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ORIGINAL ARTICLE

Problematic Gaming and Students' Academic Performance: A Systematic Review

Alanood Khalid D Alzahrani[1] · **Mark D. Griffiths**[1]

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Abstract

Introduction Research indicates that videogames can have many benefits. However, gaming can be problematic for some individuals. Consequently, over the past two decades, researchers have actively studied the risk factors and consequences of problematic gaming and gaming disorder which may affect many aspects of individuals' lives, including their academic performance.

Method The present study is the first ever systematic review of studies examining the relationship between problematic gaming and student academic performance utilising the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. A total of 27 empirical studies met the inclusion criteria and were eligible for review.

Results Most of the studies ($n = 24$) reported a negative relationship between problematic gaming and academic performance. Moreover, older studies (conducted before 2015) suggest that problematic gaming was a significant factor in predicting poor academic performance. However, most of the recent studies have found the opposite, showing that problematic gaming is not a significant predictor for academic performance and/or that academic performance is a significant factor in predicting problematic gaming. Overall, the findings suggest that poor academic performance is more likely to be a cause for problematic gaming rather than a consequence based on more recent studies.

Conclusion Although most of the reviewed studies showed a negative relationship between problematic gaming and academic performance, research is still limited in this area because most the reviewed studies had a cross-sectional design that are unable to establish the direction of the effect. Therefore, more studies with methodological approaches that can determine the causality between problematic gaming and poor academic performance are needed.

Keywords Problematic Gaming · Gaming Disorder · Video Games · Academic Performance · Academic Achievement · Students

✉ Mark D. Griffiths
mark.griffiths@ntu.ac.uk

[1] International Gaming Research Unit Psychology Department, Nottingham Trent University, 50 Shakespeare Street, Nottingham NG1 4FQ, UK

The rise of digital technology has revolutionised various aspects of human life, including the way individuals engage in leisure activities. Among these activities, gaming has become an increasingly popular form of entertainment worldwide, capturing the attention of millions of individuals across different age groups (Gilbert, 2023). Recent statistics indicate that the number of active gamers worldwide has reached an estimated 2.7 billion, representing approximately 34% of the global population (Statista, 2023). This widespread use of videogames highlights their mainstream appeal across diverse demographics and regions. Amid the increasing number of gamers, questions have been raised about the impact of gaming on individuals' lives and futures.

A growing number of studies have shown that gaming can offer a wide range of benefits (Cai et al., 2022; Bavelier & Green, 2019). Videogames have been effectively applied in educational settings to provide supplemental learning experiences in which students can reinforce subjects such as mathematics and science (Hussein et al., 2019, 2022). In addition, gaming can enhance many cognitive abilities, including attention, critical thinking, problem-solving and decision-making (Nuyens et al., 2019; Reynaldo et al., 2021). Videogames require players to sustain their attention, analyse situations, and devise strategies to complete tasks successfully and progress through different levels (Bavelier & Green, 2019). These cognitive skills can be transferred to real-life scenarios (Reynaldo et al., 2021). Furthermore, research has shown that gaming can help in stress reduction by providing means to escape from and cope with real-life challenges (Melodia et al., 2021; Villani et al., 2018). Therefore, individuals who experience stressors or difficulties may use videogames as a stress-relief mechanism in order to improve their well-being.

Although gaming can be beneficial, research has also found that videogames can be harmful if used excessively. A cross-cultural study of 145,953 students from 26 countries concluded that excessive gaming may hinder academic success, but that moderate gaming can enhance students' academic level (Borgonovi, 2016). Furthermore, a meta-analysis conducted by Ferguson (2015) to examine the effects of videogame exposure showed that excessive gaming can lead to lower academic grades. Unlike moderate gaming, excessive and problematic gaming can lead to many issues, including reduced cognitive abilities (Nuyens et al., 2017), vision problems (Mylona et al., 2020), musculoskeletal pain (Kumar et al., 2023), sleep disturbances (Alimoradi et al., 2019; Lam, 2014), and poor nutrition (Ayenigbara, 2018).

Although some researchers have used the terms 'excessive gaming' and 'problematic gaming' synonymously, they are different concepts that may lead to different outcomes (Griffiths, 2010). Excessive gaming usually refers to spending a significant amount of time playing videogames (Borgonovi, 2016; Osuagwu, 2015) but may not lead to any problems (Griffiths, 2010). Problematic gaming, sometimes referred to as gaming addiction or gaming disorder, was defined by the World Health Organization (WHO) as an uncontrollable and persistent gaming behaviour leading to a significant impairment in personal, social, occupational or other important areas of functioning (World Health Organisation, 2020). Problematic gaming has been conceptualised in the behavioural addiction context (Dowling, 2014; Pontes et al., 2014). According to Griffiths (2005), behavioural addictions (e.g., addictions to gambling, gaming, shopping, etc.) share six particular characteristics: salience where the behaviour becomes dominant in an individual's feeling, thought and conduct; mood modification where the behaviour is used as a coping mechanism to escape from negative emotions to positive feelings and pleasure; tolerance where an individual needs an increased time or intensity to achieve the desired level of satisfaction; withdrawal symptoms where discontinuing the behaviour results in unpleasant feelings and/or physical effects, including restlessness, irritability or emotional distress; conflict where

the behaviour causes conflicts in areas of relationships, occupation and/or education; and relapse where after interrupting the behaviour for a period, there is a tendency to return to the previous behavioural pattern.

Some researchers believe that problematic internet-related behaviours (e.g., gaming, shopping) should be considered behavioural addictions (Brand et al., 2016; Weinstein et al., 2017), while others have argued that these common behaviours should not be over-pathologised (Kardefelt-Winther et al., 2017). Problematic internet gaming is currently considered a potential disorder, included in Section III ("Emerging Measures and Models") of the *Diagnostic and Statistical Manual of Mental Disorders* fifth edition (DSM-5; American Psychiatric Association, 2013) and termed internet gaming disorder (IGD). To be diagnosed with IGD, an individual must exhibit at least five out of nine criteria for a 12-month period or more. The nine IGD diagnostic criteria include: (i) preoccupation with internet gaming; (ii) constant need to increase gaming time to achieve satisfaction; (iii) unsuccessful attempts to control or reduce gaming; (iv) withdrawal symptoms (e.g., sadness, irritability) emerge when gaming is discontinued or reduced; (v) gaming becomes the primary activity, often displacing other interests and responsibilities; (vi) continued gaming despite being aware of the negative consequences; (vii) deception regarding the extent of gaming time and its impact; (viii) using gaming as a mean of escape or relief from negative emotions (e.g., anxiety, guilt, despair); and (ix) jeopardising or losing significant relationships, opportunities, education or career due to gaming.

One of the concerns associated with problematic gaming is its impact on students' academic performance. Academic performance refers to the overall achievement demonstrated by students in their educational pursuits at any stage of learning, from primary to higher education (Kumar et al., 2021). It is considered a critical indicator of students' knowledge acquisition, comprehension, and application of learned material (Kumar et al., 2021). Previous studies have employed various methods to assess students' academic performance, including standardised tests, teacher evaluations, and classroom observations (Borgonovi, 2016; Kuh et al., 2014). Some researchers have used self-evaluation rating scales by which students evaluate their own academic performance (Benjet et al., 2023; Yeşilyurt, 2020). These rating scales can be criticised for being inaccurate and assessing students' perceptions of their academic performance rather than the performance itself. Other researchers have used students' academic grades or grade point averages (GPAs) as an indicator of cumulative academic achievement and to assess academic performance more objectively (York et al., 2015). The higher the academic grades or GPA, the higher the academic performance.

Many studies have been conducted to examine the relationship between problematic gaming and academic performance and found that they are negatively correlated (e.g., Jeong & Kim, 2011; Suryawanshi et al., 2021; Toker & Baturay, 2016). With research consistently showing a negative relationship between problematic gaming and academic performance, many may intuitively assume that poor academic performance is a consequence of problematic gaming. This may be a valid conclusion since problematic gaming may cause neglect of academic responsibilities (e.g., completing homework and assignments, studying for exams), leading to decreased academic performance. However, the opposite could also be true, with problematic gaming resulting from low academic performance. This can be explained more using the compensatory use model, which suggests that individuals who experience difficulties or negative emotions can develop compensatory strategies (e.g., using the internet or videogames) to overcome or work around their issues (Kardefelt-Winther, 2014). Accordingly, students who experience academic difficulties and stressors may use videogames to escape real-life problems or to compensate for unmet

needs (e.g., feeling of power and success). This compensatory behaviour can lead to an unhealthy reliance on videogames as a coping mechanism, which may result in the development of problematic gaming behaviours (Melodia et al., 2021; Snodgrass et al., 2014). A recent review by Cilligol Karabey et al. (2023) found that poor academic performance was among the consequences and risk factors of smartphone addiction. Smartphones have been used to play videogames. Therefore, smartphone addiction may also involve problematic gaming. Therefore, the findings of Cilligol Karabey et al.'s review also suggest a reciprocal relationship between problematic gaming and poor academic performance.

The Present Study

Although some studies have found positive effects of videogames on cognitive function and learning skills (Nuyens et al., 2019; Reynaldo et al., 2021), most studies have indicated that using videogames excessively has a negative effect on academic performance (Ferguson, 2015; Stevens et al., 2020). However, researchers do not always examine the effect of problematic gaming on academic performance. More specifically, some studies examine excessive gaming using general time spent playing videogames (e.g., Borgonovi, 2016; Osuagwu, 2015), which may have confounded the results of these two different concepts. To the best of the present authors' knowledge, no previous review study has ever examined the relationship between problematic gaming and student academic performance. Therefore, the aim of the present study was to synthesise the available empirical research utilising the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.

Method

The purpose of the present study was to synthesise and review the available literature to explore the relationship between problematic gaming and academic performance and the extent to which this relationship affects students' academic functioning. To ensure comprehensive methodology and reporting, the present review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009). According to PRISMA, there are three stages in selecting studies: identification, screening, and eligibility assessment. All studies identified through searching in databases were initially screened based on their titles and abstracts, and then the full texts of the potentially relevant papers were further assessed according to the eligibility criteria. Finally, the quality of the selected studies was assessed using the Newcastle-Ottawa Scale (NOS) after the data had been extracted to minimise bias in the selection of studies.

Eligibility Criteria

All studies assessing the relationship between problematic gaming and academic performance were eligible for review. The inclusion criteria were (i) being an empirical study, (ii) using a student sample, (iii) conducting an objective assessment of problematic gaming using a screening instrument, (iv) using students' academic grades or GPA to assess academic performance, (v) being published in a peer-reviewed journal, and (vi) being written in English language. Studies were excluded from the review if they were (i) review or

theoretical studies, (ii) scale validation studies, (iii) not published in a peer-reviewed journal, and/or (iv) if they did not mention relevant data (e.g., lack of definition for problematic gaming, academic performance or how they were assessed). Study collection ended in April 2023.

Information Sources and Search

Studies for the present review were searched using two sources of information: electronic databases and reading through the reference lists of relevant papers identified. Electronic databases were *Web of Science, PubMed, PsychInfo, ERIC, Scopus* and *OneSearch* (the researchers' university library's online database). Search terms were selected based on the two main areas of interest of the study. Terms related to the first area of interest (problematic gaming) included "problematic gaming" OR "problematic gam*" OR "excessive gaming" OR "excessive game*" OR "gaming addiction" OR "gam* addiction" OR "gaming disorder" OR "gam* disorder" OR "IGD" OR "pathologic* gaming" OR "pathologic* game*" OR "compuls* gaming" OR "compuls* game*" OR "gaming dependence" OR "gam* dependence". Terms related to the second area of interest (academic performance) included "academic" OR "academic performance*" OR "academic achievement*" OR "academic outcome*" OR "academic success" OR "grade point average" OR "GPA" OR "grade*" OR "student*" OR "undergrad*" OR "college" OR "education*" OR "school" OR "scholastic" OR "university" OR "postgraduate*" OR "exam" OR "coursework". These terms were searched in titles, keywords, and abstracts of the peer-reviewed journal articles.

Results

Study Selection

The initial search identified 4,364 outputs, most of them ($n = 4{,}347$) through databases (*Scopus*: 1986; W*eb of Science*: 930; *PsychInfo*: 619; *PubMed*: 606; *ERIC*: 70; *OneSearch*: 136). The titles and abstracts of all 4,364 outputs were examined for relevancy, leading to the exclusion of 4,280 publications due to duplication or unsuitability for the present review. The full texts of the remaining 84 papers were then examined for eligibility based on the inclusion and exclusion criteria. Of these 84 papers, 57 were excluded for not meeting the eligibility criteria, including not using screening instruments for problematic gaming ($n = 12$), using academic performance as demographic information so the relationship between problematic gaming and academic performance was not tested ($n = 2$), not using student grades or GPA to assess academic performance objectively ($n = 16$), not mentioning how academic performance was assessed ($n = 7$), being a scale validation study ($n = 4$), being a review study ($n = 3$) or the full text was not written in English ($n = 13$). After completing the full-text screening process, a total of 27 studies were selected to be included in this systematic review. The full selection process is depicted in the PRISMA flow diagram (Fig. 1).

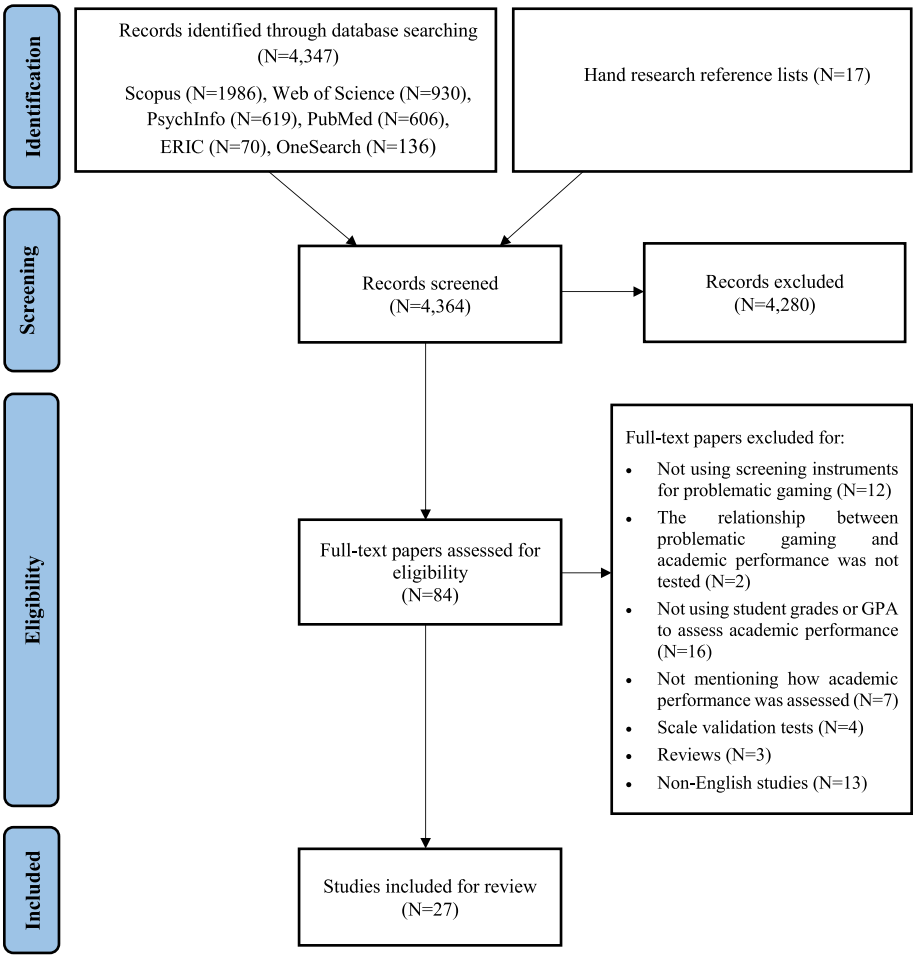

Fig. 1 PRISMA flow diagram of papers selected for systematic review

Study Characteristics

The key characteristics (i.e., study design, country, sample size, gender distribution (%), age range and mean age, sample characteristics, academic performance assessment, problematic gaming assessment) and main results of all 27 included studies can be found in the summary tables (see Tables 1 and 2).

Country of Origin

With regard to the geographic characteristics, the data of the included studies were collected from 18 countries. Seven studies were from Türkiye (Ciris et al., 2022; Durak et al., 2022; Ekşi et al., 2020; Polat & Topal, 2022; Sahin et al., 2016; Toker & Baturay, 2016; Zorbaz

Table 1 Main characteristics of the 27 reviewed studies on problematic gaming and academic performance

Study	Study design	Country	Sample size	Gender distribution (%)	Age range and mean age (SD)	Sample characteristics	Academic performance assessment	Problematic gaming assessment
Chiu et al. (2004)	Cross-sectional	Taiwan	1228	49.70% male	Range = N/R M_{age} = N/R	Primary and high-school students in grades 5–8	Academic grades	Self-developed game addiction scale
Gentile (2009)	Cross-sectional	United States	1178	49.92% male	Range = 8–18 M_{age} = N/R	School students	School grades	Pathological-Gaming Scale
Skoric et al. (2009)	Cross-sectional	Singapore	333	54% male	Range = 8–12 M_{age} = 10.00 (1.08)	Elementary school students	School grades for three subjects: English, science, and mathematics	Addictive Tendencies Scale
Jeong and Kim (2011)	Cross-sectional	South Korea	600	53.2% male	Range = 12–18 M_{age} = N/R	Middle- and high-school students	GPA	Internet Addiction Test (IAT)
Haghbin et al. (2013)	Cross-sectional	Iran	326	50.9% male	Range = N/R M_{age} = N/R	High-school students	GPA	Game Addiction Scale
Brunborg et al. (2014)	Longitudinal	Norway	1928	44.5% male	Range = 13–17 M_{age} = N/R	High-school students	School grades	Game Addiction Scale for Adolescents
Rehbein et al. (2015)	Cross-sectional	Germany	11,003	51.09% male	Range = 13–18 M_{age} = 14.88 (0.74)	School students	School grades	Video Game Dependency Scale
Schmitt and Livingston (2015)	Longitudinal	United States	383	100% male	Range = N/R M_{age} = 18 (N/R)	First-year college students	GPA	Self-developed videogame addiction scale
Zorbaz et al. (2015)	Cross-sectional	Türkiye	396	49.6% male	Range = N/R M_{age} = N/R	Primary school students in grades 4 & 5	GPA	Scale Of Game Addiction for Children (SGAC)
Sahin et al. (2016)	Cross-sectional	Türkiye	370	54.3% male	Range = 14–18 Mage = 16.18 (1.1)	High-school students	GPA	Game Addiction Scale (GAS)
Toker and Baturay (2016)	Cross-sectional	Türkiye	159	44% male	Range = N/R M_{age} = 21.72 (1.95)	Undergraduate students	GPA	Scale of Game Addiction

Table 1 (continued)

Study	Study design	Country	Sample size	Gender distribution (%)	Age range and mean age (SD)	Sample characteristics	Academic performance assessment	Problematic gaming assessment
Hawi et al. (2018)	Cross-sectional	Lebanon	524	47.9% males	Range = 15–19 M_{age} = 16.2 (1.0)	High-school students	School grade average (GPA)	Internet Gaming Disorder Test (IGD-20)
ELNahas et al. (2018)	Cross-sectional	Egypt	996	44.1% male	Range = 18–24 M_{age} = 19.6 (1.6)	University students	Academic grades	Internet Gaming Disorder Scale
Van Den Eijnden et al. (2018)	Longitudinal	Netherlands	538	48.9% male	Range = 12–15 M_{age} = 12.9 (0.73)	School students	GPA	Internet Gaming Disorder Scale
Shi et al. (2019)	Cross-sectional	Canada	1275	52.5% male	Range = N/R M_{age} = N/R	School students in grades 7–12	School grades	Problem Video Game Playing Scale (PVP)
Zhang et al. (2019)	Longitudinal	China	283	39.6% male	Range = 18–27 M_{age} = 20.47 (1.15)	University students	GPA	The nine diagnostic criteria of IGD
Al Asqah et al. (2020)	Cross-sectional	Saudi Arabia	228	64.9% male	Range = 18–25 M_{age} = 21.15 (1.57)	University students	GPA	IGD 9-Item Short Scale
Samaha and Hawi (2020)	Cross-sectional	Lebanon	345	73.9% male	Range = N/R M_{age} = 19.93 (2.08)	University students	GPA	Internet Gaming Disorder Test (IGD-20)
Zahra et al. (2020)	Cross-sectional	Pakistan	315	51.1% male	Range = 18–25 M_{age} = 23.97 (6.07)	University students	Academic grades	Internet Gaming Disorder Test (IGD-20)
Ekşi et al. (2020)	Cross-sectional	Türkiye	206	65.5% male	Range = 14–18 M_{age} = 15.58 (0.88)	High-school students in grades 9–11	GPA	Digital Game Addiction Scale (DGAS- 7)
Jaafar et al. (2021)	Cross-sectional	Malaysia	411	39.9% male	Range = 19–25 M_{age} = 21.81 (1.42)	Undergraduate students	GPA	The Internet Gaming Disorder Scale-Short-Form (IGDS-SF9)

Table 1 (continued)

Study	Study design	Country	Sample size	Gender distribution (%)	Age range and mean age (SD)	Sample characteristics	Academic performance assessment	Problematic gaming assessment
Karnadi and Pangestu (2021)	Cross-sectional	Indonesia	390	42.05% male	Range = 19–25 M_{age} = 19.17 (1.07)	Undergraduate students	GPA	Internet Gaming Disorder Test (IGD-20)
Suryawanshi et al. (2021)	Case-control design	India	91	46.2% male	Range = 18–24 M_{age} = N/R	Undergraduate students	Academic grades	The Gaming Addiction Scale (GAS)
Ciris et al. (2022)	Cross-sectional	Türkiye	559	57.6% male	Range = N/R M_{age} = N/R	High-school students in grades 9–12	GPA	Game Addiction Scale for Adolescents
Durak et al. (2022)	Cross-sectional	Türkiye	245	59.2% male	Range = N/R M_{age} = 16.04 (N/R)	High-school students	GPA	Self-developed online game addiction scale
Polat and Topal (2022)	Cross-sectional	Türkiye	289	55.4% male	Range = N/R M_{age} = N/R	Secondary school students in grades 5 & 6	GPA	Digital Game Addiction Scale (DGAS)
Yang et al. (2022)	Longitudinal	China	195	28.7% male	Range = 18–22 M_{age} = 19.86 (0.73)	Undergraduate students	GPA	Young's Internet Addiction Test (YIAT)

Table 2 Main results, limitations, and quality assessment of the 27 reviewed studies

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Chiu et al. (2004)	Game addiction was a significant factor in predicting academic achievement. Students who were addicted to games had lower academic performance compared to other students.	Limited generalisability to other populations due to using Taiwanese-only data; lack of some demographic information (age range, mean age); the temporal link and causality cannot be determined due to using a cross-sectional design; measurement bias due to using a tool for gaming addiction that had not been used nor validated before by previous studies; academic grades were self-reported.	2	-	1	Fair
Gentile (2009)	Pathological gamers received significantly worse grades in school compared to non-pathological gamers.	Limited generalisability to other populations due to using self-reported American-only data; lack of some demographic information (mean age); the temporal link and causality cannot be determined due to using a cross-sectional design; measurement bias due to using a tool developed based on DSM-IV criteria for pathological gambling and had not been used nor validated before by previous studies; school grades were self-reported.	2	2	1	Fair
Skoric et al. (2009)	Videogame addiction showed a consistent negative association with scholastic achievement across all subjects (English, science, mathematics). School grades were predicted by gaming addiction.	Limited generalisability to other populations due to using self-reported Singaporean-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; measurement bias due to using a tool developed based on DSM-IV criteria for pathological gambling and that had not been used nor validated before by previous studies.	2	-	2	Fair

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Jeong and Kim (2011)	A significant negative correlation was found between GPA and gaming addiction. Gaming addicts had a significantly lower GPA compared to non-addicts and mildly addicts.	Limited generalisability to other populations due to using self-reported South Korean-only data; lack of some demographic information (mean age); the temporal link and causality cannot be determined due to using a cross-sectional design; measurement bias due to using a modified tool from Internet addiction developed based on gambling addiction criteria; GPA was self-reported.	2	2	1	Fair
Haghbin et al. (2013)	There was a significantly negative association between gaming addiction and academic performance. Academic performance was predicted by gaming addiction.	Limited generalisability to other populations due to using self-reported Iranian-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range, mean age); measurement bias due to using a modified tool from gambling addiction; GPA was self-reported.	2	-	1	Fair
Brunborg et al. (2014)	Significant negative correlations were found between gaming addiction at T1 and academic performance at T1 and T2. Gaming addiction was a significant negative predictor of academic performance.	Limited generalisability to other populations due to using self-reported Norwegian-only data; lack of some demographic information (mean age); causality cannot be determined due to using a correlational design; measurement bias due to using a modified tool from gambling addiction; school grades were self-reported.	2	1	2	Fair

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Rehbein et al. (2015)	Students with gaming addiction had significantly lower grades in school compared to non-addicted students.	Limited generalisability to other populations due to using self-reported German (71.8%) data; the temporal link and causality cannot be determined due to using a cross-sectional design; school grades were self-reported.	2	2	1	Fair
Schmitt and Livingston (2015)	Significant negative correlations were found between gaming addiction and participants' high school GPA and first-year college GPA. Gaming addiction was a significant negative predictor of participants' first-year college GPA, even when controlling their high school GPA.	Limited generalisability to other populations due to using self-reported American (96.4%) data; lack of some demographic information (age range); Sampling bias due to a non-probability sampling method (convenience) and collecting data from a male-only sample; causality cannot be determined due to using a correlational design; measurement bias due to using a tool developed based on DSM-IV criteria for pathological gambling; GPA was self-reported.	1	1	2	Poor
Zorbaz et al. (2015)	A significant negative correlation was found between GPA and gaming addiction. GPA was a significant predictor for gaming addiction.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range, mean age); GPA was self-reported.	2	-	2	Fair

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Sahin et al. (2016)	A significant negative correlation between GPA and gaming addiction was found. Gaming addiction was not a significant predictor or a causal factor for poor academic performance.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; measurement bias due to using a modified tool from gambling addiction; GPA was self-reported.	2	-	1	Fair
Toker and Baturay (2016)	A significant negative correlation was found between gaming addiction and academic performance (GPA).	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range); Sampling bias due to a non-probability sampling method (convenience); GPA was self-reported.	1	-	1	Poor
Hawi et al. (2018)	Academic performance was a significant negative predictor of IGD. The school GPA of students with IGD was below the school pass grade and significantly lower than the GPAs of students who were normal or risky gamers.	Limited generalisability to other populations due to using self-reported Lebanese-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience); school grades were self-reported.	1	-	1	Poor

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
ELNahas et al. (2018)	No significant relation was found between IGD and academic performance.	Limited generalisability to other populations due to using self-reported Egyptian-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience); academic grades were self-reported.	1	-	1	Poor
Van Den Eijnden et al. (2018)	No significant correlations between IGD symptoms and school performance. IGD at T1 was not a significant predictor for GPA at T2 or T3.	Limited generalisability to other populations due to using self-reported Dutch (96.5%) data; Sampling bias due to a non-probability sampling method (convenience).	2	1	2	Fair
Shi et al. (2019)	A significant negative correlation was found between problematic gaming and academic performance in the non-urban region. No correlation was found between problematic gaming and academic performance in the urban region.	Limited generalisability to other populations due to using self-reported Canadian-only data; lack of some demographic information (age range, mean age); the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to the significant difference of the participants number between urban and non-urban groups which may have affected the results; measurement bias due to using a tool developed based on DSM-IV criteria for pathological gambling and substance dependence; school grades were self-reported.	2	1	1	Fair

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Zhang et al. (2019)	Significant negative correlations were found between IGD symptoms and GPA at both W1 and W2. IGD at W1 was not a significant predictor for GPA at W2 after controlling GPA at W1.	Limited generalisability to other populations due to using self-reported Chinese-only data; Sampling bias due to a non-probability sampling method (convenience) and the majority of the sample was female; causality cannot be determined due to using a correlational design; GPA was self-reported.	1	1	1	Poor
Al Asqah et al. (2020)	No significant difference was found between GPAs of students with IGD, without IGD or risky gamers.	Limited generalisability to other populations due to using self-reported Saudi-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience) and the majority of the sample was male; GPA was self-reported.	2	1	1	Fair
Samaha and Hawi (2020)	A significant negative correlation was found between gaming disorder and academic performance (GPA). Gaming disorder was a significant negative predictor of students GPA.	Limited generalisability to other populations due to using self-reported Lebanese-only data; lack of some demographic information (age range); the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience) and the vast majority of the sample was male; GPA was self-reported.	1	-	1	Poor

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Zahra et al. (2020)	Students with D grades (the lowest level of academic performance) showed the highest level of IGD compared to those with A, B, or C grades.	Limited generalisability to other populations due to using self-reported Pakistani-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; sampling bias due to a non-probability sampling method (purposive); academic grades were self-reported.	1	1	1	Poor
Ekşi et al. (2020)	Students with a low academic average had significantly higher levels of gaming addiction than those with a high academic average.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience) and the majority of the sample was male; measurement bias due to using a modified tool from gambling addiction; GPA was self-reported.	1	1	1	Poor
Jaafar et al. (2021)	A significant negative correlation was found between academic performance and gaming addiction. Academic performance was not a significant predictor for IGD.	Limited generalisability to other populations due to using self-reported Malaysian-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience) and the majority of the sample was female; GPA was self-reported.	2	-	2	Fair

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Karnadi and Pangestu (2021)	A significant negative correlation between academic performance and IGD was found. GPA was a significant negative predictor for student' IGD score. IGD score was not a significant predictor of GPA.	Limited generalisability to other populations due to using self-reported Indonesian-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; Sampling bias due to a non-probability sampling method (convenience); GPA was self-reported.	1	-	2	Poor
Suryawanshi et al. (2021)	A significant negative correlation was found between gaming addiction and academic performance.	Limited generalisability to other populations due to using self-reported Indian-only data; lack of some demographic information (mean age); small sample size; causality cannot be determined due to using a correlational design.	1	1	3	Poor
Ciris et al. (2022)	The general score of digital gaming addiction did not change according to students' GPA. However, digital gaming addiction in the withdrawal sub-dimension was significantly higher among students with low GPA compared to those with high GPA.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range, mean age); measurement bias due to using a modified tool from gambling addiction; GPA was self-reported.	3	1	2	Good

Table 2 (continued)

Study	Main results	Limitations	Quality assessment using the NOS			
			Selection (up to 4 stars)	Comparability (up to 2 stars)	Outcome/ Exposure (up to 3 stars)	Study quality
Durak et al. (2022)	GPA was a significant predictor for online game addiction for gifted students but not non-gifted students.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range); sampling bias due to a non-probability sampling method (purposive); GPA was self-reported.	1	1	2	Poor
Polat and Topal (2022)	A significant negative correlation was found between GPA and digital gaming addiction. Academic performance was a significant predictor for digital gaming addiction.	Limited generalisability to other populations due to using self-reported Turkish-only data; the temporal link and causality cannot be determined due to using a cross-sectional design; lack of some demographic information (age range, mean age); measurement bias due to using a modified tool from gambling addiction; GPA was self-reported.	2	-	2	Fair
Yang et al. (2022)	Significant negative correlations were found between IGD and GPA at both T1 and T2. GPA at T1 was a significant negative predictor for IGD at T2. But IGD at T1 was not a significant predictor for GPA at T2.	Limited generalisability to other populations due to using self-reported Chinese-only data; Sampling bias due to a non-probability sampling method (convenience) and the vast majority of the sample was female; causality cannot be determined due to using a correlational design; measurement bias due to using a modified tool from Internet addiction developed based on gambling addiction criteria; GPA was self-reported.	1	0	1	Poor

et al., 2015), two from China (Yang et al., 2022; Zhang et al., 2019), two from Lebanon (Hawi et al., 2018; Samaha & Hawi, 2020), two from the United States (Gentile, 2009; Schmitt & Livingston, 2015), one from India (Suryawanshi et al., 2021), one from Indonesia (Karnadi & Pangestu, 2021), one from Malaysia (Jaafar et al., 2021), one from Pakistan (Zahra et al., 2020), one from Saudi Arabia (Al Asqah et al., 2020), one from Canada (Shi et al., 2019), one from Netherlands (Van Den Eijnden et al., 2018), one from Egypt (ELNahas et al., 2018), one from Germany (Rehbein et al., 2015), one from Norway (Brunborg et al., 2014), one from Iran (Haghbin et al., 2013), one from South Korea (Jeong & Kim, 2011), one from Singapore (Skoric et al., 2009), and one from Taiwan (Chiu et al., 2004).

Participants' Characteristics

The 27 studies reviewed comprised a total of 24,794 participants. Approximately half of the total number of participants were males ($n = 12{,}982$; 52.36%). The majority of studies had similar percentages of male and female participants, and only one study recruited males exclusively due to conducting the study at an all-male university (Schmitt & Livingston, 2015). The sample sizes of the reviewed studies varied between 91 and 11,003 participants. Five studies had more than 1000 participants (Brunborg et al., 2014; Chiu et al., 2004; Gentile, 2009; Rehbein et al., 2015; Shi et al., 2019), five studies had more than 500 to 1000 participants (Ciris et al., 2022; ELNahas et al., 2018; Hawi et al., 2018; Jeong & Kim, 2011; Van Den Eijnden et al., 2018), nine studies had more than 300 to 500 participants (Haghbin et al., 2013; Jaafar et al., 2021; Karnadi & Pangestu, 2021; Sahin et al., 2016; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Skoric et al., 2009; Zahra et al., 2020; Zorbaz et al., 2015), five studies had more than 200 to 300 participants (Al Asqah et al., 2020; Durak et al., 2022; Ekşi et al., 2020; Polat & Topal, 2022; Zhang et al., 2019) and the remaining three studies had less than 200 participants (Suryawanshi et al., 2021; Toker & Baturay, 2016; Yang et al., 2022).

Regarding the age of the participants and the sample group, eleven studies recruited college or university students aged 18 to 27 years (Al Asqah et al., 2020; ELNahas et al., 2018; Jaafar et al., 2021; Karnadi & Pangestu, 2021; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Suryawanshi et al., 2021; Toker & Baturay, 2016; Yang et al., 2022; Zahra et al., 2020; Zhang et al., 2019), ten studies recruited students aged 8 to 18 years from primary, middle and/or high schools (Brunborg et al., 2014; Durak et al., 2022; Ekşi et al., 2020; Gentile, 2009; Hawi et al., 2018; Jeong & Kim, 2011; Rehbein et al., 2015; Sahin et al., 2016; Skoric et al., 2009; Van Den Eijnden et al., 2018), and six studies did not provide information about the participants' age, but the authors indicated that the participants were school students in grades 5–8 (Chiu et al., 2004), in grades 4 and 5 (Zorbaz et al., 2015), in grades 7–12 (Shi et al., 2019), in grades 9–12 (Ciris et al., 2022), in grades 5 and 6 (Polat & Topal, 2022), and high-school students (Haghbin et al., 2013).

Academic Performance Assessment

To assess student academic performance, the reviewed studies used self-reported GPA (Al Asqah et al., 2020; Ciris et al., 2022; Durak et al., 2022; Ekşi et al., 2020; Haghbin et al., 2013; Hawi et al., 2018; Jaafar et al., 2021; Jeong & Kim, 2011; Karnadi & Pangestu, 2021; Polat & Topal, 2022; Sahin et al., 2016; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Toker & Baturay, 2016; Van Den Eijnden et al., 2018; Yang et al., 2022; Zhang et al., 2019; Zorbaz et al., 2015), self-reported school grades (Brunborg et al., 2014; Gentile, 2009; Rehbein et al., 2015; Shi et al., 2019; Skoric et al., 2009) or self-reported

academic grades (Chiu et al., 2004; ELNahas et al., 2018; Suryawanshi et al., 2021; Zahra et al., 2020). Three studies used school grades reported by teachers (Skoric et al., 2009), reported by schools (Van Den Eijnden et al., 2018) or academic grades reported by the institution (Suryawanshi et al., 2021).

Problematic Gaming Assessment

The reviewed studies employed various instruments to assess problematic gaming. Three studies developed their own assessment tools. Chiu et al. (2004) used the theories of Buchman and Funk (1996), Phillips et al. (1996) and Huang (1990) to create a game addiction scale, and two studies developed a scale based on Brown's (1991, 1993) gaming and gambling addiction criteria (Gentile, 2009; Skoric et al., 2009). One study used Gentile's (2009) Pathological Gaming Scale (Schmitt & Livingston, 2015). Two studies used an adapted version of Young's (1998) Internet Addiction Scale developed based on gambling addiction criteria (Jeong & Kim, 2011; Yang et al., 2022). In addition, six studies used the Game Addiction Scale for Adolescents developed by Lemmens et al. (2009) based on gambling criteria (Brunborg et al., 2014; Ciris et al., 2022; Ekşi et al., 2020; Haghbin et al., 2013; Polat & Topal, 2022; Sahin et al., 2016). One study used the Video Game Dependency Scale (CSAS for the German version) by Rehbein et al. (2010) (Rehbein et al., 2015). One study assessed problematic gaming using the nine diagnostic criteria proposed in DSM-5 (APA, 2013) (Zhang et al., 2019). Two studies used Horzum et al.'s (2008) Scale of Game Addiction (Toker & Baturay, 2016; Zorbaz et al., 2015). Four studies used the Internet Gaming Disorder Test (IGDT-20) by Pontes et al. (2014) (Hawi et al., 2018; Karnadi & Pangestu, 2021; Samaha & Hawi, 2020; Zahra et al., 2020). Four studies used an adapted version of the Internet Gaming Disorder Scale by Lemmens et al. (2015) (Al Asqah et al., 2020; ELNahas et al., 2018; Suryawanshi et al., 2021; Van Den Eijnden et al., 2018). One study used Problem Video Game Playing Scale (PVP) by Tejeiro et al. (2002) (Shi et al., 2019). One study used the Internet Gaming Disorder Scale-Short-Form (IGDS-SF9) by Pontes and Griffiths (2015) (Jaafar et al., 2021). One study used an online game addiction scale adopted from a thesis by Kaya (2013) (Durak et al., 2022).

Main Results

The main results for each study are shown in Table 2. Cross-sectional studies either examined differences between groups ($n=5$) or the relationship between problematic gaming and academic performance ($n=16$) or tested both ($n=1$). Regarding group differences, three studies reported that problematic gamers had a significantly lower academic performance compared to non-problematic gamers (Gentile, 2009; Jeong & Kim, 2011; Rehbein et al., 2015), and two studies reported that students with a low academic performance had significantly higher levels of problematic gaming compared to those with a high academic performance (Ekşi et al., 2020; Zahra et al., 2020). One study reported no significant difference between the academic performance of students with IGD, without IGD, and risky gamers (Al Asqah et al., 2020). Twelve cross-sectional studies examined the correlation between problematic gaming and academic performance. Nine studies reported that problematic gaming was negatively correlated with academic performance (i.e., the higher the problematic gaming, the lower the academic performance; and the lower the problematic gaming, the higher the academic performance) (Jaafar et al., 2021; Jeong & Kim, 2011; Karnadi & Pangestu, 2021; Polat & Topal, 2022; Sahin et al., 2016; Samaha & Hawi, 2020; Suryawanshi et al., 2021; Toker & Baturay, 2016; Zorbaz et al., 2015), and two studies reported no correlation (Ciris et al., 2022; ELNahas et al., 2018).

Mixed results reported by Shi et al. (2019) reported a significant negative correlation between problematic gaming and academic performance in a non-urban region but no correlation in an urban region. Ten cross-sectional studies examined the association using regression analysis. Four studies reported that problematic gaming was a significant negative predictor for academic performance (Chiu et al., 2004; Haghbin et al., 2013; Samaha & Hawi, 2020; Skoric et al., 2009), and two studies reported that problematic gaming was not a significant predictor for academic performance (Karnadi & Pangestu, 2021; Sahin et al., 2016). In addition, four studies reported that academic performance was a significant negative predictor for problematic gaming (i.e., when academic performance increased, problematic gaming decreased) (Hawi et al., 2018; Karnadi & Pangestu, 2021; Polat & Topal, 2022; Zorbaz et al., 2015), and one study reported that academic performance was not a significant predictor for problematic gaming (Jaafar et al., 2021). The mixed results by Durak et al. (2022) reported that academic performance was a significant negative predictor for problematic gaming among gifted students but not significant among non-gifted students.

All longitudinal studies examined the relationship between problematic gaming and academic performance ($n=5$). Apart from one study which found no correlation (Van Den Eijnden et al., 2018), the remaining four studies reported significant negative correlations between problematic gaming and academic performance at both Time 1 and Time 2 (i.e., the higher the problematic gaming, the lower the academic performance; and the lower the problematic gaming, the higher the academic performance) (Brunborg et al., 2014; Schmitt & Livingston, 2015; Yang et al., 2022; Zhang et al., 2019). Two of the five longitudinal studies showed that problematic gaming was a significant negative predictor for academic performance (i.e., problematic gaming was significantly associated with and predicted poorer academic performance) (Brunborg et al., 2014; Schmitt & Livingston, 2015), and the three remaining studies reported that problematic gaming at Time 1 was not a significant predictor for academic performance at Time 2 or Time 3 (Van Den Eijnden et al., 2018; Yang et al., 2022; Zhang et al., 2019). One longitudinal study reported that academic performance at Time 1 was a significant negative predictor for problematic gaming at Time 2 (i.e., academic performance at T1 significantly predicted problematic gaming at T2. When academic performance increased, problematic gaming decreased) (Yang et al., 2022).

Methodological Features of Studies

All the reviewed studies were quantitative in nature. The majority of the studies ($n=21$) used a cross-sectional design (Al Asqah et al., 2020; Chiu et al., 2004; Ciris et al., 2022; Durak et al., 2022; Ekşi et al., 2020; ELNahas et al., 2018; Gentile, 2009; Haghbin et al., 2013; Hawi et al., 2018; Jaafar et al., 2021; Jeong & Kim, 2011; Karnadi & Pangestu, 2021; Polat & Topal, 2022; Rehbein et al., 2015; Sahin et al., 2016; Samaha & Hawi, 2020; Shi et al., 2019; Skoric et al., 2009; Toker & Baturay, 2016; Zahra et al., 2020; Zorbaz et al., 2015), five studies used a longitudinal design (Brunborg et al., 2014; Schmitt & Livingston, 2015; Van Den Eijnden et al., 2018; Yang et al., 2022; Zhang et al., 2019), and one study used a case-control design (Suryawanshi et al., 2021). Moreover, while one study used personal interviews to collect data (Suryawanshi et al., 2021), eight studies used online self-reported surveys (Al Asqah et al., 2020; Durak et al., 2022; Gentile, 2009; Jaafar et al., 2021; Polat & Topal, 2022; Sahin et al., 2016; Toker & Baturay, 2016; Van Den Eijnden et al., 2018), 12 studies used offline "paper-and-pencil" self-reported surveys (Brunborg et al., 2014; Ciris et al., 2022; Ekşi et al., 2020; Haghbin et al., 2013; Hawi et al., 2018; Rehbein et al., 2015; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Shi et al., 2019; Skoric et al., 2009; Zahra et al., 2020; Zorbaz et al.,

2015), and six studies used self-reported surveys but the authors did not mention whether they were conducted online or offline (Chiu et al., 2004; ELNahas et al., 2018; Jeong & Kim, 2011; Karnadi & Pangestu, 2021; Yang et al., 2022; Zhang et al., 2019).

In terms of the adopted sampling methods, 13 studies used convenience sampling to recruit participants (Chiu et al., 2004; Ekşi et al., 2020; ELNahas et al., 2018; Hawi et al., 2018; Jaafar et al., 2021; Karnadi & Pangestu, 2021; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Skoric et al., 2009; Toker & Baturay, 2016; Van Den Eijnden et al., 2018; Yang et al., 2022; Zhang et al., 2019), nine studies used random sampling (Al Asqah et al., 2020; Brunborg et al., 2014; Ciris et al., 2022; Gentile, 2009; Jeong & Kim, 2011; Polat & Topal, 2022; Rehbein et al., 2015; Sahin et al., 2016; Zorbaz et al., 2015), two studies used purposive sampling (Durak et al., 2022; Zahra et al., 2020), two studies employed two-cluster sampling (Haghbin et al., 2013; Shi et al., 2019), and one study used a universal sampling technique (Suryawanshi et al., 2021).

Quality Assessment

The quality of each reviewed study is included in Table 2, and a more detailed quality assessment can be found in Appendix A Table 3. The Newcastle-Ottawa Scale (NOS) was used to evaluate the methodological quality of all reviewed studies. The NOS is a widely used tool that provides a standardised and transparent way to assess the quality of non-randomised studies, particularly cohort and case-control studies and it has also been adapted for cross-sectional studies (Wells et al., 2013). The NOS uses a star rating system to assess the methodological quality based on three main domains: selection of study groups (4 items; e.g., sample representativeness), comparability of groups (1–2 items; i.e., the control of confounding factors), and assessment of outcome/exposure (2–3 items; e.g., appropriateness of the statistical test) (Wells et al., 2013). Overall, one study received a good rating (Ciris et al., 2022), 14 studies received a fair rating (Al Asqah et al., 2020; Brunborg et al., 2014; Chiu et al., 2004; Gentile, 2009; Haghbin et al., 2013; Jaafar et al., 2021; Jeong & Kim, 2011; Polat & Topal, 2022; Rehbein et al., 2015; Sahin et al., 2016; Shi et al., 2019; Skoric et al., 2009; Van Den Eijnden et al., 2018; Zorbaz et al., 2015), and 12 studies received a poor rating (Durak et al., 2022; Ekşi et al., 2020; ELNahas et al., 2018; Hawi et al., 2018; Karnadi & Pangestu, 2021; Samaha & Hawi, 2020; Schmitt & Livingston, 2015; Suryawanshi et al., 2021; Toker & Baturay, 2016; Yang et al., 2022; Zahra et al., 2020; Zhang et al., 2019).

Several limitations were identified across the reviewed studies, including (i) using non-probability sampling techniques ($n=15$), (ii) not reporting power analyses for cross-sectional studies ($n=25$), (iii) relying mainly on self-report data for assessing problematic gaming ($n=26$) and academic performance ($n=24$), (iv) having measurement bias due to using tools were not originally designed for assessing problematic gaming ($n=13$), (v) using cross-sectional designs ($n=21$), (vi) not having clinical samples ($n=27$), and (vii) lacking some important demographic data (e.g., age range and/or mean age) ($n=14$).

Discussion

The present review aimed to identify all studies examining the relationship between problematic gaming and academic performance as assessed by students' grades or GPA. A total of 27 studies met the inclusion criteria, and the data extracted comprised (i) country

of origin, (ii) participants' characteristics, (iii) type of problematic gaming assessment, (iv) academic performance assessment, and (v) methodological features of studies.

Most studies ($n=24$) reported a negative relationship between problematic gaming and academic performance (i.e., the higher the problematic gaming, the lower the academic performance). Furthermore, there was a significant difference in the results of the regression analyses between the older studies and the more recent studies. Studies conducted prior to 2015 found that problematic gaming to be a significant factor in predicting poor academic performance, while most of recent studies conducted after 2015 reported that poor academic performance was a significant factor in predicting problematic gaming and/or that problematic gaming was not a significant factor in predicting academic performance. These results suggest that problematic gaming may have had a role in causing poor academic performance in the past, but recently it is more likely to be a consequence rather than a cause.

There are several possible explanations for the significant change between the findings of the older studies and the more recent studies. One possible explanation could be gaming-related technological changes. The gaming industry experienced significant changes more recently, with the rise of mobile gaming, virtual reality, and online interactive games (Palma-Ruiz et al., 2022). These technological advancements might have altered the nature of gaming itself (e.g., games becoming more immersive, gaming on the move), leading to different implications for academic performance. In addition, the evolution of gaming culture may also have an effect. In recent years, gaming has become more mainstream and integrated into daily life. This normalisation of gaming may also have led to different impacts on academic performance. Another reason could be related to research methodologies. More specifically, the type of instruments used to assess problematic gaming. All studies published prior to 2015 used tools developed based on criteria of pathological gambling or internet addiction, which may have affected the results of these studies and limited their reliability (Pontes & Griffiths, 2014). In contrast, most of the studies published after 2015 relied on instruments designed specifically to assess problematic gaming, which perhaps makes their results more reliable compared to earlier studies.

Researchers consider studies over five years old to be outdated and irrelevant to the present time for many reasons, including the continuous and rapid change of environmental and social factors (Gottlieb, 2003; Helfer et al., 2015). Accordingly, the results of more recent studies are arguably more valid and relevant to the present time. Therefore, currently, poor academic performance is more likely to be a risk factor for developing problematic gaming behaviours rather than a consequence. This finding can be explained using the compensatory use model, which refers to intentional behaviours that an individual engages in to avoid real-life stressors or to compensate for unmet needs (Kardefelt-Winther, 2014). Based on the compensatory use model, when students experience academic stressors and difficulties (e.g., poor performance), they may turn to gaming to escape real-life stressors or to fill their need to feel powerful and successful through virtual achievements, which may lead to developing problematic gaming behaviours (Melodia et al., 2021; Snodgrass et al., 2014).

The results pattern was consistent irrespective of the study design. Older longitudinal studies showed that problematic gaming was a significant predictor of low academic performance (Brunborg et al., 2014; Schmitt & Livingston, 2015), while more recent longitudinal studies found that academic performance was not predicted by problematic gaming (Van Den Eijnden et al., 2018; Yang et al., 2022; Zhang et al., 2019). Yang et al. (2022) also reported that academic performance was a significant factor in predicting problematic gaming. A similar pattern of results is also found in cross-sectional studies.

In terms of sample groups, studies that used school-student samples and were conducted before 2015 showed that problematic gaming predicted poor student performance. In contrast,

more recent studies found that scholastic performance was not predicted by problematic gaming and/or poor performance was a significant factor in predicting problematic gaming among school students. However, all studies used university-student samples were conducted after 2015 and showed mixed findings. Some studies reported no association between problematic gaming and academic performance among university students, while others reported negative associations. These mixed findings may be due to conducting the studies in different countries. Various factors, such as biological, social, and environmental differences between countries, may have influenced the relationship between problematic gaming and academic performance, leading to mixed results regarding university students in the present review.

In terms of geographical location, three-quarters of the reviewed studies ($n=21$) were conducted in Asian countries, while the others were conducted either in European ($n=3$) or North American countries ($n=3$). Türkiye had the largest number of studies (seven), followed by China, Lebanon, and the United States (two each), then the rest of countries (all one each). Apart from three studies which found no association (Egypt, Netherlands) or no significant difference (Saudi Arabia), all the remaining studies conducted in other countries found a negative relationship between problematic gaming and academic performance.

Studies using regression analyses in Türkiye and China reported that poor academic performance was a significant factor in predicting problematic gaming, but problematic gaming was not a significant predictor for academic performance. It should be noted that most of these studies were conducted recently and may suggest that poor academic performance of Turkish and Chinese students is more likely to be a risk factor for problematic gaming rather than a consequence. Similarly, problematic gaming was not a significant factor in predicting the academic performance of Indonesian and Dutch students. Studies conducted in Lebanon indicated that poor academic performance was a significant predictor for problematic gaming among high-school students and that problematic gaming was a significant predictor for poor academic performance among university students. One study conducted in Malaysia reported that academic performance was not a significant factor in predicting problematic gaming. Studies conducted in the United States, Norway, Taiwan, Singapore, and Iran found problematic gaming to be a significant predictor for poor academic performance. However, these studies were carried out between 2004 and 2015 and relied mainly on modified assessment tools. Therefore, conclusions regarding the current situation for these countries cannot be drawn due to the significant time gap, indicating the need to conduct cross-cultural studies to have up-to-date data and examine the differences in the relationship between problematic gaming and academic performance between different countries.

The findings of the present review are similar to previous reviews in the same research field. A meta-analysis by Ferguson (2015) showed that exposure to videogames in general leads to lower academic performance among children and adolescents. However, Ferguson's study examined the impact of general videogame use rather than problematic gaming specifically. Moreover, the review also looked at many other areas and not just academic performance (i.e., aggression, mental health, prosocial behaviour), and only focused on adolescents. His findings are more in line with the findings of the older studies in the present review rather than the more recent ones. A recent systematic review conducted by Cilligol Karabey et al. (2023) examining the risk factors and consequences of smartphone addiction also found similar results. Smartphone addiction may involve problematic gaming, as videogames can be played on smartphones. Cilligol Karabey et al. (2023) reported a negative relationship between smartphone addiction and academic performance among adolescents. Poor academic performance was among the consequences of smartphone addiction and was also a risk factor for developing the addiction. However, the review did not specify the publication year of all studies that examined the relationship between smartphone addiction and

academic performance, but it is more likely that they are recent studies since they focused on smartphone addiction, and smartphones have only been used widely in the past decade.

Limitations

The limitations of the present review can be grouped into two types: (i) limitations related to the reviewed studies and (ii) limitations related to the review itself. Beginning with the quality assessment conducted using the NOS to evaluate the overall quality of the literature in the field. Apart from one study that received a good quality rating (Ciris et al., 2022), the remaining studies were rated as fair or poor. The major concerns were related to generalisability, sample selection, recruitment and methods of measurement. Research studies on this topic have tended to use (i) correlational and cross-sectional designs that do not enable conclusions to be drawn about the causality between variables, (ii) non-probability sampling techniques, restricting the generalisability of the findings, (iii) self-report data that are subject to well-known biases (e.g., memory recall, social desirability), and (iv) measures that were not originally designed for assessing problematic gaming, limiting the reliability of the results. Consequently, more attention should be paid to these limitations in order to improve the quality of studies in the field of problematic gaming and academic achievement.

There were also some limitations related to the present review. Despite the comprehensive search performed to find eligible studies across the various databases, some relevant studies might have been missed due to the chosen search terms, the limitations of the databases, and only including studies that were published in English. In addition, including only peer-reviewed studies might have resulted in missing important data included in studies that were not peer-reviewed, unpublished dissertations, and theses. Another limitation of the present review was that it only included studies that used academic grades or GPA as the sole direct measure of academic performance. Although academic grades and GPAs can be used to assess academic performance objectively, they are not always representative of students' academic abilities and performance. Therefore, considering students' academic skills, abilities, and motivations in addition to their gaming behaviour, can provide a more comprehensive approach to understanding the relationship between problematic gaming and academic functioning.

Recommendations for Future Research

Although the present review demonstrated a negative relationship between problematic gaming and academic performance, the majority of the reviewed studies were cross-sectional and correlational, which cannot determine causal relationships. Of all 27 reviewed studies, only five were longitudinal and the most recent were conducted exclusively in China. Therefore, future researchers should conduct more longitudinal and experimental studies in a greater number of countries to draw more comprehensive and meaningful cross-cultural conclusions. Future research could also examine the relationship between problematic gaming and academic performance in both directions, as most of the included studies tested the relationship in just one direction, which may limit the conclusions drawn. In addition, the findings of the present review suggested that the escape motive may be a potential contributing factor in the relationship between problematic gaming and poor academic performance. Therefore, future studies should test the role of the escape motive and other potential factors (e.g., study motivation) in this relationship. Moreover, the reviewed studies were conducted among either

school students or university students. Future research may want to include both samples in the same study to compare the effects between them. Most of the used samples were high-school and university students, therefore future studies could also include children and early adolescents and use clinical samples to enhance external validity.

In terms of measurement methods, approximately two-thirds of the reviewed studies used assessment tools developed based on the criteria of pathological gambling or internet addiction to assess problematic gaming. Therefore, future studies should only use instruments designed specifically to assess problematic gaming to have more reliable findings (Pontes & Griffiths, 2014). Furthermore, the vast majority of studies relied mainly on self-report data that may involve biases. Alternatively, future research could use different assessment procedures, such as asking parents, teachers or educational institutions to obtain more valid and reliable information regarding academic performance, using behavioural tracking technologies to monitor gaming behaviours, and conducting clinical interviews to assess problematic gaming in relation to academic achievement.

Implications

The findings of the present review study have several practical implications. First, educational institutions should incorporate awareness programs to educate students about the potential negative effects of problematic gaming on academic performance and provide support services for student's mental health and academic difficulties. Second, clinicians and school counsellors can utilise screening tools to identify at-risk students and implement early intervention strategies targeting underlying academic difficulties and teaching healthier coping mechanisms. Third, parental awareness and guidance are essential in monitoring children's gaming habits and promoting alternative activities and social engagement, which can also help reduce reliance on gaming as a primary coping mechanism. Lastly, policymakers can consider implementing guidelines to reduce problematic gaming behaviour and support research initiatives aimed at understanding the relationship between gaming and academic performance. Considering these implications, a multidisciplinary approach can be adopted to help address problematic gaming among students and promote healthier behaviours.

Conclusion

The present study is the first review that has systematically reviewed the relationship between problematic gaming and students' academic performance. Most of the reviewed studies (24 out of 27) found a negative relationship between problematic gaming and academic performance. The higher the students' problematic gaming behaviours, the lower their academic performance. When researchers found this negative relationship, most of them assumed that problematic gaming was the cause of decreased academic performance. This may be due to what earlier studies concluded. However, most of the recent studies indicate that poor academic performance could be a potential risk factor for the development of problematic gaming behaviours rather than a consequence. Research is still limited in this area, as the cause-and-effect relationship between problematic gaming and poor academic performance is still unknown. As aforementioned, this gap in the literature should be addressed in future studies.

Appendix A

Table 3 The NOS for the risk of bias and Quality Assessment of the Reviewed Studies

Case Control Study (1 study)									
Author	**Selection**				**Comparability**	**Exposure**			**Study quality**
	Adequate definition of the case	Representativeness of the cases	Selection of controls	Definition of controls	Control for important or additional factors (e.g., gender, playing time)	Ascertainment of exposure	Same method of ascertainment for participants	Non-response rate	
Suryawanshi et al. (2021)			★		★	★	★	★	Poor
Cohort Studies (5 studies)									
Author	**Selection**				**Comparability**	**Outcome**			**Study quality**
	Representativeness of the exposed cohort	Selection of the non-exposed cohort	Ascertainment of exposure	Demonstration that the outcome was not present at start of study	Control for important or additional factors (e.g., gender, playing time)	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow up of cohorts	
Brunborg et al. (2014)	★	★			★		★	★	Fair
Schmitt and Livingston (2015)		★			★		★	★	Poor
Van Den Eijnden et al. (2018)		★		★	★	★	★		Fair
Zhang et al. (2019)		★			★		★		Poor
Yang et al. (2022)		★					★		Poor

Table 3 (continued)

Cross-sectional Studies (21 studies)								
Author	**Selection**				**Comparability**	**Outcome**		**Study quality**
	Representativeness of the sample	Sample size	Ascertainment of exposure	Non-respondents	Control for important or additional factors (e.g., gender, playing time)	Assessment of outcome	Statistical test	
Chiu et al. (2004)	★		★		-		★	Fair
Gentile (2009)	★		★		★★	★	★	Fair
Skoric et al. (2009)	★		★		-	★	★	Fair
Jeong and Kim (2011)	★		★		★★		★	Fair
Haghbin et al. (2013)	★		★		-		★	Fair
Rehbein et al. (2015)	★		★		★★		★	Fair
Zorbaz et al. (2015)	★		★		-	★	★	Fair
Sahin et al. (2016)	★		★		-		★	Fair
Toker and Baturay (2016)			★		-		★	Poor
Hawi et al. (2018)			★		-		★	Poor
ELNahas et al. (2018)			★		-		★	Poor
Shi et al. (2019)	★		★		★		★	Fair

Table 3 (continued)

Al Asqah et al. (2020)	★		★	★		★	Fair
Samaha and Hawi (2020)			★	-		★	Poor
Zahra et al. (2020)			★	★		★	Poor
Ekşi et al. (2020)			★	★		★	Poor
Jaafar et al. (2021)		★	★	-	★	★	Fair
Karnadi and Pangestu (2021)			★	-	★	★	Poor
Ciris et al. (2022)	★	★	★	★	★	★	Good
Durak et al. (2022)			★	★	★	★	Poor
Polat and Topal (2022)	★		★	-	★	★	Fair

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Declarations

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Informed Consent Not applicable

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