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Metacognitions and emotion recognition in Internet Gaming Disorder among adolescents☆

Orkun Aydın[a], Merve Güçlü[a], Pınar Ünal-Aydın[a], Marcantonio M. Spada[b,*]

[a] Department of Psychology, Faculty of Arts and Science, International University of Sarajevo, Sarajevo, Bosnia and Herzegovina
[b] Division of Psychology, School of Applied Sciences, London South Bank University, London, UK

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ABSTRACT

Internet Gaming Disorder (IGD) is associated with considerable psychological distress in adolescents. However, studies which strive to shed light on the developmental background of IGD are still sparse. We aimed to examine the role of metacognitions and emotion recognition in predicting IGD during the early adolescence period. Four hundred and seventy-seven secondary school students were recruited for the study. Participants completed the Internet Gaming Disorder Test (IGDT), the Metacognitions Questionnaire for Children (MCQ-C), and the Children's Version of Reading the Mind in the Eye Test (RMET). Correlation analyses indicated that three factors of the MCQ-C (positive meta-worry, negative meta-worry, and superstition, punishment, and responsibility) and its total score were positively correlated with the majority of factors of the IGDT. The negative factor of the RMET was positively correlated with the salience, tolerance, and relapse factors and total score of the IGDT. Daily internet use was positively correlated with all factors of the IGDT and its total score. Hierarchical regression analyses indicated that daily internet use and metacognitions (in different combinations) were significant independent predictors of IGDT factors and its total score, and that the negative factor of the RMET was a significant independent predictor of the salience and tolerance factors of IGDT and its total score. The implications of these findings are discussed.

1. Introduction

The internet has penetrated all aspects of our social life making it an increasingly popular means of gaming and entertainment (Spada, 2014). It is widely acknowledged that playing digital games without excessive and pathological use can be regarded as part of a healthy lifestyle, and that gaming may have benefits such as emotional relaxation (Prot et al., 2014).

However, urbanisation, lack of playgrounds, and technological developments are fast supporting the spread of internet-based games among adolescents (Rideout, Foehr, & Roberts, 2010). Indeed, internet gaming has become commonplace and there is growing concern that when it becomes excessive and prolonged it may lead to a host of negative outcomes. These have been shown to include depression (Mentzoni et al., 2011), aggression (Anderson & Carnagey, 2009), anxiety (Gentile et al., 2004), violence (Williams, Kennedy, & Moore, 2011), attention deficits with impulsivity (Gentile et al., 2012), and psychiatric symptomatology (Starcevic et al., 2011). The inclusion of "Internet Gaming Disorder (IGD)" in the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders ([APA], 2013) indicates its emergence as an important mental health issue. Prevalence rates for IGD, based on representative samples, have been estimated to be between 1.2% and 8.5% in adolescents and young adults (e.g. Fam, 2018; Jo et al., 2019; Moudiab & Spada, 2019; Rehbein et al., 2015; Wartberg, Kriston, & Thomasius, 2017).

Research has confirmed that brain development may be impeded by excessive or pathological use of digital games for long periods of time, particularly among children and adolescents (Han, Lyoo, & Renshaw, 2012). Therefore, further steps warrant being taken for early intervention in IGD in order to alleviate its detrimental effects among young populations. Despite the abovementioned studies having highlighted IGD as a significant problem there is a notable paucity of evidence-based literature which specifically addresses the etiology of this addictive behaviour. We propose that two key factors, not yet investigated

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* Corresponding author.
E-mail address: spadam@lsbu.ac.uk (M.M. Spada).

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in the literature, could be potentially associated with IGD in adolescence: metacognitions and emotion recognition.

1.1. Metacognitions

Metacognitions have been defined as the information individuals hold about their own cognition and internal states, and about coping strategies that impact both (Wells, 2000, 2009). Over the last 30 years a large literature base has emerged showcasing the role of metacognitions across the spectrum of psychological disorders (for a review see Wells 2013). Metacognitions have also been widely implicated in addictive behaviours including gambling (Caselli et al., 2018; Jauregui, Urbiola, & Estevez, 2016; Lindberg et al., 2011; Mansueto et al., 2016; Spada et al., 2015; Spada & Roarty, 2015), nicotine dependence (Nikčević & Spada, 2008, 2010; Nikčević, Caselli, Wells, & Spada, 2015; Spada et al., 2007), problematic alcohol use (Spada & Wells, 2005; Spada, Zandvoort & Wells, 2007; Spada et al., 2015), problematic Internet use (Akbari, 2017; Casale, Caplan, & Fioravanti, 2016; Casale, Rugai, & Fioravanti, 2018; Caselli, Marino, & Spada, 2020; Spada et al., 2008; Spada & Marino, 2017), problematic social media use (Marino et al., 2016, 2019) and problematic smartphone use (Casale, Caponi, & Fioravanti, 2020). Recent reviews (e.g. Spada, Caselli, Nikčević, & Wells, 2015; Hamonniere & Varescon, 2018) have shown the ubiquity of this construct in addictive behaviours.

In broad terms, metacognitions can be separated into two factors: positive and negative. Positive metacognitions refer to the benefits of engaging in a given coping strategy (e.g. alcohol use, worry, social media use) as a means cognitive and affective regulation such as "worrying will help me to control my thoughts" or "engaging with social media use distracts my mind from problems". Negative metacognitions concern the uncontrollability and dangers of thoughts and outcomes relating to the coping strategy employed. For example, "once I start worrying, I cannot stop" or "thoughts about using alcohol interfere with my functioning" (Marino et al., 2018).

Recently, Spada and Caselli (2017) developed and validated the first self-report measure designed to assess metacognitions about online gaming and investigated the association between these metacognitions and both weekly online gaming hours and PIU controlling for negative affect (Spada & Caselli, 2017). Findings from this preliminary study confirmed the distinction between positive and negative metacognitions about online gaming and revealed that metacognitions were significantly associated to both weekly online gaming hours and PIU over and above negative affect (Spada & Caselli, 2017). The importance of metacognitions in online gaming has been reiterated in a recent review of cognitions in IGD (Marino & Spada, 2017) as well as in a very recent piece of research which, broadly, supported Caselli and Spada's 2017 findings (Caselli et al., 2020).

At present, no measures to assess metacognitions about online gaming are available for adolescents. For the purposes of this study, we therefore decided to employ the Metacognitions Questionnaire for Children (MCQ-C; Bacow, Pincus, Ehrenreich, & Brody, 2009) which evaluates different *generic* metacognitions in children. These include beliefs about worry (positive and negative meta-worry beliefs), superstitious thinking, punishment, responsibility, and cognitive monitoring. We know from the literature that these generic metacognitions exacerbate negative affect by leading to the activation of maladaptive forms of coping (e.g. worry, rumination, avoidance, and thought suppression) which in turn increase the probability of engaging in addictive behaviours as a means of self-regulation (for a review see Spada et al., 2015; Hamonniere & Varescon, 2018). We are therefore predicting that the presence of such metacognitions will predict IGD as a means of cognitive-affective control.

1.2. Emotion recognition

Emotion recognition provides the capacity to understand and predict others' behaviours, to balance conflicting needs in the environment and to have improved social relationships with others (Chronaki et al., 2015). Hence, better emotion recognition facilitates the accomplishment of goals and desires. This provides numerous positive outcomes such as having a job, easier adaptation, and affirmative relationship quality (Kohler et al., 2004). Lacking emotion recognition, conversely, may yield reduced social enactment of the individual. From a developmental standpoint, each emotion is essential in the establishment of congruent social relationships, however negative emotion recognition is acknowledged to be a vital aptitude for acquiring coping skills during the childhood. Henceforth, individuals who have poor capacity in negative emotion recognition may not develop sufficient coping skills yielding elevated distress (Kopp, 1989). Consequently, the lack of ability in negative emotion recognition may result in impaired psychological wellbeing for the adolescent. Data from several studies has suggested that the deficits in emotion recognition and regulation are observed among several psychiatric disorders (Aydın et al., 2019; Balikci et al., 2018; Lyvers et al., 2018). There are also studies highlighting the key role played by negative emotion recognition in addictive behaviours including substance use (Ernst et al., 2010), problematic internet use (Spada & Marino, 2017), problematic social media use (Ünal-Aydın et al., 2019) and IGD (Yavuz et al., 2019). In these studies, it was shown that individuals who engage in addictive behaviours have poorer ability in negative emotion recognition. With respect to IGD, Yavuz et al. (2019) suggested that adolescents may engage in gaming as a means of providing a rapid reward and relief from psychological distress caused by poor ability in negative emotion recognition. We are therefore predicting that poorer negative emotion recognition will lead to IGD as a means of relief from psychological distress caused by this deficit.

1.3. Aims of the study

Despite the importance of IGD, there remains a paucity of evidence on the developmental origins of this pathological gaming behaviour. In a similar vein, there is also very limited empirical research that seeks to identify the predictors of IGD among adolescents whom can be considered as population at risk in regards to brain development (Han et al., 2012). Most studies in the field of IGD have focused on psychological comorbidities among young adults, however the determination of the potential risk factors (e.g. metacognitions and emotion recognition deficits) could be, potentially, prominent targets for early intervention, particularly among adolescents. This paper seeks to advance the field by examining the relative contribution of metacognitions and emotion recognition to level of IGD among adolescents who may be the most vulnerable population for pathological gaming behaviour. We hypothesised that both metacognitions and poor ability in negative emotion recognition would be correlated with IGD and that they would remain significant predictors of IGD controlling for frequency of internet use.

2. Methods

2.1. Participants

Initially, five hundred fifteen individuals were included in the study. The data was obtained from two different state schools in Istanbul, Turkey. All the participants were eighth-grade secondary school students. The written informed consent was given to the participants and their caregivers. All the students and their caregivers were informed about their right to withdraw their participation at any time without the risk of penalty. Two participants did not sign the informed consent forms. Participants with diagnosed mental disorders (depression (n = 7), attention deficit and hyperactivity disorder (n = 5), autism (n = 2), intellectual disability (n = 5), generalized anxiety disorder (n = 8) were excluded from the study due to the possibility of

inadequate completion of the applied tests. The information for mental health status were collected through self-reports and the counselling centre registry of the schools. Nine participants did not complete the tests. Therefore, statistical analyses were computed with 477 students. The administration of the tests lasted fifty minutes on average and a researcher supervised the session in each classroom. The study was approved by Institutional Review Board of the International University of Sarajevo (12/09/2019; IUS-REC-01-2342/2019) and the official permissions were provided by the relevant school directorates.

2.2. Measures

Socio-demographic form. The socio-demographic form consisted of each participant's age, gender, total count of siblings, grade point average, socio-economic status of the adolescent's family, residential area, presence of internet connection at home, average daily internet use, tools for gaming, and type of game. This form was developed based on the purpose of the current study.

The Internet Gaming Disorder Test (IGDT; Pontes, Kiraly, Demetrovics, & Griffiths, 2014). The IGDT is a self-report measure that consists of 20 items. Responses are recorded on the following 5-point Likert-style scale: 0 (strongly disagree), 1 (disagree), 2 (neither agree or disagree), 3 (agree), and 4 (strongly agree). It consists of six subscales: salience, mood modification, tolerance, withdrawal symptoms, conflict, and relapse. Higher subscale scores are indicative of greater pathological internet gaming behaviour. The IGDT has been previously used to assess patterns of IGD among Turkish samples (e.g. Çakiroğlu & Soylu, 2019) demonstrating strong internal consistency (Cronbach's $\alpha = 0.86$), and adequate test–retest reliability ($r = 0.86$). The authors reported that the individuals who scored above 60 points were considered to be at risk for IGD (Çakiroğlu & Soylu, 2019).

Metacognitions Questionnaire for Children (MCQ-C; Bacow, Pincus, Ehrenreich, & Brody, 2009). The MCQ-C is a 24-item self-report measure which is an adaptation of the Metacognitions Questionnaire for Adolescents (MCQ-A) (Cartwright-Hatton et al., 2004), that evaluates different metacognitions in children. The MCQ-C also differs from the MCQ-A by including only four out of five of the original subscales. These are positive meta-worry, negative meta-worry, superstitious, punishment, and responsibility beliefs, and cognitive monitoring. The cognitive confidence subscale was omitted in MCQ-C adaptation study due to the theoretical reasons. To improve the readability of the test with children, easier words are utilized instead of complex ones (e.g. "bad" instead of "negative") in MCQ-C. Each subscale consists of six items, and responses are based on the following 4-point Likert-style scoring: 1 (do not agree), 2 (slightly agree), 3 (somewhat agree), and 4 (strongly agree). Higher scores of the subscales indicate higher levels of pathological metacognitions. The validity and reliability study of MCQ-C was established in a Turkish sample (Irak, 2012), and strong internal consistency (Cronbach's $\alpha = 0.73$) and adequate test–retest reliability ($r = 0.76$–0.82) were demonstrated.

Children's Version of Reading the Mind in the Eye Test (RMET; (Baron-Cohen, Wheelwright, Spong, Scahill, & Lawson, 2001). The RMET is an adaptation of the adult RMET test which requires participants to put themselves in the mind of the individuals in photographs presented to them, and to attribute a mental state to these individuals (Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997). The test consists of 28 photographs that show only the eye region of the face in which the participants are asked to choose among four words that define the feeling or thinking of the person in the photograph. For example, item 6 has the options of "hate", "unkind", "worried", and "bored" (the correct answer is "worried"). Test scores for the children version can be calculated for positive emotions (e.g. happy, joyful, eager, calm, grateful), negative emotions (e.g. sad, worried, upset, bored), and neutral emotions (e.g. normal, questioning, focused and unsure) (Cassels, 2015). The total number of correct responses in each category are calculated by the clinician and higher scores in the relevant category indicate better ability in emotion recognition. The validity and reliability study of the children's version of RMET was conducted in Turkish sample, and internal consistency was strong (Cronbach's $\alpha = 0.69$–0.73) and construct validity was adequate (Girli, 2014).

2.3. Statistical analysis

The descriptive statistics method was applied to estimate the mean, standard deviation, total count, and frequency of the socio-demographic and test variables. The distribution of normality was checked using Kolmogorov-Smirnov test, skewness, and kurtosis. The assumptions of normality were met. To evaluate the relationships between daily internet use, IGDT, MCQ-C, and RMET subtests, Pearson product-moment correlations were performed. Hierarchical multiple regression analyses were then conducted to investigate the predictive value of MCQ-C and RMET factors for IGDT factors, after confirming that the assumptions for multiple regressions were met. Daily internet use was entered in the first step to control its effects on IGDT. RMET and MCQ factors were entered into the following steps respectively if they were associated with corresponding IGDT factors. Cohen's f^2, which is appropriate for calculating the effect size within a regression model was computed, and according to Cohen's guidelines, $f^2 \geq 0.02$, $f^2 \geq 0.15$, and $f^2 \geq 0.35$ represent small, medium, and large effect sizes, respectively (Cohen, 1988). The level of statistical significance (p) was adjusted to < 0.05, and all analyses were estimated with the Statistical Package for Social Sciences (SPSS) version 22.0 (IBM Corp., Armonk, NY).

3. Results

3.1. Sample characteristics

Demographic characteristics of the participants are presented in Table 1. The mean age of the participants was 13.21 years ($SD = 0.56$). Data analyses suggest that among the participants, 53% ($n = 253$) were male and 47% ($n = 224$) were females. In terms of internet connection at home, 84% ($n = 403$) of the participants indicated that they have an internet connection with 69% ($n = 300$) of them indicating using internet for less than 2 h per day and 31% ($n = 177$) for more than 2 h per day. The most common tool for gaming was the mobile phone (76%, $n = 365$), and the most common type of game played was action (65%, $n = 312$). Finally, 5% of the participants indicated that they consider themselves addicted to gaming (n = 22), and 106 participants (22%) stated the possibility of addiction; however only 27 participants (6%) were in a risk category according to the overall score (greater than60) on the IGDT. Mean scores and standard deviations of the study variables are presented in Table 2.

3.2. Correlations between daily internet use, IGDT, MCQ-C, and RMET factors

As can be seen in Table 2, bivariate correlation analyses revealed that daily internet use was positively correlated with all subscales of IGDT. The salience, withdrawal, relapse subscales and total score of IGDT were positively correlated with each MCQ-C subscale. Mood modification was correlated in a positive direction with all MCQ-C subscales excluding positive meta-worry. The tolerance and conflict subscale of IGDT were correlated with MCQ-C subscales except for cognitive monitoring. Only negative emotion recognition was found to be negatively correlated with salience, relapse, and the total score of IGDT.

3.3. Hierarchical multiple regression analyses

Results from these analyses are presented in Table 3. Only the final

Table 1
Socio-demographic features of the sample.

	Mean	S.D.	Count (%)
Age	13.21	0.56	
Gender			
Male			253(53%)
Female			224(47%)
Total count of siblings	2.83	1.45	
Grade point average (out of 100)	79.10	12.68	
Family economic status (converted to U.S. Dollar)			
Less than $350			52(11%)
$350 - $850			290(61%)
More than $850			135(28%)
Residential area			
City center			470(99%)
Not city center			7(1%)
Presence of internet connection at home			403(84%)
Average internet usage (hour/day)			
Average internet usage (hour/day)			
Less than 2 h			300(69%)
More than 2 h			177(31%)
Tools of gaming			
Computer			209(44%)
Tablet			107(22%)
Mobile phone			365(76%)
Game console			85(18%)
Type of game			
Action			312(65%)
Battle			123(26%)
Racing			110(23%)
Sport			95(20%)
Do you consider yourself addicted to gaming?			
No			267(56%)
I have no idea			82(17%)
Maybe			106(22%)
Yes			22(5%)

step of each model is displayed for simplicity of presentation.

Predictors of Salience. In the first step of the hierarchical multiple regression, daily internet use was significant F(1, 474) = 87.03, $p < .01$, accounting for 15% of the variance. In the second step, negative emotion recognition significantly contributed an additional 1% of variance (F(2, 473) = 46.51, $p < .01$). In the third step positive meta-worry made a significant contribution to the model, F(6, 469) = 18.89, $p < .01$, accounting for 3% of the variance. In the final step daily internet use, negative emotion recognition and positive meta-worry were significant predictors of salience with a total variance explained of 19%. The effect size of the final regression model was medium ($f^2 = 0.23$).

Predictors of Mood Modification. In the first step of the hierarchical multiple regression, daily internet use was significant F(1, 475) = 29.56, $p < .01$, accounting for 6% of the variance. In the second step, only cognitive monitoring significantly contributed an additional 4% of variance (F(4, 472) = 13.69, $p < .01$). In the final step both daily internet use and cognitive monitoring were significant predictors of mood modification and they accounted for 10% of the total variance. The effect size of the final regression model was small ($f^2 = 0.11$).

Predictors of Tolerance. In the first step of the hierarchical multiple regression daily internet use was significant F(1, 475) = 53.87, $p < .01$, accounting for 10% of the variance. In the second step negative emotion recognition significantly contributed an additional 2% of variance (F(2, 473) = 31.61, $p < .01$). In the third step, positive meta-worry significantly contributed to the model, F(4, 472) = 17.27, $p < .01$, accounting for 4% of the variance. In the final step, daily internet use, negative emotion recognition, and positive meta-worry were all significant predictors of tolerance explaining 16% of the total variance. The effect size of the final regression model was medium ($f^2 = 0.19$).

Predictors of Withdrawal. In the first step of the hierarchical multiple regression daily internet use was significant F(1, 475) = 38.78, $p < .01$, accounting for 7% of the variance. In the second step, only negative meta-worry significantly contributed to the model, F(5, 471) = 11.69, $p < .01$, accounting for 4% of the variance. In the final step, both daily internet use and negative meta-worry were significant predictors of withdrawal, explaining 11% of the total

Table 2
Pearson product-moment correlations between the study variables.

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	Daily Internet use	1.84 (0.87)	1															
2.	IGDT-S	5.76 (2.43)	0.39**	1														
3.	IGDT-MM	7.56 (2.67)	0.24**	0.37**	1													
4.	IGDT-T	5.38 (2.34)	0.32**	0.65**	0.42**	1												
5.	IGDT-W	5.42 (2.46)	0.27**	0.54**	0.39**	0.60**	1											
6.	IGDT-C	8.63 (2.96)	0.18**	0.33**	0.08	0.33**	0.23**	1										
7.	IGDT-R	6.16 (2.89)	0.30**	0.58**	0.36**	0.51**	0.50**	0.35**	1									
8.	IGDT-Total	38.94 (11.2)	0.40**	0.79**	0.61**	0.80**	0.75**	0.57**	0.78**	1								
9.	MCQ-PMW	16.42 (3.34)	0.07	0.17**	0.06	0.17**	0.13**	0.16**	0.24**	0.22**	1							
10.	MCQ-NMW	18.98 (3.36)	0.08	0.13**	0.17**	0.15**	0.18**	0.21**	0.14**	0.23**	0.13**	1						
11.	MCQ-SPR	18.64 (3.46)	0.12*	0.15**	0.14**	0.16**	0.17**	0.20**	0.16**	0.23**	0.25**	0.51**	1					
12.	MCQ-CM	20.31 (3.3)	0.07	0.12*	0.21**	0.08	0.12**	0.03	0.12**	0.16**	0.18**	0.38**	0.41**	1				
13.	MCQ-Total	74.37 (9.39)	0.12**	0.20**	0.21**	0.20**	0.21**	0.21**	0.24**	0.30**	0.56**	0.73**	0.79**	0.71**	1			
14.	RMET-POS	4.51 (1.21)	0.01	−0.03	−0.08	−0.08	−0.07	−0.01	0.01	−0.06	−0.01	0.02	−0.05	−0.05	−0.03	1		
15.	RMET-NEG	7.74 (1.43)	−0.01	−0.10*	−0.03	−0.13**	−0.07	−0.08	−0.09*	−0.12*	0.01	0.07	0.05	−0.05	0.03	0.18**	1	
16.	RMET-NEU	7.45 (1.51)	0.06	−0.04	−0.07	−0.08	−0.01	−0.04	0.02	−0.05	0.08	0.12**	0.03	0.04	0.10*	0.21**	0.21**	1

Notes: *p < .05, **p < .01, Daily internet use: Average internet use (hour/day), IGDT-S: Internet Gaming Disorder Test Salience, IGDT-MM: Internet Gaming Disorder Test Mood Modification, IGDT-T: Internet Gaming Disorder Test Tolerance, IGDT-W: Internet Gaming Disorder Test Withdrawal Symptoms, IGDT-C: Internet Gaming Disorder Test Conflict, IGDT-R: Internet Gaming Disorder Test Relapse, IGDT-Total: Total sum of IGDT subdomains, MCQ-PMW: Metacognitions Questionnaire Positive Meta-Worry, MCQ-NMW: Metacognitions Questionnaire Negative Meta-Worry, MCQ-SPR: Metacognitions Questionnaire Superstition, Punishment and Responsibility, MCQ-CM: Metacognitions Questionnaire Cognitive Monitoring, MCQ-Total: Total sum of MCQ subdomains, RMET-POS: Reading the Mind in the Eyes Test Positive, RMET-NEG: Reading the Mind in the Eyes Test Negative, RMET-NEU: Reading the Mind in the Eyes Test Neutral.

Table 3
Hierarchical regression statistic with IGDT factors as the outcome variables and negative emotion recognition and MCQ-C factors as the predictor variables.

IGDT-Factors	Predicting Factors	Standardized Beta	*t*	*p*	R^2
Salience	Daily internet use	0.03	8.94	**0.00**	0.19
	Negative emotion recognition	−0.10	−2.43	**0.01**	
	Positive meta-worry	0.12	2.88	**0.00**	
	Negative meta-worry	0.06	1.30	0.19	
	Superstition, Punishment and Responsibility	0.03	0.61	0.54	
	Cognitive monitoring	0.02	0.56	0.57	
Mood modification	Daily internet use	0.22	5.09	**0.00**	0.10
	Negative meta-worry	0.09	1.78	**0.07**	
	Superstition, Punishment and Responsibility	0.00	0.05	0.95	
	Cognitive monitoring	0.15	3.24	**0.00**	
Tolerance	Daily internet use	0.29	6.92	**0.00**	0.16
	Negative emotion recognition	−0.13	−3.19	**0.00**	
	Positive meta-worry	0.12	2.74	**0.00**	
	Negative meta-worry	0.09	1.90	0.05	
	Superstition, Punishment and Responsibility	0.05	1.07	0.28	
Withdrawal	Daily internet use	0.25	5.76	**0.00**	0.11
	Positive meta-worry	0.07	1.66	0.09	
	Negative meta-worry	0.10	2.05	**0.04**	
	Superstition, Punishment and Responsibility	0.05	1.08	0.27	
	Cognitive monitoring	0.02	0.48	0.63	
Conflict	Daily internet use	0.15	3.39	**0.00**	0.09
	Positive meta-worry	0.11	2.45	**0.01**	
	Negative meta-worry	0.15	2.93	**0.00**	
	Superstition, Punishment and Responsibility	0.07	1.38	0.16	
Relapse	Daily internet use	0.27	6.51	**0.00**	0.16
	Negative emotion recognition	−0.09	−2.17	**0.03**	
	Positive meta-worry	0.19	4.42	**0.00**	
	Negative meta-worry	0.07	1.41	0.15	
	Superstition, Punishment and Responsibility	0.03	0.66	0.50	
	Cognitive monitoring	0.02	0.47	0.63	
IGDT-Total score	Daily internet use	0.36	8.97	**0.00**	0.24
	Negative emotion recognition	−0.12	−3.16	**0.00**	
	Positive meta-worry	0.15	3,64	**0.00**	
	Negative meta-worry	0.15	3.13	**0.00**	
	Superstition, Punishment and Responsibility	0.07	1.46	0.14	
	Cognitive monitoring	0.01	0.26	0.79	

variance. The effect size of the final regression model was small ($f^2 = 0.12$).

Predictors of Conflict. In the first step of the hierarchical multiple regression daily internet use was significant $F(1, 475) = 15.65$, $p < .01$, accounting for 3% of the variance. In the second step, positive and negative meta-worry significantly contributed to the model, $F(4, 472) = 11.82$, $p < .01$, accounting for 6% of the variance. In the final step, daily internet use, positive and negative meta-worry were significant predictors of conflict, explaining 9% of the total variance. The effect size of the final regression model was small ($f^2 = 0.09$).

Predictors of Relapse. In the first step of the hierarchical multiple regression daily internet use was significant $F(1, 474) = 48.28$, $p < .01$, accounting for 9% of the variance. In the second step, negative emotion recognition significantly contributed to model, $F(2, 473) = 26.24$, $p < .01$, accounting for 1% of the variance. The third step was significant with a significant contribution of positive meta-worry, $F(6, 469) = 14.60$, $p < .01$, accounting for 6% of the variance. In the final step daily internet use, negative emotion recognition, and positive meta-worry were significant predictors of relapse, explaining 16% of the total variance. The effect size of the final regression model was medium ($f^2 = 0.19$).

Predictors of IGDT Total Score. In the first step of the hierarchical multiple regression daily internet use was significant $F(1, 474) = 88.18$, $p < .01$, accounting for 16% of the variance. In the second step, negative emotion recognition significantly contributed 1% to the variance ($F(2, 473) = 48.36$, $p < .01$). In the third step significant contributions of positive and negative meta-worry, $F(6, 469) = 25.41$, $p < .01$, accounting for 7% of the variance, were observed. In the final step, daily internet use, negative emotion recognition, positive, and negative meta-worry were significant predictors of IGDT Total Score, explaining 24% of the total variance. The effect size of the final regression model was medium ($f^2 = 0.31$).

4. Discussion

This study set out with the aim of assessing the relative contribution of metacognitions and negative emotion recognition in predicting IGD among adolescents. The results of our study showed that both metacognitions and negative emotion recognition played an independent role in predicting IGD when controlling for daily internet use. It would therefore appear to be the case that dysfunctional metacognitions and poor ability at negative emotion recognition are vulnerability factors for IGD.

Positive meta-worry was found to independently predict salience, tolerance, conflict and relapse. Positive meta-worry is key in the activation of forms of coping (rumination, worry, thought suppression) in the presence of distressing triggers (e.g. upsetting thoughts, emotions, sensations) that may 'backfire' leading to an escalation of negative affect (Wells, 2000). This, in turn, may increase the probability of engaging in internet gaming as a means of cognitive-affective regulation. For example, worrying about internal states may bring to greater salience of internet gaming triggers as well as the worsening of affective states which may facilitate relapse.

Negative meta-worry was found to independently predict withdrawal and conflict. Negative meta-worry pertains to the evaluation and judgment of the lack of control over, and danger of, internal states and forms of maladaptive coping such as worry. The presence of negative meta-worry indicates that psychological distress has escalated to higher thresholds. This may explain the link between negative meta-worry and those aspects of IGD that denote a more marked pathology

(withdrawal, an indicator of dependence, and conflict, an indicator that behaviour is beginning to impact interactions with others). This finding aligns itself to what has been observed in other studies, which is that negative metacogntive beliefs are a marker of more severe aspects of addictive behaviour (Spada et al., 2015; Hamonniere & Varescon, 2018). Finally, cognitive monitoring independently predicted mood modification. This may indicate that those who spend more time monitoring internal states may be more likely to engage in internet gaming as a means of attempting to modify these states.

Another important finding of our study was that poor ability at negative emotion recognition predicted salience, tolerance and relapse but not other aspects of IGD. Taken together, these three facets of IGD are makers of the 'automaticity' of an addictive behaviour. It is therefore plausible to assume that internet gaming, particularly for those who have a poor ability in negative emotion recognition, can become an 'automatic', and possibly exclusive, means of rapid reward attainment and relief from psychological distress. Indeed, previous studies evaluating emotion recognition have reported similar results in social networking sites addiction (Ünal-Aydın et al., 2019), alcohol use disorder (Freeman et al., 2018), substance use disorder (Bayrakçı et al., 2015), and internet addiction (Chen, Poon, & Cheng, 2017; Spada & Marino, 2017). Owing to the scarcity of the studies among adolescents (Yavuz et al., 2019), to our knowledge one very recent study revealed the association of alexithymia and IGD among adolescents. The research in question highlighted that the recognition of emotions is a key social tool for launching compatible communication between individuals. Thus, the poor ability in negative emotion recognition may bring to a deterioration in psychological well-being for the adolescent by causing vulnerability to mental disorders such as anxiety and depression. The adolescent may then, in turn, engage in gaming which can provide a rapid reward and relief from psychological distress. This rather intriguing result could be attributed to the developmental process of emotions. However all emotions are prominent in daily life, the capacity to recognize negative emotions may play a fundamental role in the maturation of coping skills during childhood according to this perspective. Furthermore, individuals who have deficits in negative emotion recognition may suffer from restricted coping skills which result in non-compatibility with the environment (Kopp, 1989). Therefore, we may infer that the adolescents with insufficient capability in negative emotion recognition may be more likely to engage in internet gaming in order to alleviate the negative outcomes that originate from conflict with the environment. An alternative explanation may lie within the behavioral inhibition framework. In this framework an individual's behaviour ordinarily results in withdrawal when it is exposed to negative stimuli (e.g. punishment, non-reward, unfamiliarity) by external sources (e.g. parent, peer, spouse) (Davidson, Ekman, Saron, Senulis, & Friesen, 1990). From this perspective, parents' negative attitudes towards excessive internet gaming behaviour may not be recognized by the adolescent, and this misinterpretation may cause to sustain the unbalanced engagement in internet gaming.

The present results are preliminary, and some limitations must be highlighted. First, the sample was not randomly selected and the use of data from self-report questionnaires may have been influenced by recall bias and answer accuracy. Second, a cross-sectional design does not allow definitive statements about causality. Future studies should employ longitudinal designs and monitor how and when metacognitions and emotion recognition change over time and how these changes may or may not be correlated with IGD. Third, though the sample size was fair, the risk of IGD diagnosis was not evaluated by a structured clinical interview. Therefore, it is likely to underestimate the true prevalence of IGD across our sample. For instance, 27% of the participants indicated they were a potential internet gaming addict however, only 6% of them were found to be at risk of IGD according to the established cut off on the IGD. Additionally, the overall mean score of IGDT in our sample was lower than what was observed in individuals who participated in the reliability and validity study of among Turkish samples (Çakiroğlu & Soylu, 2019). It should be noted that the very low count of the participants at risk of IGD may have caused a bias while interpreting the results. Fourth, some effect sizes were small (e.g. predictors of mood modification). This may indicate the importance of utilizing psychometric measures which specifically tap into metacognitions about gaming rather than the generic measure of metacognitions employed in the current study. In addition, although we excluded the participants with mental health disorders, it is probable that undiagnosed cases would have been present among our sample due to the lack of a structured clinical interview. This may have affected their test performance and internet gaming behaviour. Our sample consisted of individuals in the early adolescence period, therefore it is possible that these results may not be generalizable to a broader range of adolescents within different age intervals. Finally, future studies should also control for other variables which have been found to be associated with IGD.

Despite these limitations, results of this study indicate that both metacognitions and emotion recognition difficulties may play a role in IGD. Targeting both constructs possibly through interventions aimed at 're-parenting' and/or building assertiveness skills such as schema focused therapy (Taylor, Bee, & Haddock, 2017) or cognitive behaviour therapy (Speed, Goldstein & Goldfried, 2017) may prove of value. The modification of metacognitions (in particular relating to cognitive confidence) may also be potentially of therapeutic benefit. There is a large literature demonstrating the effectiveness of metacognitive therapy in treating psychological distress (see Wells, 2013) and growing evidence of its application to addictive behaviours (see Spada et al., 2015). These interventions may include the direct restructuring of metacognitions as well as techniques aimed at potentiating attentional flexibility (attention training technique) and interrupting rumination and worry (detached mindfulness and postponement) which may free up valuable resources for problem-solving and engagement with the environment. In conclusion, the results from the current study provide an important addition to the literature on the role of metacognitions and emotion recognition in predicting IGD.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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