03 | 0.135 |
| Age | 0.02 | -0.00 – 0.04 | 0.081 | 0.06 | -0.00 – 0.12 | 0.061 | 0.04 | 0.01 – 0.08 | **0.008** |
| Religiosity | -0.04 | -0.08 – -0.00 | **0.037** | -0.10 | -0.21 – 0.01 | 0.068 | -0.18 | -0.24 – -0.12 | **<0.001** |
| SES | -0.01 | -0.08 – 0.06 | 0.815 | -0.02 | -0.21 – 0.16 | 0.829 | 0.03 | -0.06 – 0.13 | 0.494 |
| R-squared | 32.04% | | | 16.96% | | | 19.86% | | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Escape** | | | **Competition** | | | **Coping** | | |
| *Predictors* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* |
| (Intercept) | -0.60 | -1.21 – 0.01 | 0.055 | 1.14 | 0.42 – 1.85 | **0.002** | 0.27 | -0.32 – 0.86 | 0.373 |
| Negative metacognitions | 0.40 | 0.29 – 0.50 | **<0.001** | 0.43 | 0.30 – 0.55 | **<0.001** | 0.29 | 0.19 – 0.39 | **<0.001** |
| Positive metacognitions | 0.35 | 0.26 – 0.43 | **<0.001** | 0.26 | 0.16 – 0.36 | **<0.001** | 0.48 | 0.40 – 0.57 | **<0.001** |
| Attachment anxiety | 0.10 | 0.03 – 0.17 | **0.006** | -0.09 | -0.17 – -0.01 | **0.030** | 0.02 | -0.04 – 0.09 | 0.483 |
| Attachment avoidance | 0.14 | 0.06 – 0.22 | **0.001** | 0.08 | -0.01 – 0.17 | 0.095 | 0.13 | 0.05 – 0.20 | **0.002** |
| Gender | 0.07 | -0.04 – 0.18 | 0.192 | -0.40 | -0.53 – -0.28 | **<0.001** | -0.11 | -0.22 – -0.01 | **0.037** |
| Age | 0.03 | -0.00 – 0.07 | 0.053 | 0.03 | -0.01 – 0.07 | 0.109 | 0.02 | -0.01 – 0.05 | 0.189 |
| Religiosity | -0.08 | -0.14 – -0.02 | **0.006** | -0.03 | -0.10 – 0.03 | 0.301 | -0.08 | -0.14 – -0.03 | **0.003** |
| SES | 0.03 | -0.07 – 0.12 | 0.562 | 0.03 | -0.08 – 0.14 | 0.594 | -0.03 | -0.12 – 0.06 | 0.550 |
| R-squared | 22.73% | | | 16.58% | | | 25.92% | | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Skill development** | | | **Fantasy** | | | **Recreation** | | |
| *Predictors* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* | *Estimates* | *CI* | *p* |
| (Intercept) | 0.79 | 0.06 – 1.53 | **0.035** | 0.08 | -0.53 – 0.69 | 0.786 | 3.53 | 2.69 – 4.37 | **<0.001** |
| Negative metacognitions | 0.18 | 0.05 – 0.31 | **0.006** | 0.41 | 0.31 – 0.52 | **<0.001** | -0.09 | -0.23 – 0.06 | 0.242 |
| Positive metacognitions | 0.40 | 0.29 – 0.50 | **<0.001** | 0.21 | 0.12 – 0.30 | **<0.001** | 0.53 | 0.41 – 0.65 | **<0.001** |
| Attachment anxiety | -0.08 | -0.17 – 0.00 | 0.053 | 0.05 | -0.02 – 0.12 | 0.160 | 0.02 | -0.07 – 0.12 | 0.673 |
| Attachment avoidance | 0.14 | 0.05 – 0.24 | **0.004** | 0.09 | 0.01 – 0.17 | **0.031** | -0.03 | -0.14 – 0.08 | 0.604 |
| Gender | -0.12 | -0.25 – 0.01 | 0.060 | -0.05 | -0.16 – 0.05 | 0.333 | -0.34 | -0.49 – -0.19 | **<0.001** |
| Age | 0.01 | -0.03 – 0.05 | 0.545 | 0.02 | -0.01 – 0.05 | 0.199 | -0.02 | -0.07 – 0.02 | 0.286 |
| Religiosity | -0.06 | -0.13 – 0.00 | 0.064 | -0.08 | -0.14 – -0.03 | **0.003** | -0.13 | -0.21 – -0.05 | **0.001** |
| SES | 0.08 | -0.04 – 0.19 | 0.200 | 0.03 | -0.07 – 0.13 | 0.529 | -0.01 | -0.15 – 0.12 | 0.827 |
| R-squared | 13.02% | | | 12.43% | | | 13.38% | | |

Table 4

*Indirect and direct path significance and sensitivity analyses.*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | ACME  (95% CI) | ADE  (95% CI) | Prop.  Mediated | Sensitivity |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | IGD | 0.10 (.07, .14)\*\*\* | 0.02 (-.04, .07) | 86.16% | 0.40 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | POSI | 0.15 (.10, .22)\*\*\* | 0.05 (-.11, .20) | 75.30% | 0.30 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Social | 0.06 (.03, .08)\*\*\* | -0.04 (-.12, .03) | 100.0% | 0.20 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Escape | 0.05 (.03, .08)\*\*\* | 0.10 (.02,.19)\* | 34.56% | 0.20 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Competition | 0.07 (.05, .10)\*\*\* | -0.09(-.17,-.01)\* | 100.0% | 0.20 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Coping | 0.05 (.02, .07)\*\*\* | 0.02 (-.05, .10) | 64.05% | 0.20 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Skill development | 0.02 (.00, .05)\* | -0.09 (-.17, .00) | 33.14% | 0.10 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Fantasy | 0.06 (.04, .09)\*\*\* | 0.04 (-.04, .11) | 59.78% | 0.20 |
| Attachment anxiety | ⇒ | Negative metacognitions | ⇒ | Recreation | -0.01 (-.04, .01) | 0.02 (-.07, .11) | 1.11% | 0.00 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | IGD | 0.03 (.01, .04)\*\*\* | 0.02 (-.03, .07) | 57.95% | 0.10 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | POSI | 0.04 (.00, .07)\* | 0.04 (-.11, .20) | 32.63% | 0.10 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Social | 0.07 (.05, .10)\*\*\* | -0.04 (-.12, .03) | 100.0% | 0.30 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Escape | 0.08 (.05, .10)\*\*\* | 0.10 (.03, .18)\* | 42.34% | 0.30 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Competition | 0.05 (.03, .08)\*\*\* | -0.09 (-.17, -.01)\* | 79.05% | 0.20 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Coping | 0.10 (.07, .13)\*\*\* | 0.03 (-.05, .10) | 77.55% | 0.40 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Skill development | 0.08 (.06, .12)\*\*\* | -0.08 (-.17, .00) | 100.0% | 0.30 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Fantasy | 0.05 (.03, .07)\*\*\* | 0.04 (-.03, .11) | 55.01% | 0.20 |
| Attachment anxiety | ⇒ | Positive metacognitions | ⇒ | Recreation | 0.10 (.07, .14)\*\*\* | 0.02 (-.07, .11) | 84.89% | 0.30 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | IGD | 0.08 (.05, .12)\*\*\* | 0.13 (.06, .20)\*\* | 38.07% | 0.40 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | POSI | 0.12 (.08, .19)\*\*\* | 0.41 (0.23, 0.58)\*\*\* | 23.00% | 0.30 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Social | 0.04 (.02, .07)\*\*\* | 0.05 (-.05, .13) | 46.12% | 0.20 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Escape | 0.04 (.02, .07)\*\*\* | 0.15 (.06, .24)\*\*\* | 21.20% | 0.20 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Competition | 0.06 (.03, .09)\*\*\* | 0.08 (-.02, .17) | 42.17% | 0.20 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Coping | 0.04 (.02, .06)\*\*\* | 0.11 (.02, .20)\* | 25.65% | 0.20 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Skill development | 0.02 (.00, .04)\* | 0.13 (.03, .23)\*\* | 13.01% | 0.10 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Fantasy | 0.05 (.02, .08)\*\*\* | 0.10 (.02, .19)\* | 31.76% | 0.20 |
| Attachment avoidance | ⇒ | Negative metacognitions | ⇒ | Recreation | -0.01(-.03, .01) | -0.03 (-.14, .08) | 11.90% | 0.00 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | IGD | 0.02 (.01, .03)\*\* | 0.13 (.06, .20)\*\*\* | 10.04% | 0.10 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | POSI | 0.02 (.00, .05)\* | 0.41 (.22, .59)\*\*\* | 4.55% | 0.10 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Social | 0.04 (.02, .06)\*\*\* | 0.04 (-.04, .12) | 48.84% | 0.30 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Escape | 0.04 (0.02, .07)\*\*\* | 0.15 (.07, .25)\*\*\* | 21.55% | 0.30 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Competition | 0.03 (.01, .05)\*\*\* | 0.08 (-.02, .17) | 24.98% | 0.20 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Coping | 0.05 (.02, .08)\*\*\* | 0.11 (.02, .20)\* | 32.83% | 0.40 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Skill development | 0.05 (.02, .08)\*\*\* | 0.13 (.04, .23)\*\* | 26.15% | 0.30 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Fantasy | 0.03 (.01, .05)\*\* | 0.10 (.02, .19)\* | 20.76% | 0.20 |
| Attachment avoidance | ⇒ | Positive metacognitions | ⇒ | Recreation | 0.06 (.03, .10)\*\* | -0.03 (-.14, .07) | 83.57% | 0.30 |

Note. \* *p* < .05, \*\* *p* < .01, \*\*\* *p* < .001. IGD = Internet Gaming Disorder, POSI = Preference for Online Social Interactions, ACME = average causal mediation effects, ADE = average direct effect; higher sensitivity values refer to less plausible effect for unobserved confounding variables.

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.*

Chart, histogram

Description automatically generated

*Figure 2. 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 generated *Figure 3. Summary of the Causal Mediation Analysis. \* p < .05, \*\* p < .01, \*\*\* p < .001. IGD = Internet Gaming Disorder, POSI = preference for online social interactions.*

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