**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**

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**Abstract**

The use of the Metacognitions about Online Gaming Scale (MOGS) has been linked with online gaming disorder. 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 mediator 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, 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 6-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 [APA], 2013; World Health Organization [WHO], 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 with 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 (beliefs about cognition) 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., generic 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 towards 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 judgements 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 fun 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: social connections, escaping from reality, competition with others, coping with distress, skill development, fantasy world engagement, recreation, and relation. 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, challenging others, provocation, and similar motives. Social motives lead to goals such as making friends, helping others, self-disclosure, and 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 being potentially connected to gaming motives.

**1.3 Emotion regulation strategies**

metacognitions about online gaming might also be connected to 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 toward goal accomplishment (Thompson, 1994), and 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. The two main emotion regulation strategies are: cognitive reappraisal, a cognitive change strategy that involves redefining a potentially emotion-eliciting situation in such a way that its emotional impact is changed; and 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 internet gaming disorder (Wu et al., 2020), substance use disorder (Cavicchioli et al., 2019), and gambling (Rogier & Velotti, 2018). Evidence also suggests that poor emotion regulation (i.e., excessive use of suppression and less frequent use of reappraisal) may be a significant predictor of IGD. Recently, Yen et al (2018) found that

IGD group had significantly lower cognitive reappraisal strategies and greater expressive suppression strategies than did the control group and cognitive reappraisal negatively predicts IGD and that 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 on five hundred and forty-three Italian gamers, that POSI associated with positive and negative metacognitions about online gaming, and IGD. Therefore, the second aim of the current study, to examine adolescents with difficulties in cognitive emotion regulation (reappraisal and suppression) and POSI could correlated 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 the 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 of 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 inadequatet, 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 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 perceived insecure attachments (e.g., lower trust, lower levels of communication, and higher levels of alienation) are more prevalent among individuals with IGD, including parental attachment (Estevez, Jauregui, & Lopez-Gonzalez, 2019; Schneider, King, & Delfabbro, 2017; Wang, Ho, Chan, & Tse, 2015; Zhu, Zhang, Yu, & Bao, 2015). Thus, it seems that attachment insecurity (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 being potentially connected to MOGS and IGD.

**1.5 The current study**

Given the limited focus on adolescence in research of MOGS, and especially regarding 6-month prospective study, in the current research we have two aims: (i) to evaluate psychometric properties of the MOGS, including its factor structure, reliability, and predictive validity among Israeli adolescents by six-month prospective study, and (ii) to examine MOGS by theoretical model, as a mediate the effect of attachment patterns on IGD, preference for online social interactions, and motives for online gaming. Specifically, we examine two questions in the current study: (a) Is the factorial structure of the Hebrew-MOGS comprised two factors? (b) Do metacognitions mediate the effect of attachment patterns on IGD, preference for online social interactions, motives for online gaming?

**2. Method**

**2.1 Participants**

The study population comprised 1,056 Jewish Israeli adolescents from the general community (610 males and 446 females), aged 13–18 (M = 15.77, SD = 1.43), all enrolled in the eighth (n= 133; 12.7%), ninth (n= 161; 15.4%), tenth (n = 225; 21.5%), eleventh (n = 270; 25.8%), and twelfth (n = 259; 24.7%) grades. Most (96.8%) were native Israelis. Socioeconomically, 0.3% of participants described their level as being very bad, 2.2% bad, 58% good, and 39.5% very good. In terms of religious affiliation, the sample consisted of 507 (48%) self-reported religious individuals, of which 223 (21.1%) traditional, 252 (23.9%) secular, and 74 (7%) ultra-Orthodox. Game types/genre (participants could mark multiple genres): 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 Bbattle Arena (MOBA; n=308; 29%).

**2.2 Measures**

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

**2.2.2 Preference for Online Social Interactions (POSI).** The POSI subscale was translation to Hebrew for this study by back-to back translation procedure (from English to Hebrew and back) of the Generalized Problematic Internet Use Scale 2 (GPIUS2; Caplan, 2010) was used to assess the POSIs. The subscale comprises 3 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 of item on a 8-point scale (from 1- “definitely disagree” to 8 - “definitely agree”). The 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 (IGD).** 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 (IGDS9-SF; Pontes & Griffiths, 2015) based on the nine IGD DSM-5 items (American Psychiatric Association [APA], 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 such that higher scores represent a higher internet gaming disorder severity. In this study, Cronbach’s alpha was .86 (T1) and .89 (T2).

**2.2.4 The Metacognitions about Online Gaming Scale (MOGS).** The MOGS (Spada and Caselli 2017) was used to assess positive and negative metacognitions about online gaming. The MOGS was translated for this study by back-to back translation procedure (from English to Hebrew and back). The scale has two factors, each of which is assessed by 6 items: “positive metacognitions about online gaming” (P-MOG) referring to the usefulness of online gaming as cognitive-affective self-regulatory strategy (e.g., “Online gaming helps me to control my negative thoughts”); and “negative metacognitions about online gaming” (N-MOG) referring 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 item on a 4-point scale (from (1) “do not agree” to (4) “agree very much”). Items were summed to obtain a score for both positive and negative metacognitions. Higher scores represent higher levels of metacognitions. The 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** (MOGQ; Demetrovics et al., 2011) was used to assess a range of motives for online gaming. Items were translated from English to Hebrew by three independent psychologists and back translated in English by one bilingual researcher 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 (from 1= “never” to 5 = “almost always/always”). The scale comprised seven motivational dimensions: (i) social (4 items; e.g., “...because gaming gives me company”; Cronbach’s alpha was .82 (T1) and .84 (T2), (ii) escape (4 items; e.g., “...because gaming helps me escape reality”; Cronbach’s alpha was .88 (T1) and .88 (T2), (iii) 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), (iv) skill development (4 items; e.g., “...because it improves my coordination skills”; Cronbach’s alpha was 0.81 (T1) and .83 (T2), (v) coping (4 items; e.g., “...because gaming helps me get into a better mood”; Cronbach’s alpha was 0.88 (T1) and .89 (T2), (vi) fantasy (4 items; e.g., “...because I can do things that I am unable to do or I am not allowed to do in real life”; Cronbach’s alpha was 0.84 (T1) and .86 (T2), and (vii) 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 with higher scores representing higher levels of each motive.

**2.2.6 The Emotion Regulation Questionnaire for Children and Adolescents** (ERQ–CA): This scale, developed by Gullone and Taffe (2012), was based on the ERQ questionnaire (Gross & John, 2003). The scale contains 10-item scales for assessing the ER strategies of cognitive reappraisal (CR) (6 items) and expressive suppression (ES) (4 items). 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 are “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 taped the Ainsworth’s 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 children 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 (males and females, secular and religious, from the eastern, central, southern, or northern parts of Israel). The participants constituted a convenience sample recruited from a variety of sources (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 participant who was assured anonymity. Participants were then asked to complete the survey in private, in a quiet room in their home (without the presence of others). Following receipt of a signed informed consent form, questionnaires were presented in random order. All questionnaires were in Hebrew, Israel’s the native language. Lastly, there was an online debriefing and participants were thanked for their participation. Participants were sampled twice, once in a baseline assessment, and a second time at 6-month follow-up measurement. The procedure was approved by the Institutional Review Board (IRB).

**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 steal limited. In the current study, we focused on key factors that might account for evaluate psychometric properties of the MOGS, including its factor structure, reliability, and predictive validity – attachment style, IGD, preference for online social interactions, 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. By doing so, we were able to examine the contribution of MOGS as a mediate the effect of attachment patterns on IGD, preference for online social interactions, and motives for online gaming.

The present study aimed to examine psychometric properties of the Hebrew version of the MOGS among adolescents. Overall, we corroborated the results of the EGA with a Confirmatory Factor Analysis (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. The Cronbach's alpha coefficients for all factors and the total score were good by six-month follow-up (ranged 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 psychometric properties of the MOGS. Moreover, as we expected, we found weak correlations with emotion regulation strategies, moderate correlations with preference for online social interactions and motives for online gaming, and strong correlations with IGD. This finding is in line with previous research that showing strong correlations with IGD specially with negative metacognitions (Marino et al., 2020; Akbari et al., 2020) reflects beliefs the adolescences hold about lacking control over the playing. These types of beliefs, possibly activated during or after playing, may lead to continued playing to reduce negative affect with the paradoxical effect of increasing it (Marino & Spada, 2017).

We hypothesized that metacognitions mediate the effect of attachment patterns on IGD, preference for online social interactions, motives for online gaming. Unsurprisingly, and in keeping with the hypotheses, 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 showing that boys indicate higher level 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 our finding about SES, recent study not found correlation between SES and metacognitions (Marino et al., 2019). One possibility is that because they use generic metacognition (MCQ). Another reason is the different between problematic Facebook use which less use by adolescence compared to IGD that more use in our study. Moreover, adolescents with higher SES found to be in more at risk to addictive behavior on the internet and gaming (Petruzelka et al., 2020; Toker, & Baturay, 2016), we may explain that by more awareness (parents' education or school prevent program) of problematic behavior on online gaming, that may lead to more negative metacognitions about online gaming.

Aside from correlation between metacognitions about online gaming and other measures, in the current study we examined this correlation after controlling for attachment patters. Results indicated that 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. 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) and preference for online social interactions, and motives for online gaming (Marino et al., 2020). Specifically, the current study also focuses on demographic aspects, revealed that older adolescents had higher motivation for social benefits of gaming, this may be related to a greater technology affinity of ‘digital natives’ (Andreassen et al., 2016) and to the developmental tasks of this age period (personal goals vs life optimization) (Freund, A& Baltes, 1998). In addition, we found that boys had higher motivation for competition and recreation than girls. This result found by Demetrovics et al (2011) on Hungarian sample of 3,818 participants that male had higher motivation for competition, but in contrast female indicate more recreation than male. Explain to that we can find by differences between the ages, age 14-17 was the lowest score of recreation (Demetrovics et al., 2011). In addition, religious adolescents had less IGD, and lower motivation for social, escape, coping fantasy and recreation as compared with secular adolescents. Previous study on Israeli adolescence indicates less IGD for religious compared to secular (Efrati & Spada, 2022), but we don’t found research that indicate differences by religious on motivation of internet gaming, future research needed. 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 goal and fear of rejection. Thus, higher motivation to escape and less to compete may serve as a substitute for those adolescents who harbor attachment anxiety. From different reasons, adolescence who indicate attachment avoidance may also seek compensation for lack of warmth, closeness, and intimacy. Research has shown that pornographic users, serves as a compensation for avoidance attachment and loneliness (Efrati & Amichai-Hamburger, 2019). Therefore, it is not surprising that 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.

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 indicated that positive and negative metacognitions significantly mediated the effect of attachment anxiety and avoidance on IGD, POSI, and motives for online gaming. It is likely that anxiety may guide children toward threat monitoring, and focusing attention on signals of separation and danger, as well as to engage 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. Moreover, 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 prospective assessment of metacognitions and therefore, we can appraise the directionality of the associations, cautious is warranted when implementing the current findings into interventions. In addition, the research population was comprised Jewish Israeli adolescence. Future studies should examine other adolescence and diverse ethnic and cultural populations to ascertain the replicability and generalizability 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 IGD among adolescents. By doing so, therapy would have 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, so that when dealing with IGD symptoms, clinicians may consider adding cognitive approach to the individual therapy for adolescents with 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.

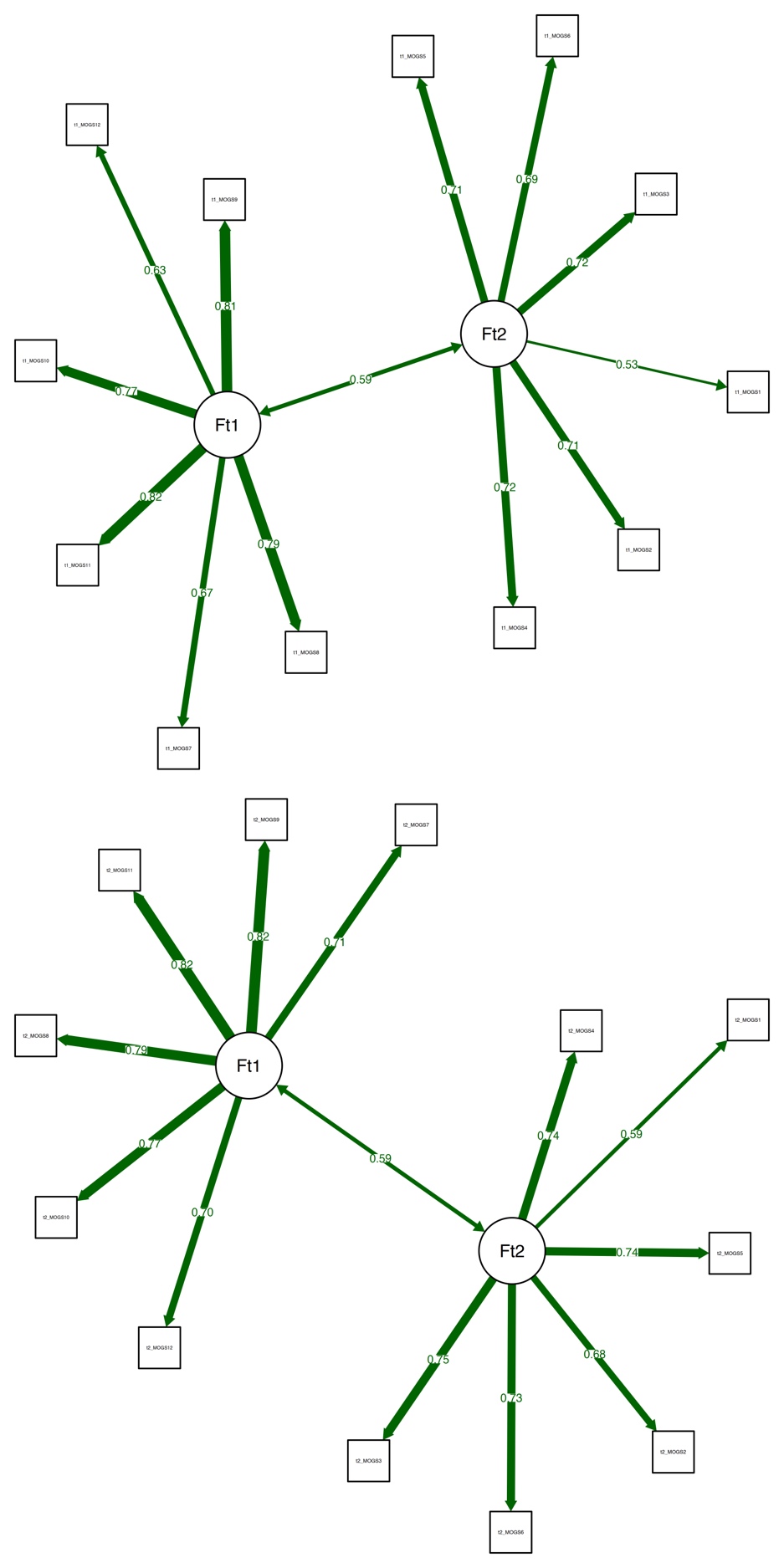


Figure 3. The final CFA at T1 (upper panel) and 6-month follow-up (bottom panel).

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.

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