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Students' game addiction caused by multi-constructs and multi-dimensions: Self-controls, cognitive biases and opportunistic behaviours

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Purpose: This study investigates some extant research concentrating on student self-regulation to play online games addictively. Then, it proposes a new design to explain game addiction caused by students' cognitive biases according to three contested approaches: self-control or self-regulation, cognitive distortion, and opportunistic behaviour. Moreover, it separates each contested approach in detail.

Research methodology: This research generalises research subjects with specific qualities and characteristics according to the researchers' provisions. It selects the population with specific attributes: self-control, cognitive bias, opportunistic behaviour, habits and addiction to online games. Then, this study distributes bilingual questionnaires to the respondents throughout Indonesia. Finally, it tests these research hypotheses, splits them according to each model, and avoids perfect-collinearity among the constructs.

Originality: This research creates a new design incorporating three contested models of students' addiction to games. The authors argue that online game addiction is due to students' weak self-control, cognitive distortion, and opportunistic behaviours. The first perspective suggests that students play games addictively because of their low self-control in managing their tasks and enjoying leisure time. Secondly, this research deals with students playing the game due to their cognitive distortions: embodiment, stereotype, and heuristic biases. Finally, the third perspective explains students' addiction to games because of their probable attitudes and behaviours: indeterminism, escapism, and adverse selection.

Findings: This research finds that each contested model could explain students' tendencies to be addicted to playing online games. The authors conclude that multi-constructs and multi-dimensions explain students' tendency to play games addictively in all three contested models. Moreover, this research infers that students' habits and addictive behaviours are due to the number of games available on social media and the internet. This

availability would likely damage academic habits, behaviours, culture and environment. Meanwhile, educational systems cannot stop the emergence and alterations of some new games. Finally, this study innovates the multi-paradigm for teachers' counselling guidance.

Implications: This study's findings imply a need for students' behavioural therapy to be conducted by academic counsellors who are careful of the causal factors of multi-constructs and multi-dimensions. Then, it argues that the different causal factors impact the need for different cognitive therapies. Moreover, it explains that equal treatment for these students addicted to games would make them more stressed. Then, academic counsellors developing healing and wellness programmes should mitigate these students with a specific trait from the subdimensions of each construct.

KEYWORDS

academic stress, game addiction, self-control, cognitive distortion, opportunistic behaviour

Introduction

One of the technological developments that students love is online games. However, adolescents' penchant for online games presents a new addiction problem. Online game addiction arises from students' inability to respond to various aspects of their attitudes and behaviour. Currently, the authors highlight that most university students or adolescents are massively addicted to online games in Indonesia, with rising new issues of hedonic needs and professional jobs as game boosters (Hanafi et al., 2019; Rakhmawati et al., 2021; Sumiyana et al., 2022; Vasudevan and Fung, 2022). On the other side, much of the extant research states that online game addiction is a psychopathology of modern culture (Lemmens et al., 2009; Van Rooij et al., 2011; Hyun et al., 2015). This opinion is correct because online games are a product of modern civilisation, which students can use for good entertainment but magnify as an escape from their realities (Hutchins, 2008; Yong and Downing, 2008; Hyun et al., 2015). This study suggests that the extant studies on students' addictive behaviour in online games focus on self-regulation deficiency and its reflective factors. In addition, this research investigates other aspects and concepts that constitute a more comprehensive and integrative approach. This research further inquires whether students' stress-escalating in-game addiction can comprise multi-constructs and multi-dimensions, such as weak self-control, cognitive distortion, or opportunistic behaviour. These three multi-constructs and multi-dimensions, and this study's detailed examination of their traits, simultaneously reflect the students' cognitive biases. In other words, this study proposes three contested models to explain the relationship between students' anxiety and online game addiction.

This study raises novel arguments in explaining students' online game addiction. First, it demonstrates another perspective from the extant research on self-regulation deficiency (LaRose et al., 2003; Tokunaga, 2015; Gong et al., 2019). The authors argue that online game addiction is not only due to students' weak self-control; it could also probably be from the students' cognitive distortion (Li and Wang, 2013; Çelik and Odacı, 2013; King and Delfabbro, 2014) and adverse selection (Lemmens et al., 2009; Weinstein, 2010; Wöfling et al., 2019). Second, the authors complement the students' weak self-regulation with social networks and negative affectivity in influencing game habits and addiction. This research highlights that students with low self-regulation usually make social networks more straightforward than those with high (LaRose et al., 2003; Çelik and Odacı, 2013; King and Delfabbro, 2014). These students always search for others to become teammates or partners in the game. Otherwise, they usually perceive their tasks are light loads that can be accomplished immediately (Zhou and Leung, 2012; Schou Andreassen and Pallesen, 2014). They consider that they can quickly achieve their performance, although they are oblivious to their responsibilities and tasks. This study argues that those students have innovative characteristics. However, they transformed their inner creative surfaces into playing games intensively.

Third, this study designs a new model to explain student addiction to playing an online game from the second perspective of students' cognitive biases: embodiment, stereotype and heuristics. In other words, it raises cognitive biased behaviours as the determinant factors of students' game habits and addiction. The authors argue that those students had a behavioural illness in their beliefs and attitudes (Rikkens et al., 2016; Han et al., 2020; Banerjee et al., 2021). Furthermore,

this research considers that friendship, social environment, and culture distort the students' cognition accumulatively and further drive them to become more addicted. Fourth, this study arranges its last model, which accommodates the opportunistic behaviours of students' characters (Laffont, 1990; Kardefelt-Winther, 2014; Banerjee et al., 2021): adverse selection, escapism, and indeterminism. The authors argue that these students are addicted to online games because they prefer not to optimise their efforts to achieve academic performance. On the other hand, these students are likely to engage in indeterminism in which they run away from reality and seek refuge in enjoyment, entertainment or hedonism. Simultaneously, they have indeterminate characters because they have some opportunities and leisure time. Moreover, they take academic classes daily with their adverse selection without eagerness to achieve high performances.

This study makes certain assumptions as it investigates these three models in an integrative way and separately. First, this study ignores students' personalities (Harris, 1993; Cole, 2002; Mahajan and Rastogi, 2011), such as masculinity, eagerness, openness, etc. The authors also do not consider students' nature in terms of their transforming or confronting orientation (Domahidi et al., 2014; Thompson, 2019) when they receive criticism and comments from others when playing online games. Thus, this study simplifies the factors tested even though individual personality affects the speed at which online game addiction occurs. Second, this study does not measure students' emotionality (Braun et al., 2016; Di Blasi et al., 2020; de Hesselte et al., 2021) in their intention to play online games. In other words, the authors ignore the students' emotional states because the questionnaire that has been designed does not differentiate between the level of acute addiction. Finally, this research does not consider the sensitive status of students' addiction to playing online games.

This study will contribute to managerial and theoretical disciplines from three comprehensive models. This research contributes to the academic management of students' addiction to online games caused by multi-constructs and multi-dimensions: self-control, cognitive distortion, and opportunistic behaviour. This study further argues that these elements are not the only internal characteristics that cause students to be addicted to online games; the external environment and culture support their beliefs and behaviours. Moreover, it raises social influence as the dominant factor that builds students' cognition to be addicted (Rudolph and Clark, 2001; Ota et al., 2020). It also references students' mental illness as explained by their adverse selection, escapism, and indeterminism (Li et al., 2011; Kardefelt-Winther, 2014; Chang et al., 2018). Finally, this study shows that the transformation of students addicted to online games can only be secured with concurrent therapy to increase self-control, improve the educational environment, and decrease mental illness. In other words, this study criticises those approaches that focus on the weakness of self-control or

self-regulation because the leading cause of students' addiction comes from multi-constructs and multi-dimensions.

Furthermore, this research demonstrates that self-control or self-regulation, cognitive distortion, and opportunistic behaviour, together as a set, mediate (amplify) the relationship between students' cognitive biases and online game addiction. This set means a unified process that does not work is mutually exclusive. Process unification occurs because students' beliefs, attitudes, and behaviour are complex realities of life (Wolff, 2003; Marinier et al., 2009; Colombo and Hartmann, 2017). This study also confirms that separating the unification process in the students' cognition is challenging because these factors intersect instantaneously. In other words, students' motivation to play online games is caused by mutually complementary factors (Mehroof and Griffiths, 2010; Myrseth et al., 2010; Mills and Allen, 2020) among self-control, cognitive distortion, and opportunistic behaviour. This study demonstrates the integrity of the three causative factors that complement each other with complex symptoms. In short, students addicted to online games are those with low self-control, supplemented by distorted cognition and, in parallel, enhanced with mental illness. Meanwhile, social media influences the other students affecting their mental illness, simultaneously accompanied by weak self-regulation.

This study's remaining sections discuss students' cognitive biases, online game addiction, self-control, and opportunistic behaviours. The authors also elaborate on all constructs in detail. Section 3 presents the research method. This study does not compare the three independent research models due to their mutually complementary perspectives, presented in Section 4. In Section 4, the authors also demonstrate the inference from this research, especially regarding the unified process of the students addicted to playing online games. The last section discusses the conclusion, limitations and future research.

Literature review and hypotheses development

This section explains three contested aspects of this study's design to elaborate on students' addiction to playing online games. It starts with self-control, cognitive biases, and opportunistic behaviours. Then, each dimension is discussed in detail.

Self-control

Finkel and Fitzsimons (2011) and Gul and Pesendorfer (2001) suggest that a person can guide his behaviour. This ability manifests itself in suppressing or blocking behavioural impulses. According to behaviourism, a lack of self-control limits a person's ability to achieve long-term goals (Goldiamond, 1965;

Goldfried and Merbaum, 1973; Muraven, 2010). For example, the individual intentionally avoids or immediately engages in self-satisfying behaviour independently. However, some act to replace it with less usual behaviour or seek pleasure that is not immediately felt. This study explains students' self-control, including self-regulation deficiency, social relations, and negative affectivity.

Self-regulation deficiency frames an individual's self-control to generate thoughts, feelings, and actions and continuously plan and adapt to achieve missions and goals. Furthermore, this study describes self-regulation deficiency as a person's failure to adequately assess and adjust his or her behaviour (Newman and Wallace, 1993; Baumeister and Heatherton, 1996). This study indicates that high self-control always leads to good social relationships (Gul and Pesendorfer, 2001; Finkel and Fitzsimons, 2011). Therefore, social relationships reflect cooperation and coordination among people based on active and reciprocal social ties. Moreover, the remaining effect of an individual's low self-control conforms to be highly negative affectivity. The authors explain that an individual's emotional experiences can produce low negative affectivity (Watson and Clark, 1984) due to bad feelings: anger, humiliation, disgust, guilt, fear, and nervousness (Tan and Forgas, 2010; Koch et al., 2013). This study also explains that high negative affectivity is characterised by low mood traits: anxiety, stress, restlessness, relaxation, and serenity. Meanwhile, low negative affectivity is characterised by calm, self-confidence, liveliness, and enthusiasm.

In summary, this study contends that self-regulation deficiency, social relationships and negative affectivity have functioned as the signifiers of an individual's self-control. Therefore, this study argues that low self-regulation deficiency, high social networks, and intense negative affectivity are marks of good self-control (Goldiamond, 1965; Newman and Wallace, 1993; Gong et al., 2019). Meanwhile, this demonstrates that poor self-control develops individuals quickly become addicted to online games. In other words, students who tend to be addicted to online games have high self-regulation deficiency, stiff social networks, and intense negative affectivity. Moreover, they always intend to play online games due to low awareness, ignorance of their duties, and neglect of academic responsibilities. Therefore, this study formulates the hypotheses in Panel A: Model-1 below.

H1a: Students' self-regulation deficiency positively affects their online game habits.

H1b: Students' social relationships positively affect their online game habits.

H1c: Students' negative affectivity positively affects their online game habits.

Cognitive bias

This study considers cognitive bias as a pattern of abnormal deviations from the standard of judgement. However, cognitive bias can also be interpreted as a subjective opinion or specific heuristics that are errors in thinking, judging, remembering, and making decisions. Consequently, cognitive bias causes a person to make less rational and less comprehensive decisions (Barnes, 1984; Simon et al., 2000). Therefore, this study explains students' cognitive biases as embodiment, stereotype and heuristic.

This study argues that embodiment composes the nature of the problems faced by a person. The composition means that resources could become more or less valuable when problem-solving is achieved through cognitive enrichment that accommodates roles, actions, and the environment (Greenberg et al., 1993; Milgram et al., 2006). On the other hand, humans naturally tend to categorise things, especially when overloaded. As a result, a person processes problems no more efficiently because of the desire to free up mental resources for other tasks (Bargh et al., 1996; Milgram et al., 2006). Thus, this study argues that students embody playing games to replace their academic stressors. Second, stereotype bias is a mental state because a person maintains and reinforces the selection of information that contradicts pre-existing beliefs or attitudes. The remaining form of cognitive bias is heuristic. This research explains that the heuristic describes the placement of more weight on convenience. For example, a person may choose up-to-date information and ignore other relevant facts (Tversky and Kahneman, 1974; Stanovich et al., 2008; Toplak et al., 2011). This study links this heuristic bias with mental paths to reduce difficulty in carrying out tasks and achieve expected maximum outputs with simple actions.

Furthermore, this study integrates embodiment, stereotype and adverse selection biases to measure an individual's cognitive distortion. Then, it argues that students with cognitive biases in embodiment, stereotype and adverse selection would probably play the online game (Winkielman et al., 2015; Beukeboom et al., 2019). These students embody experiential cognition due to environmental and social influences supported by a lenient academic load. Simultaneously, they have stereotype biases due to the contradiction of their duties and responsibilities as students. Moreover, they probably play the online game starting as a poor player, encouraging them to be heuristic. Finally, this study develops the hypotheses in Panel B: Model-2 below.

H2a: Students' embodiment bias positively affects their online game habits.

H2b: Students' stereotype bias positively affects their online game habits.

H2c: Students' heuristic bias positively affects their online game habits.

Opportunistic behaviour

This study explains that opportunistic behaviour or opportunism attempts to seek personal self-interest by deception (Williamson, 1995). Opportunistic behaviour refers to a specific action performed by an individual when he or she organises higher expediency than others (Lyons and Mehta, 1997; Cheng and Sheu, 2012; Banerjee et al., 2021). For example, the authors argue that individuals will probably shirk other activities to pursue enjoyment, entertainment or hedonism. The individuals also do not want to optimise their outcomes (Eckbo and Masulis, 1992; Cohen et al., 2007; Calleja, 2010) due to no expectation of higher rewards. Therefore, this research demonstrates students' opportunistic behaviours: indeterminism, escapism and adverse selection.

This study posits Kožnjak (2018), who suggests indeterminism explains that individuals will always be free without limits. For example, students decide to play online games, and their choice is based on their own will without any outside influence. Consequently, this study argues that students with low academic motivation will search for other enjoyable activities, i.e., playing the game. Furthermore, these students always want to repeat their behaviour without any interference from others. For example, students could become escapists because they seek temporary calmness or pleasure as an alternative to facing their problems. Therefore, escapist behaviour is repeated and makes it a preferred behaviour pattern. The more often students do it, the more the behaviour becomes a habit that is considered reasonable (Panova and Lleras, 2016; Meier et al., 2018). Schmitz (2021) explains that insufficient information determines an individual's preferences. Furthermore, problems become natural over time because of the consistent lack of information (Hoppe and Schmitz, 2015; Saeedi, 2019).

The authors have unified the opportunistic behaviour to include indeterminism, escapism and adverse selection to explain students' addiction to online games. These three measurements construct student behaviour in terms of their opportunism because they could get an optimal outcome different from others (Khushalani et al., 1994; Rowe and O'Brien, 2002). Moreover, students who experience lenient learning systems in their academic life probably have many opportunities to engage in different activities (Becker, 2007; Alzahrani et al., 2017), such as playing online games. In other words, the authors argue that these students perceive academic responsibilities with their bias, namely that they can conduct their academic tasks in a short amount of time. Therefore, they are in the stiff indeterminism, escapism and adverse selection when students ignore their academic tasks to play online games.

Therefore, the authors formulate the hypotheses in Panel C: Model-3 below.

H3a: Students' indeterminism positively affects their habits of playing online games.

H3b: Students' escapism positively affects their habits of playing online games.

H3c: Students' adverse selection bias positively affects their online game habits.

Habit and addiction to playing online games

This research concurs with Wood et al. (2002) and Lally et al. (2010), who suggest that habit is an individual's routine, experiential value-constructing behaviour that is engaged consistently. However, this engagement does not need self-analysis when someone does it persistently and consistently. This study considers habit formation from the aspects of the context cue, behaviour repetition and rewards (Lally et al., 2010; Wood and Neal, 2016; Wood and Runger, 2016). Then, an individual's habit could become an addiction when suffering from a mental disease (Valverde, 1988; Verplanken and Faes, 1999). The authors argue that addicted people have the willpower to do something they choose, overriding other activities. This study infers that students continually engaging in a habit compounded by a mental disease will become addicted to playing online games. Therefore, this study has designed a hypothesis relating to individual habits and addiction for all models. Hence, it presents the three contested models in Figure 1.

H4: Students' habit of playing online games positively makes them addicted.

Research method

Data and sampling

According to the researchers' provisions, this research generalises its subjects with specific qualities and characteristics. For example, it reveals the population of university students with self-control, cognitive bias, opportunistic behaviour, habits and addiction to online games. This study marks the general criteria for gamers in universities throughout Indonesia.

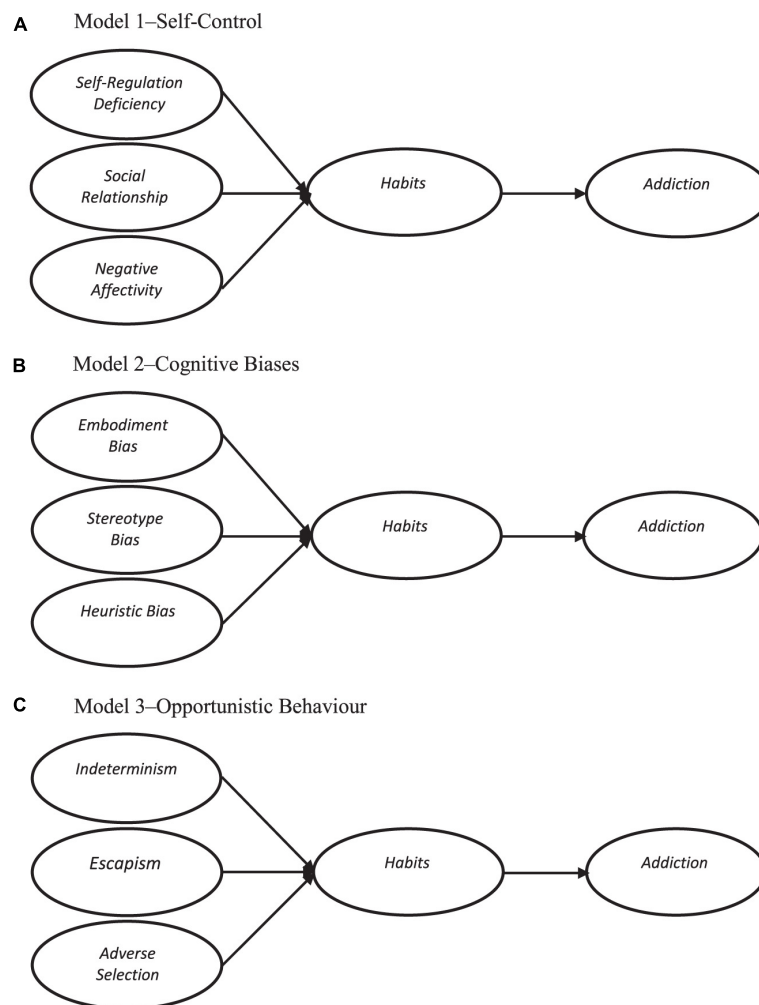


FIGURE 1
Three contested models. (A) Model 1-self-control, (B) model 2-cognitive biases, and (C) model 3-opportunistic behavior.

Likewise, this study purposively measures (1) university students, (2) habits in playing online games, which are marked by the number of hours, and (3) marking by participating in one or several online games. This study then distributed bilingual questionnaires to the respondents in Indonesian and English (Ebert et al., 2018). This survey was designed so that all the respondents would remain anonymous. The authors guaranteed to keep it confidential. This survey used Google Forms, and the researchers contacted each respondent directly.

Variable measurements

This study employs variables that some previous studies had used. In addition, it identified that some previous studies tested the face and content validities. On the other hand, this research first identifies respondents' academic stress separated into all the models' measurements. Then, the authors designed

it to determine if respondents were specifically under academic stress. Moreover, the design uses variable measurements with a five-point Likert scale. However, this study made minor modifications to the questionnaire's items to fit this research's content, as presented in Table 1.

Statistical tests

First, this study collected data from the respondents and then conducted validity and reliability testing. It examined convergent and discriminant validities for all variables using confirmatory factor analysis, including the reliability of each variable with Cronbach-Alpha. This study tested all the hypotheses using structural equation modelling (SEM) to identify the variables' relationship in the three research models. Evaluation of the level of data suitability with each model was carried out in three stages: the overall model fit, the

measurement model fit, and the structural model fit. The model would be feasible if it passed at least three statistical tests. Finally, this study conducted category tests to measure the Goodness of Fit Indices below. They were Chi-Square, CMIN/DF, Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), Adjusted Goodness of Fit Index (AGFI), Tucker-Lewis Index/Non-Normed Fit Index (TLI/NNFI), and Comparative Fit Index (CFI).

Statistical results

Descriptive statistics

This research collected inputs from 1,072 respondents, but only 864 (80.59%) were measured in academic stress and others in tendentious family stress. On the other hand, it collected respondents' academic stress using specific questions to recognise their existing stress and measure their levels. It also identified that all respondents were university students. Thus, it infers that university students tend to get stressed due to academic pressures or their leisure activities affecting their free time. Furthermore, this study divides these 864 students into low, medium and high levels of academic stress and presents the descriptive statistics in [Table 2](#) below. Then, the authors infer that the collected data indicate differences in the students' academic stress levels. Hence, students' academic stresses are not conditionally equal among these levels; this

heterogeneity could indicate the divergently causal factors for their habits and addiction to playing games. Thus, academic stress measurements are validly reflected in each construct.

The subsequent statistical tests analyse the collected data to determine reliability, convergent and discriminant validities with standard criteria produced by the simultaneous model in [Table 3](#) below. This study tests the validity and reliability of each model, meaning three separate tests for these three models. However, it presents these test results integrally in [Table 3](#). Then, the authors infer that variable measurements in each model show that these variables were highly reliable, convergent and discriminant. Moreover, this research obtained standard measurements after deleting item questions of SRD1, SR2, and SR4 in Model 1-Self Control. Moreover, it deleted SB2 and SB4 in Model 2-Cognitive Bias. The latest Ind.4 in Model 3-Opportunistic Behaviour. In addition, the authors deleted Add.8 and Hab.2 due to how they disturbed the optimal values of these convergent validities. Finally, the authors inferred that all statistical results have no vague reliability: Cronbach Alpha and Composite, and validities: convergent and discriminant measures. Hence, this research associates these variables that match the designed models.

Hypotheses results in each model

[Table 4](#) Column Model 1-Self-Control indicates the association between gamers' self-regulation deficiency and

TABLE 1 Variables definition.

Variables	Items	Operational definition
Self-regulation deficiency: Baumeister and Heatherton (1996) , Newman and Wallace (1993)	7	It is a person's failure and an inadequate state of assessing and adjusting his behaviour
Social relationship: Finkel and Fitzsimons (2011) , Gul and Pesendorfer (2001)	7	It reflects an individual's cooperation and coordination based on active and reciprocal social ties
Negative affectivity: Koch et al. (2013) , Tan and Forgas (2010)	7	It is characterised by low mood traits: anxiety, stress, restlessness, relaxation, and serenity
Embodiment bias: Greenberg et al. (1993) , Milgram et al. (2006)	8	It is composed of the problems faced by a person who naturally tends to be biased due to work overload
Stereotype bias: Bargh et al. (1996) , Milgram et al. (2006)	9	It is a mental state where a person maintains and reinforces the selection of information that contradicts pre-existing beliefs or attitudes
Heuristic bias: Stanovich et al. (2008) , Tversky and Kahneman (1974) , Toplak et al. (2011)	9	It is a mental path toward reducing the difficulty in carrying out tasks and achieving expected maximum outputs with simple actions
Indeterminism: Kožnjak (2018)	4	An individual decides to play online games, and their choice is based on his willingness without any outside influence
Escapism: Meier et al. (2018) , Panova and Lleras (2016)	4	An individual escapes from an activity and then repeats and makes other activities in a preferred behaviour pattern
Adverse selection: Alzahrani et al. (2017) , Becker (2007)	4	A person would get insufficient information to determine an individual's choice preferences, which become natural over time
Habits: Wood et al. (2002) , Lally et al. (2010)	7	An individual's experiential value is to construct normal behaviour with consistent engagement, not needing self-analysis
Addiction: Verplanken and Faes (1999) , Valverde (1988)	8	Addicted people, getting a mental disease, have the willpower to do something they choose, overriding other activities

habits with a beta estimation of 0.270, which is significant at 1%. This result means that hypothesis H1a is supported. The other results support hypotheses H1b (social relationship) and H1c (negative affectivity) at a 1% level. Finally, this statistical result supports hypothesis H4, which associates gamers' habits with addiction to playing games with the estimated coefficient of 0.908 (1%). Therefore, this study infers that gamers' self-control (i.e., self-regulation deficiency, social relationships, and negative affectivity) influences their game habits. Hence, the gamers' habits mediate the relationships between three self-control types and game addiction. Meanwhile, Column Model 2-Cognitive Biases indicates the association between gamers' embodiment and habits with a beta estimation of 0.294, significant at 1%. This result means that hypothesis H2a is supported. The other results support hypotheses H2b (stereotype bias) and H2c (heuristic bias) at 5 and 1% levels. Finally, this statistical result consistently supports hypothesis H4 with the estimated coefficient of 0.904 (1%). Therefore, this study infers that gamers' cognitive biases: embodiment, stereotype, and heuristic dimensions influence their habits in playing games. Hence, the gamers' habits re-intervene in the

relationships between three types of cognitive biases and their game addiction.

The latest results in Column Model 3-Opportunistic behaviour indicate the association between gamers' indeterminism and habits with a beta estimation of 0.662, significant at 1%. This result means that hypothesis H3a is supported. The other results support hypotheses H3b (escapism) at a 10% level. This result supports hypothesis H3c (adverse selection) at the 1% level. However, this statistical result consistently reinforces hypothesis H4 with the estimated coefficient of 0.949 (1%). Therefore, this study infers that gamers' opportunistic behaviours, such as indeterminism, escapism, and adverse selection, influence their habits of being addicted to playing games. Hence, the gamers' habits re-intervene the relationships between three types of opportunistic biases and game addiction.

This study takes note of the statistical results for the nomological validity of these models. It fulfils all the criteria that exhibit mediocre goodness-of-fits. The statistical results show that the CMIN/DF for all models are statistically

TABLE 2 Descriptive statistics.

Academic stress	Min.	Max.	Mean	Median	Std. dev.
Panel A: Academic stress identification					
Low	1	3	2.62	2.67	0.412
Medium	3	4	3.52	3.50	0.185
High	4	5	4.35	4.17	0.253
Mean comparisons	Differences		t-Value(Sig.)		
Low-Medium	-0.907		-25.775***		
Medium-High	-0.668		-19.400***		
Low-High	-1.630		-35.485***		
Variables	Min.	Max.	Mean	Median	Std. dev.
Panel B: Statistic descriptive					
Model-1:					
SRD (Self-regulation deficiency)	1.000	5.000	3.19	3.50	0.657
SR (Social relationships)	1.000	5.000	3.26	3.33	0.685
NA (Negative affectivity)	1.143	4.571	3.10	3.29	0.623
Model-2:					
EB (Embodiment bias)	1.000	4.857	3.19	3.43	0.629
SB (Stereotype bias)	1.000	4.857	3.17	3.43	0.749
HB (Heuristic bias)	1.111	4.889	3.19	3.44	0.720
Model-3:					
Ind. (Indeterminism)	1.000	5.000	3.07	3.33	0.796
Esc. (Escapism)	1.000	5.000	3.21	3.25	0.650
AS (Adverse selection)	1.000	5.000	3.38	3.50	0.609
Hab. (Habits)	1.000	4.833	3.17	3.33	0.686
Add. (Addiction)	1.000	5.000	3.11	3.43	0.707

$n = 864$; ***(1%), **(5%), *(10%).

TABLE 3 Validity and reliability test results.

Variables	Item	Factor loading	AVE	Corrected item total correlation	Cronbach's alpha	Composite reliability
SRD (Self-regulation deficiency)	SRD2	0.608	0.493	0.452	0.793	0.852
	SRD3	0.738		0.585		
	SRD4	0.753		0.601		
	SRD5	0.692		0.535		
	SRD6	0.636		0.477		
	SRD7	0.770		0.621		
	SR (Social relationships)	SR1		0.722		
SR3		0.848	0.549			
SR5		0.674	0.442			
NA (Negative affectivity)	NA1	0.706	0.444	0.557	0.791	0.846
	NA2	0.732		0.590		
	NA3	0.591		0.446		
	NA4	0.610		0.462		
	NA5	0.599		0.449		
	NA6	0.679		0.533		
	NA7	0.733		0.589		
EB (Embodiment bias)	EB2	0.602	0.452	0.458	0.794	0.850
	EB3	0.742		0.603		
	EB4	0.750		0.609		
	EB5	0.667		0.514		
	EB6	0.633		0.485		
	EB7	0.753		0.607		
	EB8	0.525		0.489		
SB (Stereotype bias)	SB1	0.672	0.534	0.553	0.854	0.888
	SB3	0.656		0.536		
	SB5	0.789		0.686		
	SB6	0.634		0.510		
	SB7	0.758		0.649		
	SB8	0.817		0.719		
	SB9	0.769		0.661		
HB (Heuristic bias)	HB1	0.654	0.486	0.558	0.866	0.893
	HB2	0.625		0.520		
	HB3	0.739		0.652		
	HB4	0.727		0.638		
	HB5	0.769		0.677		
	HB6	0.704		0.609		
	HB7	0.678		0.583		
	HB8	0.684		0.579		
	HB9	0.681		0.577		
Ind. (Indeterminism)	Ind.1	0.615	0.615	0.434	0.685	0.823
	Ind.2	0.832		0.551		
	Ind.3	0.880		0.641		
Esc. (Escapism)	Esc.1	0.639	0.493	0.479	0.654	0.791
	Esc.2	0.593		0.443		
	Esc.3	0.787		0.522		
	Esc.4	0.771		0.500		
AS (Adverse selection)	AS1	0.599	0.458	0.425	0.602	0.769
	AS2	0.751		0.459		

(Continued)

TABLE 3 (Continued)

Variables	Item	Factor loading	AVE	Corrected item total correlation	Cronbach's alpha	Composite reliability
Hab. (Habits)	AS3	0.704	0.471	0.405	0.773	0.893
	AS4	0.644		0.447		
	Hab.1	0.651		0.488		
	Hab.3	0.598		0.433		
	Hab.4	0.658		0.492		
	Hab.5	0.732		0.572		
	Hab.6	0.727		0.560		
Add. (Addiction)	Hab.7	0.737	0.570			
	Add.1	0.612	0.483	0.831	0.872	
	Add.2	0.700	0.570			
	Add.3	0.683	0.556			
	Add.4	0.774	0.659			
	Add.5	0.644	0.513			
	Add.6	0.762	0.641			
Add.7	0.744	0.620				

n: 864 participants.

TABLE 4 Hypotheses results in each model.

	Model 1-self-control		Model 2-cognitive biases		Model 3-opportunistic behaviour	
	Est.	CR(sig.)	Est.	CR(sig.)	Est.	CR(sig.)
SRD→Hab. (H1a:+)	0.270	2.388***				
SR→Hab. (H1b:+)	0.122	3.441***				
NA→Hab. (H1c:+)	0.262	3.260***				
Hab.→Add. (H4:+)	0.908	10.018***				
EB→Hab. (H2a:+)			0.294	6.663***		
SB→Hab. (H2b:+)			0.203	2.409**		
HB→Hab. (H2c:+)			0.234	2.788***		
Hab.→Add. (H4:+)			0.904	10.901***		
Ind.→Hab. (H3a:+)					0.622	3.554***
Esc.→Hab. (H3b:+)					0.279	1.916*
AS→Hab. (H3c:+)					0.166	2.993***
Hab.→Add. (H4:+)					0.949	9.551***
CMIN/DF		5.752***		5.749***		7.246***
GFI		0.836		0.787		0.823
RMSEA		0.074		0.074		0.085
CFI		0.818		0.810		0.802
TLI		0.800		0.796		0.777
AGFI		0.807		0.758		0.783
PCFI		0.745		0.755		0.712

n = 864; ***(1%), **(5%), *(10%). SRD: self-regulation deficiency; SR: social relationship; NA: negative affectivity; EB: embodiment bias; SB: stereotype bias; HB: heuristic bias; Ind.: indeterminism; Esc.: escapism; AS: adverse selection; Hab.: habits; Add.: addiction.

significant at 1%. However, the authors consider that goodness-of-fit has several criteria, which could be excellent, acceptable, and bad. Thus, all the research models were at an unprecedented goodness-of-fit level. For example, the GFI in the Models 1, 2, and 3 indicated an acceptable score of 0.836, 0.787, and 0.823, respectively. In addition, the

RMSEA, CFI, TLI, ACFI and PCFI scores are also acceptable goodness-of-fit levels. In other words, the research model meets the marginal standard scores for the goodness of fit at acceptable levels. However, the authors still believe that this study's models achieve nomological validity for all tested models.

Findings and consequences

This study finds that three contested models of student game addiction are good constructive designs. Initially, it explains that students become addicted to playing games after considering academic stress. Thus, it infers that students' self-control (LaRose et al., 2003; Tokunaga, 2015; Gong et al., 2019), cognitive biases (Li and Wang, 2013; Çelik and Odacı, 2013; King and Delfabbro, 2014) and opportunistic behaviours (Lemmens et al., 2009; Weinstein, 2010; Wölfling et al., 2019), including detailed dimensions, explain their game playing addiction. The first perspective is students' self-control, namely self-regulation deficiency, social relationships, and negative affectivity, affecting their game addiction. Furthermore, the second perspective of students' cognitive distortions, such as embodiment, stereotype and heuristic biases, develop their habits of playing the game by ignoring academic tasks. Finally, students with the attributes of opportunistic behaviours, namely indeterminism, escapism and adverse selection, search for other chances to play the games and enjoy their addiction.

This study shows that students with self-regulation deficiency, social networks, and negative affectivity develop their habits with low self-control (Goldiamond, 1965; Newman and Wallace, 1993; Gong et al., 2019), which affects game addiction. Moreover, it demonstrates that poor self-control within self-regulation deficiency means individuals quickly become addicted to online games. Thus, this study explains that students play online games due to low awareness, ignorance of their duties, and neglect of their responsibilities to engage in serious study. However, on the other hand, these students usually have high social networks (Gul and Pesendorfer, 2001; Finkel and Fitzsimons, 2011) to maintain their continuing game playing. Furthermore, they increase their social relationships because of continuous gaming competitions and tournament challenges. Thus, this study concludes that high social relationships complement their poor self-regulation deficiency, making them play games habitually. Finally, this research demonstrates that students' negative affectivity that does not seriously enhance their academic performance explains their decreased self-control (Tan and Forgas, 2010; Koch et al., 2013). In other words, students' negative affectivity weakens their academic focus, which is replaced by habitual game playing.

This research finds that students become less rational (Barnes, 1984; Simon et al., 2000) with cognitive biases regarding the embodiment, stereotype, and adverse selection in online games (Winkielman et al., 2015; Beukeboom et al., 2019). These students embody experiential values changing their habitual cognition due to environmental and social influences supported by a lenient academic load (Bargh et al., 1996; Milgram et al., 2006). Simultaneously, they lead their daily lives within stereotype biases to accommodate their academic duties and responsibilities and pursue enjoyment from their addiction. On the other hand, they played the online game starting

as a weak player, which encouraged them to be heuristic to win future tournaments. Finally, they are conditionalised in their increasing cognitive biases (Tversky and Kahneman, 1974; Stanovich et al., 2008; Toplak et al., 2011). Accordingly, their mental biases regarding game addiction reduce their academic stress and replace them with playing the game, likely producing optimal outputs.

The authors find that university students suffer inference cognition through opportunistic behaviours comprising indeterminism, escapism and adverse selection. Then, this study explains students' addiction to online games due to their opportunism to avoid academic stress while being indifferent to getting an optimal outcome compared to others (Khushalani et al., 1994; Rowe and O'Brien, 2002). On the other hand, students probably get lenient learning systems and have many opportunities to engage in different activities (Becker, 2007; Alzahrani et al., 2017), such as playing online games. Consequently, these students believe they can still perform their academic duties while playing games. Therefore, the authors demonstrate that these students enjoy their spare time playing the game as an opportunistic habit (Panova and Lleras, 2016; Meier et al., 2018) and further engage in more indeterminism, escapism and adverse selection. Moreover, the authors also show that these students incrementally ignore their studies to play online games.

This research results imply that students' game addictions are multi-constructs and multi-dimensions, affecting specific counselling guidance. Therefore, this study argues that academic counsellors should hold healing and wellness programmes for students addicted to games while bearing in mind causal factors such as self-control, cognitive biases or opportunistic behaviours. Moreover, it explains that counsellors should separate each factor into sub-dimensional traits of self-regulation deficiency, social relationships, negative affectivity (LaRose et al., 2003; Tokunaga, 2015; Gong et al., 2019), embodiment, stereotype, heuristic biases (Li and Wang, 2013; Çelik and Odacı, 2013; King and Delfabbro, 2014), indeterminism, escapism, and adverse selection (Lemmens et al., 2009; Weinstein, 2010; Wölfling et al., 2019). Furthermore, the authors argue that each sub-dimensioned causal factor suggests there should be a specific treatment for these students' addiction to games. For example, students with poor self-regulation deficiency could be given therapy involving rigorous discipline, task readiness, improved commitment, etc. These therapies support shifting the students' behaviours to an academic focus. Meanwhile, students with indeterminism bias could be occupied with candid academic responsibilities, such as principled morality, extra-curricular related to scientific knowledge, etc. Finally, this study argues that students' cognitive and occupational therapies should be relevant to each construct, dimension and trait related to the psychological factors that affect game addictions.

The second implication is the need for revitalised academic loads. The authors explain that an academic load of three-course credits consumes two and a half hours within the classroom learning system. On the other hand, these students should be required to complete their self-study at home, consuming 2 h. Thus, a course with three credits should add up to 4.5 h. In sum, this study calculates that if these students take eight courses, each with three credits, they will have spent 40 h, which fulfils the 40 h per week standard (in Indonesia). Moreover, it recommends that these students could use the four remaining hours for their extra-curricular activities. Finally, this study demonstrates that these university students should not experience the problematic chaos of self-control (Goldiamond, 1965; Goldfried and Merbaum, 1973; Muraven, 2010), cognitive distortions (Tversky and Kahneman, 1974; Stanovich et al., 2008; Toplak et al., 2011), and opportunistic behaviours (Becker, 2007; Alzahrani et al., 2017), affecting their habits and addictions to playing games. In addition, these students would not have fallen into bad habits and become addicted to playing the games if these universities strictly applied academic regulations.

Conclusion and future research

This study concludes that students' self-control, cognitive distortion, and opportunistic behaviours explain their habits and addiction to playing games. It emphasises that the extant research focusing on self-control can be comprehended with other constructs of students' cognitive biases and opportunistic behaviours. Furthermore, it confirms that three contested models in this study explain students' game addictions. Moreover, this research re-accentuates that each dimensioned causal factor became its focus on detailed explanations. In other words, it demonstrates that each detailed dimension recommends the specific mitigation to evacuate students' addiction to games. Hence, the authors argue that academic counsellors should have specific cognitive and occupational therapies for the causal factors of students' game addictions. However, the authors emphasise that all causal factors of self-control, cognitive biases, and opportunistic behaviours have combined integratively that further affect students' game addictions.

This study was designed with limitations. Its first limitation is that it did not consider students' personalities. Meanwhile, students' addictions to playing the games depended on their personalities, such as transform- and confront-proactive personalities. Thus, this study opens up the possibility of future research which induces proactive personalities into its models. Furthermore, future studies could recommend that proactive personalities influence students' game addictions and further elaborate mitigation. The second limitation is that this research did not accommodate students' emotional states. However, this study highlights that students' emotional state affects their habits and game addictions due to cognitive

maturity styles. Thus, future studies could factor students' emotional characteristics into the research models to explain the dominant determinants of their cognitive biases and opportunistic behaviours. Moreover, future studies would be better designed if the emotional characteristics were treated as experimental approaches.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study involving human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants in accordance with the national legislation and the institutional requirements.

Author contributions

SS: research design and writing. IP: administrative task, data collection, and drafting. CH and EU: data collection and statistical analysis. MS: data collection, drafting, and writing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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