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ORIGINAL ARTICLE

ASSOCIATION BETWEEN ONLINE GAME ADDICTION AND SELF-REPORTED COGNITIVE FUNCTIONING AMONG SCHOOL-AGE CHILDREN IN INDONESIA

Yanuar Fahrizal[1]*, Wardah Hafizh[2], Neil Madulara Martin[3]

1. Psychiatric and Mental Health Nursing Department, School of Nursing, Faculty of Medicine and Health Science, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
2. School of Nursing, Faculty of Medicine and Health Science, Universitas Muhammadiyah Yogyakarta, Indonesia
3. MSU-IIT College of Nursing, Iligan City, Lanao del Norte 9200, Philippines

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***Corresponding Author**
Yanuar Fahrizal
yanuarfahrizal@umy.ac.id

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ABSTRACT

Problematic online gaming may be associated with perceived cognitive difficulties among school-age children, but evidence from Indonesia remains limited. To examine the association between online game addiction and self-reported cognitive functioning among school-age children. This cross-sectional study included 254 students in grades 4–6 from six private elementary schools in Godean and Sleman, Yogyakarta, Indonesia. Online game addiction and cognitive functioning were measured using the Video Game Addiction Test and the Cognitive Functioning Self-Assessment Scale, respectively. Data were analyzed using descriptive statistics, bivariate correlation, and simple linear regression. The mean online game addiction score was 26.57 ± 6.37, and the mean cognitive functioning score was 39.28 ± 10.36. Online game addiction was positively correlated with cognitive functioning scores ($r = .476$, $p < .001$) and explained 22.7% of their variance ($R^2 = .227$; $B = 0.774$; $SE = 0.090$; $\beta = .476$; $t = 8.594$; $p < .001$). Because higher cognitive functioning scores indicate greater perceived difficulties, greater online game addiction was associated with poorer self-reported cognitive functioning. Online game addiction was moderately associated with self-reported cognitive difficulties. Longitudinal studies with objective cognitive assessments are needed to clarify temporal and causal relationships.

Keywords: *Cognitive functioning; online game addiction; school-age children*

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BACKGROUND

Digital devices, including smartphones, tablets, and computers, have become increasingly integrated into children's daily lives. These devices are used not only for communication and learning activities but also for entertainment, such as offline and online games. In this study, the term "gadget" refers to portable digital devices that enable children to access internet-based applications and online games. The rapid advancement of digital technology has made these devices more accessible and attractive to children due to their interactive, visual, and diverse features (Mahr et al., 2023; Sunita & Mayasari, 2018).

Online gaming is one of the most common digital activities among school-age children. In this study, school-age refer to elementary students aged 10 to 12 years, specifically those in grades 4 through 6. Although online games can provide entertainment and opportunities for social interaction, excessive or poorly controlled gaming may become problematic when it interferes with daily routines, learning activities, emotional regulation, and social functioning. Online game is characterized by a pattern of gaming behavior marked by salience, tolerance, mood modification, relapse, withdrawal, conflict, and impairments in daily functioning (Torres-Rodríguez et al., 2018).

Previous studies have suggested that high involvement in online gaming among school-age children may be associated with learning and cognitive difficulties. Guno (2018)reported problematic online gaming behavior in this demographic, while Farchakh et al (2020) found that video game addiction was associated with impairments in memory, attention, and learning skills among children. In the Indonesian context, the

increasing use of gadgets by children have raised concerns about parental supervision and the impact on children's daily activities (Sunita & Mayasari, 2018). More broadly, parenting practices and peer support represent important social contexts in child and adolescent development. Indonesian evidence indicates that democratic parenting and peer support are associated with developmental outcomes involving self-concept, religiosity, and moral literacy among adolescents (Masitah et al., 2024)
In addition, data from national child protection and internet-usage reports indicate that many children are exposed to digital devices and online activities; however, the interpretation of these figures requires careful consideration of factors such as age range, population, and measurement method (Harjono, 2019; KPAI, 2020).

Cognitive functioning is a essential aspect of children's learning and development. It encompasses processes such as attention, memory, concentration, information processing, and problem-solving. Difficulties in these areas may affect children's ability to participate effectively in school activities. Within the school context, teachers are expected to recognize students' learning needs and psychosocial characteristics; however, implementing student assessments and providing individualized learning support can be challenging in practice (Zulaiha et al., 2023). Therefore, identifying factors associated with children's perceived cognitive difficulties is essential for school-based health promotion and early preventive efforts.

Although several studies have examined online gaming behavior among children, evidence regarding its association with cognitive functioning among elementary school students in local Indonesian school settings remains limited. Importantly, because this study employed a cross-sectional design, it does not aim to determine the causal impact of online game addiction on cognitive ability. Instead, the study aimed to investigate the association between online game addiction and self-reported cognitive functioning among school-age children in Yogyakarta, Indonesia.

METHOD

Study design

This study employed a cross-sectional design to examine the association between video game addiction and cognitive functioning in elementary school students. Data were collected at a single point in time without any intervention.

Sample

The sample calculation is based on the Lameshow formula for a limited population. The calculations give us a sample of 254 people participating in this study from the population of 750 with a confidence level of 95%, a proportion of 50% and a margin of error of 5%. The sample comprosed 254 students from grades 4 to 6 attending six private elementary schools in the Godean and Sleman Districts of the Yogyakarta Special Region, Indonesia. Participants were eligible if they were active students, aged 10 to12 years, had experience using electronic devices, and reported playing online games. Students were excluded if they were absent during data collection, declined to participate, lacked parental or guardian consent, or were unable to complete the questionnaire with age-appropriate assistance.

Schools were selected based on accessibility, permission from school authorities, and the presence of students who met the study criteria. Eligible students were screened through self-reported online gaming experience. Written informed consent was obtained from parents or guardians, and assent was obtained from the students prior to participation.

Instrument

Two instruments were used: the Video Game Addiction Test (VGAT) and the Cognitive Functioning Self-Assessment (CFSS). Online game addiction was measured using the Indonesian version of the VGAT. The Indonesian validation study reported that the instrument consists of 14 items with a one-factor structure and good internal consistency, with a Cronbach's alpha of .846. Higher scores indicate greater levels of video game addiction symptoms. In the present study, internal consistency was recalculated and confirmed with a Cronbach's alpha of 0.846 (Lintang et al., 2021). Self-reported cognitive functioning was measured using theCFSS, which was originally developed to assess perceived cognitive functioning in non-neurological settings and includes cognitive domains such as memory, attention, and orientation. Recent psychometric evaluations have reported satisfactory reliability in adult community samples; however, the instrument was not originally developed specifically for Indonesian children aged 10–12 years.

Therefore, in this study, CFSS scores were interpreted as self-reported cognitive difficulties rather than objective cognitive measures of ability. To support children's comprehension, the questionnaire was administered with standardized instructions, and trained researchers provided clarification when needed without influencing participants' responses. The internal consistency of the CFSS in the present sample was high, with a Cronbach's alpha of 0.878 (Annunziata et al., 2016).

Data collection

Data were collected in classrooms during school hours after obtaining permission was obtained from school authorities. Students completed questionnaires in a supervised setting. Trained researchers explained the purpose of the study, provided standardized instructions, and emphasized that there were no right or wrong answers. To minimize social desirability bias, teachers were not involved in reviewing students' responses. Students completed the questionnaires privately, and researchers provided neutral clarification when students had difficulty understanding any item. Completed questionnaires were checked for completeness immediately after submission.

Data analysis

Data were analyzed using descriptive statistics, including means, standard deviations, frequencies, and percentages. Prior to inferential analysis, the distribution of variables, linearity, scatterplots, homoscedasticity, and outliers were examined. Pearson correlation was employed when the assumptions of linearity and approximate normality were satisfied. If the data were not normally distributed, Spearman's rank correlation was used instead. Simple linear regression was conducted to examine the extent to which online game addiction scores were associated with self-reported cognitive functioning scores. Statistical significance was set at $p < .05$, and results were reported using standard statistical notation, including r, R^2, β, and $p < .001$ where appropriate.

Ethical consideration

This study was approved by the FKIK UMY Health Research Ethics Committee under case number 302/EC-KEPK FKIK UMY/XII/2023. Informed consent was obtained from all participants, and their confidentiality was strictly.

RESULT

A total of 254 students participated in this study. The sample include 139 female students and 115 male students. Participants were aged 10 years (n = 81), 11 years (n = 107), and 12 years (n = 66). Regarding grade level, 76 students were in grade 4, 104 in grade 5, and 74 in grade 6. Most participants reported playing online games for less than three hours per day (n = 200), while 54 students reported playing online games for more than three hours daily.

The mean online game addiction score was 26.57 ± 6.37. The mean self-reported cognitive functioning score was 39.28 ± 10.36. Higher CFSS scores indicate greater perceived cognitive difficulties; therefore, a higher score reflects more self-reported problems in daily cognitive functioning.

Table 1. Online Game Addiction Scores by Participant Characteristics (n=254)

Data Demografi	Mean	Std. Deviation	N
Online Game Addiction	26.57	6.368	254
Woman	24.95	5.857	139
Man	28.52	6.435	115
Age 10 years old	27.00	6.301	81
Age 11 years old	26.36	6.707	107
Age 12 years old	26.36	5.937	66
4th grade	27.09	6.214	76
5 th grade	26.07	6.676	104
6 th grade	26.73	6.107	74
less than 3 hours of online gaming	24.78	5.451	200
more than 3 hours of online gaming	33.20	5.000	54

Table 2. Self-Reported Cognitive Functioning Scores by Participant Characteristics (n=254)

Data Demografi	Mean	Std. Deviation	N
Cognitive Function	39.28	10.358	254
Woman	38.02	10.624	139
Man	40.79	9.861	115
Age 10 years old	38.88	10.058	81
Age 11 years old	39.55	11.198	107
Age 12 years old	39.32	9.394	66
4th grade	39.91	10.131	76
5 th grade	37.70	10.737	104
6 th grade	40.84	9.863	74
less than 3 hours of online gaming	37.87	9.889	200
more than 3 hours of online gaming	44.50	10.471	54

Table 3. Bivariate Correlation Between Online Game Addiction Score and Self-Reported Cognitive Functioning

Variables	n	r	95% CI for r	p
Online game addiction and self-reported cognitive functioning	254	.476	[.375, .566]	< .001

Table 4. Simple Linear Regression Analysis Predicting Self-Reported Cognitive Functioning

Predictor	B	SE	95% CI for B	β	t	p
Online game addiction score	0.774	0.090	[0.597, 0.951]	.476	8.594	< .001

Online game addiction scores were moderately and positively associated with self-reported cognitive functioning scores, r = .476, p < .001. A simple linear regression analysis revealed that online game addiction significantly predicted self-reported cognitive functioning scores, B = 0.774, SE = 0.090, β = .476, t = 8.594, p < .001. The model accounted for 22.7% of the variance in self-reported cognitive functioning scores, R^2 = .227. Since higher cognitive functioning scores indicate greater perceived cognitive difficulties, these findings suggest that higher online game addiction scores are associated with increased self-reported cognitive difficulties.

DISCUSSION

In this study, male students exhibited higher mean scores for online game addiction and self-reported cognitive difficulties than female students, with mean scores of 28.52 and 40.79, respectively. However, these findings should be interpreted solely as descriptive patterns, as this study did not perform inferential subgroup analyses to test for sex-based differences. Therefore, the current data are insufficient to conclude that male and female students differ significantly in online game addiction or cognitive functioning. Previous literature has suggested that boys may be more interested in challenging, competitive, or aggressive online games, such as fighting and adventure games (Kristiawan & Yunanto, 2021). Nevertheless, this study did not assess game genre, gaming motivation, or other psychosocial factors that might explain this descriptive pattern.

Several previous studies have explored potential neurocognitive and behavioral mechanisms related to gaming behavior, including self-control, decision-making, impulsivity, attention, working memory, and executive functioning (Alizadeh Mansouri et al., 2024; Hertrich et al., 2021; Mathews et al., 2022). Additionally, other research has reported sex-related differences in brain connectivity, hormonal profiles, and cerebral blood flow that may influence cognitive development and behavioral regulation (Gur & Gur, 2017). However, these mechanisms were not directly

examined in the present study. Therefore, they should be regarded only as possible theoretical explanations derived from previous literature, rather than as direct evidence from our data. Future research should incorporate appropriate statistical testing, game-related variables, psychosocial factors, and, when relevant, objective cognitive or neuropsychological measures to better understand whether sex-related differences exist in the association between online game addiction and cognitive functioning among school-age children.

Children aged 10 years had the highest mean online game addiction score, with a mean score of 27.00. Similar to the sex-based findings, this result should be interpreted as a descriptive trend only, as no inferential statistical tests were conducted to compare online game addiction scores across age groups. Therefore, this study cannot conclude that younger children have significantly higher online game addiction levels than older children. Previous studies suggest that children may be attracted to online games because digital technology offers interactive visual features that are enjoyable and engaging during developmental periods (Wiguna et al., 2020). In addition, self-control and emotional regulation are still developing during childhood (Sangsuk & Thipchart, 2023), which may influence how children manage enjoyable activities such as online gaming (Habibuddin et al., 2022; Hawi et al., 2019). Children's gaming behavior does not occur in isolation but develops within a broader psychological and social environment. Previous research involving Indonesian adolescents has shown that behavioral problems may be shaped by a combination of psychological and environmental factors (Musslifah et al., 2024). Although these factors were not assessed in the present study, they may help explain why children with similar gaming habits experience different levels of perceived cognitive difficulty. However, these explanations should be interpreted cautiously, because this study did not directly measure self-control, emotional regulation, motivation to learn, or environmental influences.

The relationship between longer gaming durations and perceived cognitive difficulties may be linked to behavioral regulation and daily routines. Children exhibiting excessive gaming behavior may reduce their sleep or rest time to continue playing games (Assagaf et al., 2020). Tolerance is also a characteristics of gaming addiction, where players progressively spend increasing amounts of time gaming (Chi & Hsiao, 2025). Previous literatures have also explored reward-related mechanisms, including dopamine responses and orbitofrontal cortex involvement, in relation to intensive gaming behavior (van Rooij et al., 2017). Nevertheless, the present study did not measure dopamine activity, brain structure, sleep duration, or objective neurocognitive performance.

This finding can be understood through behavioral and cognitive mechanisms discussed in previous literature. Problematic online gaming has been associated with higher impulsivity, impaired response inhibition, difficulties in emotional regulation, reduced cognitive control, and deficits in working memory and decision-making abilities (Kuss et al., 2018). Additionally, challenges in selecting appropriate strategies for receiving and processing information may contribute to errors in information processing and learning-related activities (Adriani, 2020). However, the present study did not directly measure impulsivity, executive function, response inhibition, or objective cognitive performance. Therefore, these mechanisms should be considered as possible explanations based on prior research rather than direct evidence from the current data.

These findings should be interpreted according to the study design. The study was cross-sectional, measuring online gaming addiction and self-reported cognitive performance at the same time, so it cannot tell us which came first or whether one caused the other. The questionnaires were useful in exploring the children's experiences, but the children's understanding, memory or ways of responding may have affected their answers. The sample was limited to six private elementary schools in two districts of Special Region of Yogyakarta; thus, the results may not be representative of children in public schools or in different social and cultural contexts. Other factors, such as sleep, total screen time, parental supervision, mental health and existing learning difficulties, were not included in the analysis. Future longitudinal studies that include diverse school demographics and combine subjective impressions with objective cognitive assessment may provide a more complete picture of the association between internet gaming and children's cognitive skills.

CONCLUSION AND RECOMMENDATIONS

The findings of this study indicate that online game addiction is moderately associated with increased self-reported cognitive difficulties among school-age children. However, because the study employed a cross-sectional design, theses findings do not establish causality. Schools, parents, and health professionals should encourage balanced gaming habits, monitor excessive gaming behavior, and promote routines that protect sleep, learning, and psychosocial well-being. Future research should utilize longitudinal designs and objective cognitive assessments to validate these results.

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