



Characteristics of Gamers who Purchase Loot Box: a Systematic Literature Review

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Abstract

Purpose of Review Research has indicated that loot boxes are risky gaming components that could exacerbate Internet gaming disorder due to a link between loot box purchasing and gambling. We conducted a systematic review to identify the characteristics of people who purchase loot boxes with real money, focusing on the relationships (a) between loot boxes and gaming, (b) between loot boxes and gambling, and (c) between loot boxes and other variables.

Recent Findings Of the 201 studies examined for eligibility, we reviewed 20 studies that met the predefined criteria, which were extracted by searching electronic databases (PsycINFO, PubMed, Ovid, EBSCO, and Web of Science) and the reference lists of included studies, and that were published up to March 27, 2021. Overall, this review identified positive relationships among Internet gaming disorder–related symptoms, disordered gambling symptoms, and engagement with, or investment in, loot boxes. In addition to gaming and gambling, the relationships among some variables, such as mood, gender, physiological state, motivation, and loot box engagement, were examined.

Summary The present review clarified relationships between loot box engagement, gaming, gambling, and other variables, such as mood, gender, physiological state, and motivation, and partially identified the characteristics of people who purchase loot boxes using real money. Specifically, those who spend more money in-game on loot boxes exhibit Internet gaming–related and/or disordered gambling symptoms and behaviors. Finally, we discussed future directions for clinical psychological studies on loot boxes.

Keywords Loot box · Internet gaming · Gambling · Review

Introduction

Addiction to gaming is described in the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders (DSM-5). There was not sufficient evidence to determine whether the condition is a unique mental disorder or

the best criteria to classify it at the time the DSM-5 was published in 2013. However, the American Psychiatric Association recognized Internet gaming disorder in the section recommending conditions for further research [1]. The World Health Organization included “gaming disorder” in the 11th revision of the International Classification of Diseases (ICD-11) with the diagnostic code 6C51. According to the ICD-11 [2], gaming disorder is characterized by a pattern of persistent or recurrent gaming behavior and is manifested by impaired control over gaming, increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences. In addition, the gaming is of sufficient severity to result in significant impairment in personal, family, social, educational, occupational, or other important areas of functioning.

Fam [3] conducted a meta-analysis on the prevalence of Internet gaming disorder in adolescents and reported a pooled prevalence rate of 4.6% (95% confidence interval [CI] = 3.4–

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6.0%) in adolescents aged 10–19 years. Furthermore, while high prevalence estimates of Internet gaming disorder have been found in Asia (pooled prevalence = 9.9%, 95% CI = 1.0–21.5%) and North America (pooled prevalence = 9.4%, 95% CI = 8.3–10.5%), low prevalence estimates were found in Australia (pooled prevalence = 4.4%, 95% CI = 1.9–7.4%) and Europe (pooled prevalence = 3.9%, 95% CI = 2.8–5.3%). Despite the rapid expansion of Internet use and gaming technology over the past 20 years, the prevalence of Internet gaming disorder does not appear to have increased as exponentially as has exposure to the Internet and/or gaming technology [4].

Systematic reviews of the literature revealed several risk factors for Internet gaming disorder, including gaming factors (e.g., longer time spent and higher frequency of playing games), and sociodemographic (e.g., male gender, younger age, and family or marital difficulties), interpersonal (e.g., friends with problems related to Internet or video game addiction, low educational and career attainment, and poor social skills), and personality factors (e.g., anxious or aggressive tendencies) [5, 6]. Although adolescents might find some benefits of Internet gaming, such as having fun and pleasure, constructing social networks, and escaping from personal problems, most are likely to experience various adverse consequences from excessive gaming behaviors, such as poor mental health, academic performance, and quality of life [7, 8].

In relation to Internet gaming disorder, people have recently begun to realize that loot boxes could be a risky component of Internet gaming, worsening Internet gaming behaviors due to the potential link between loot boxes and gambling [9]. To provide some perspective, loot boxes, also known as “loot crates,” “loot cases,” or “loot chests,” are a central feature of many popular Internet games; gamers purchase loot boxes to receive valuable in-game items that serve to enhance their gameplay. Although, in some cases, gamers can collect virtual keys to open loot boxes, they can also buy keys with real money. Once gamers purchase these keys and open loot boxes, the value that they receive from the in-game items and services they gain are random (i.e., they can be high or low at a random chance). This randomness suggests a similar characteristic (i.e., random outcomes based on chance) between loot boxes and gambling. Furthermore, a previous study suggested that some motivations for purchasing loot boxes, such as to have fun or excitement, were like those for gambling behaviors [10]. Gambling disorder was the first behavioral addiction to be classified in the substance and other related disorders section of the 5th edition of the DSM-5 [1]. Similarly, the IDC-11 classified gambling disorder as a disorder due to addictive behaviors [2].

A recent study found that 78% of Internet gamers worldwide had conducted microtransactions to open loot boxes [11]. Thus, considering that loot boxes could exacerbate the

severity of Internet gaming disorder [12], sufficient treatment for this disorder may be helpful for excessive Internet gamers, especially those that engage in microtransactions to purchase in-game loot boxes. Internet gaming disorder is mostly treated using psychological interventions, especially cognitive-behavioral therapy and motivational interviewing, and pharmacological interventions through antidepressants [13]. Cognitive-behavioral therapy for Internet gaming is supported by more evidence than other psychological and pharmacological interventions, with a previous meta-analysis [14] indicating that cognitive-behavioral therapy was highly effective at reducing Internet gaming disorder symptoms (Hedge’s $g = 0.92$, 95% CI = 0.50–1.34) and depression (Hedge’s $g = 0.80$, 95% CI = 0.21–1.38). This suggests that cognitive-behavioral therapy should be conducted to reduce pathological gaming behavior and depressive symptoms through behavior modification and relapse prevention [15]; however, research on the treatment and prevention of excessive loot box purchasing is currently insufficient. Thus, given the apparent close relationship between Internet gaming disorder and loot boxes, it is important to clarify the psychosocial characteristics of people who excessively purchase loot boxes by microtransactions using real money.

In this study, we conducted a systematic review to identify the characteristics of people who purchase loot boxes using real money. Specifically, this review focused on the relationships between (a) loot boxes and gaming, (b) loot boxes and gambling, and (c) loot boxes and other variables. This study aimed to reveal the psychosocial characteristics of people who excessively purchase loot boxes and identify factors that may develop or buffer loot box use. The findings of the present study are expected to provide valuable information that could be used to update treatment elements for Internet gaming disorder by incorporating treatment/prevention components for excessive loot box purchases.

Methods

Search Strategy

We conducted a search to identify studies that describe the bivariate relationships between loot boxes and other variables. We identified relevant articles published up to March 27, 2021, using multiple electronic databases (i.e., PsycINFO, PubMed, Ovid, EBSCO, and Web of Science) and the references cited in the reviewed articles. The selected search terms were “loot box” and “microtransaction.”

Inclusion and Exclusion Criteria

Studies included in the literature review met the following criteria: (1) written in English, (2) assessed a bivariate

relationship between loot boxes and other variables, and (3) were published in a peer-reviewed journal. Articles that included microtransactions in which people purchased pre-specified valuable in-game items (e.g., resources, gear, or skins) to enhance gameplay were excluded, as these were not considered to be associated with the gambling-like characteristics of loot boxes.

Screening Procedures

First, based on the inclusion criteria, four independent raters evaluated the title and abstract of each article as “include,” “exclude,” or “unsure.” Of the 201 articles extracted using the electronic search, we initially rejected 29 articles which all raters evaluated as “exclude,” resulting in 172 articles. Of these, 19 received an “include” evaluation by all raters, while 35 received inconsistent ratings (total 54 articles). Among the 172 remaining articles, 48 were duplicates and 70 did not meet inclusion criteria. We searched the reference sections of the 54 articles, which did not yield any new articles for review. Then, the four raters who previously reviewed the 201 articles independently read the full text of each of the 54 articles to evaluate them for inclusion. Inter-rater disagreements were resolved by discussion between the raters until they reached a consensus. Ultimately, 20 articles were selected for the systematic review (Table 1). Figure 1 presents the article extraction procedure.

Data Extraction

For each reviewed study, data were independently extracted by two raters who had previously reviewed the initial 201 articles. They resolved inter-rater disagreements by discussing until they reached a consensus. We collected the following information from each study: author, country/nationality, sample characteristics, research design, index of loot boxes, other variables related to loot boxes, and main results about the loot boxes.

Assessment of Methodological Quality

The two reviewers independently assessed the methodological quality of the included articles by applying the 14 items of the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies [36]. The summary score of each study was calculated, expressed as a percentage, and could range from 0 to 100%. We categorized the methodological quality into four categories: poor (0–24%), fair (25–49%), good (50–74%), or excellent (75–100%) based on a previous study [37]. For Brooks and Clark’s [16] article, because they had two studies in their article, we assessed each study independently. Consequently, we evaluated 21 studies based on 20 articles.

Results

Characteristics of Reviewed Studies

Table 1 shows each article’s study characteristics, sample characteristics, research design, and measures used to assess loot box use and loot box–related variables. Eight studies collected data from populations worldwide [11, 12, 16, 38–42]. For example, Zendle and Cairns [11] collected data from 14,182 participants across 95 countries via an online bulletin board. Moreover, data from three studies were collected from a specific group of countries; King et al. [43] collected data from the USA, Australia, Canada, and the UK via online forums related to specific games, while Drummond et al. [44] and Hall et al. [45] collected data from Australia, New Zealand, and the USA using an online survey tool. Fifteen studies used online questionnaires. Almost all studies were conducted using online survey platforms, such as Qualtrics and Amazon Mechanical Turk, or social networking services, such as Facebook and Reddit. One study used an online experimental design employing Qualtrics [46], while another was a local experimental study [47]. In addition, one study was the secondary analysis of combined open-access data [42]; another was a cross-sectional natural experiment [45].

For the measurement of loot box use and purchasing, only two studies [44, 45] used the Risky Loot Box Index [16], and almost all studies incorporated loot box–specific questions created by the researchers. These questions assessed participants’ engagement with loot boxes, such as obtaining loot boxes, frequency, and amount of purchase [12, 16, 38, 40, 42, 48–52]. In two experimental studies [46, 47], physiological variables (e.g., heart rate, skin conductance responses, and galvanic skin response) and subjective ratings relating to viewing an actual video of a loot box or obtaining an actual loot box were measured.

Loot Boxes and Gaming

Ten of the 20 studies reported a relationship between loot boxes and excessive gaming. Measurements assessing symptoms of Internet gaming disorder included the Internet Gaming Disorder Checklist [18], the Internet Gaming Disorder Scale [30], and items about problem online gaming [49]. People with excessive gaming symptoms were found to spend more on loot boxes than peers with low symptoms on one or both individual measures [44, 52]. In addition, participants who spent real money on loot boxes were significantly more likely than non-spenders to play a specific game for longer times on weekends, on more devices, and have more friends who also paid for loot boxes [43]. However, this cited study did not find any differences in the gaming history, time spent weekly playing a specific game, or time spent playing a specific game with friends between those who did and did not

Table 1 Study characteristics, sample characteristics, research design, and measurement of loot box use in the reviewed studies

Study	Country	Sample characteristics and population	Research design and setting	Index of loot boxes	Other loot box-related variables
DeCamp (2021)	USA	N = 13,042 (age: N/A; gender: N/A) Participants were 5th, 8th, and 11th grade students in public and public-charter schools	Cross-sectional study Data collection date: 2018 to 2019 Delaware School Survey	Spending on loot boxes	Parental bond Depression/anxiety Victimization Bullying Substance use School grades Gender Race/ethnicity
Hall et al. (2021)	Australia, New Zealand, USA	N = 1144 (age: 31.4±10.5; gender: 619 women, 499 men, 26 other) Participants who played video games	Cross-sectional study (natural experiment) Data collection date: the 7th and 9th of April 2020	Risky Loot Box Index [16], spending on loot boxes	Problem Gambling Severity Index [17] Internet Gaming Disorder Checklist [18] Self-isolating (eliminating contact with other people) or quarantined (under mandated self-isolation) by the pandemic
Ide et al. (2021)	Japan	N = 1615 (age: 14; gender: 595 girls, 1020 boys) Participants that played online video games, and these data were obtained from the Tokyo Teen Cohort study	Cross-sectional study Data collection date: Sep 2002 and Aug 2004	Spending on loot boxes	Items about problem online gaming
Rockloff et al. (2021)	Australia	N = 1954 (age: 53.0% 18–24, 47.0% 12–17, gender: 59.9% were girls and women) Participants aged 12 to 24	Cross-sectional study Data collection date: None	Playing loot boxes Opening loot boxes Buying loot boxes Selling loot boxes Attitudes toward loot boxes	Problem Gambling Severity Index [17] Short Gambling Harms Screen [19] Gambling frequency The amount of money spent on gambling Attitudes toward gambling
Close et al. (2020)	Australia, Global (online), New Zealand, USA	N = 7771 (age: N/A; gender: N/A) Datasets were combined from previous surveys	Secondary analysis of the combined open-access data Data collection date: None	Spending on loot boxes	Problem Gambling Severity Index [17]
Drummond et al. (2020)	Australia, New Zealand, USA	N = 1288 (age: 40.0±15.4; gender: 816 women, 457 men, 15 other) A sample representative to the age and income demographics of the country as reported in national Census data	Cross-sectional study Data collection date: None	Risky Loot Box Index [16], spending on loot boxes	Problem Gambling Severity Index [17] Internet Gaming Disorder Checklist [18] Positive and Negative Affect Scale-Short Form [20] Kessler Psychological Distress Scale [21]
King et al. (2020)	USA, Australia, Canada, The UK	N = 428 (age: 23.5±7.3; gender: 393 men, 28 women, 7 other) Fortnite players from online forums	Cross-sectional study Data collection date: Nov to Dec 2018	Spending on loot boxes	<i>Fortnite</i> Rating and Ranking Hours playing <i>Fortnite</i> Number of devices, payment methods, and friends who play or pay for <i>Fortnite</i> 24-item scale that measures perceived value of purchasing online game items [22]. Barratt Impulsiveness Scale-Brief [23] Gaming-Contingent Self-Worth Scale [24] Gaming Disorder Criteria [25]
Kristiansen and Severin (2020)	Denmark	N = 1137 (age: 43.7% aged 12–13, 41.0% aged 14–15, 15.4% aged 16; gender: 49.5% boys, 50.6% girls) A representative gross sample of 5000 Danish adolescents drawn randomly	Cross-sectional study Data collection date: None	Obtaining loot boxes Spending on loot boxes	The South Oaks Gambling Screen-Revised for Adolescents [26]

Table 1 (continued)

Study	Country	Sample characteristics and population	Research design and setting	Index of loot boxes	Other loot box-related variables
		from the Danish Civil Registration System		Selling virtual items that were originally obtained from a loot box	
Wardle and Zendle (2020)	The UK	N = 3549 (age: 33.4% 16–18, 31.0% 19–21, 35.6% 22–24; gender: 1627 boys/men, 1922 girls/women) Participants aged 16 to 24, and data were from the Emerging Adult's Gambling Survey	Cross-sectional study Data collection date: Jun to Aug 2019	Spending on loot boxes	Problem Gambling Severity Index [17] Gambling behaviors Gender Age group Ethnic group
Zendle (2020)	The UK	N = 1081 (age: 190 aged 18–27, 176 aged 28–37, 203 aged 38–47, 184 aged 48–57, 328 aged 58+; gender: 526 men, 549 women) Participants aged 18 or older were recruited by Prolific Academic, which was quota-sampled to be nationally representative of the 2011 UK Census	Cross-sectional study Data collection date: Aug 30 to Sep 9 2019	Spending on loot boxes Watching loot box openings	Gambling Disorder Criteria [1]
Zendle et al. (2020)	Global (online)	N = 1203 (age: 19.8% aged 18–24, 27.3% aged 25–29, 25.2% aged 30–34, 13.3% aged 35–39, 14.4% aged 40+; gender: 729 men, 445 women, 29 other) People who purchased and opened loot boxes within the last month	Cross-sectional study Data collection date: None	Spending on loot boxes Selling virtual items that were originally obtained from a loot box	Problem Gambling Severity Index [17]
Larche et al. (2019)	Canada	Experiment 1: N = 47 (age: N/A; gender: N/A) Students who played the game <i>Overwatch</i> and opened a loot box within <i>Overwatch</i> at least once in the past 4 weeks Experiment 2: N = 46 (age: N/A, gender: N/A) Students who played the game <i>Overwatch</i> and opened a loot box within <i>Overwatch</i> at least once in the past 4 weeks	Experimental study Data collection date: None	Videos of actual <i>Overwatch</i> loot box openings	Experiments 1 and 2: Subjective ratings of arousal and valence were measured using the Self-Assessment Manikins [27] Subjective ratings of urge to open another loot box (0–100) Loot box subjective value (1 = no worth, 16 = high worth). Experiment 2: Skin conductance responses force (quantified as the amount of pressure (mv) imparted on the modified mouse when the participant made the press response to initiate the subjective surveys following the loot box video).
Zendle (2019)	Global (online)	N = 112 (age: 22 aged 18–24, 39 aged 25–29, 31 aged 30–34, 11 aged 35–39, 9 aged 40+; gender: 80 men, 27 women, 5 other) Players of <i>Heroes of the Storm</i>	Cross-sectional and longitudinal study Data collection date: time 1 Mar 21 to Mar 24 2019, time 2 May 24 to Jun 3 2019	Spending on loot boxes	Problem Gambling Severity Index [17]
Zendle et al. (2019)	Global (online)	N = 1150 (age: 26.4% were 16, 26.6% were 17, 47.0% were 18; gender: 88% boys, 9% were girls, 3% other) Older adolescent gamers aged 16–18	Cross-sectional study Data collection date: Dec 20 to Dec 25 2019, time 2 May 24 to Jun 3 2019	Obtaining loot boxes Spending on loot boxes	Canadian Adolescent Gambling Inventory [28] Impulsivity [29]

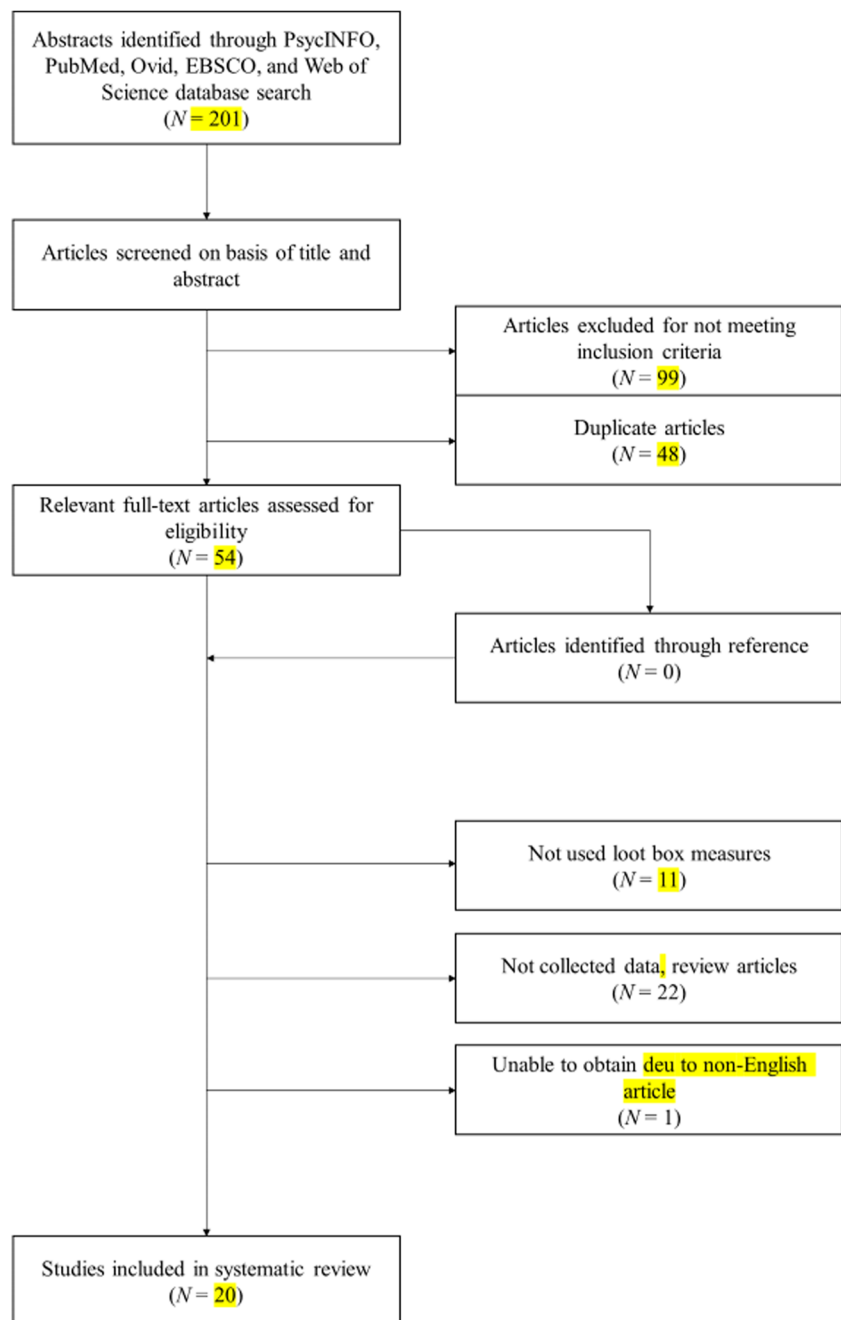
Table 1 (continued)

Study	Country	Sample characteristics and population	Research design and setting	Index of loot boxes	Other loot box-related variables
Li et al. (2019)	Global (online)	N = 618 (age: 27.0±8.9; gender: 394 men) Aged 18 or older	Cross-sectional study Data collection date: Aug to Nov 2018	Spending on loot boxes	Video gaming and online gambling engagement (frequency; 1 h, 1–2 h, 2–3 h, 3–5 h, 5–7 h, 7–10 h, and >10 h) DSM-5 Internet Gaming Disorder Criteria [30] Problem Gambling Severity Index [17] 18-item Brief Symptom Inventory [31]
Brooks and Clark (2019)	Study 1: Global (online) Study 2: Canada	Study 1: N = 144 (age: 34.0±10.0; gender: 48.6% women) Study 2: MTurk Workers who had completed ≥ 1000 MTurk tasks with > 98% approval ratings, resided in North America, were fluent in English, and aged 21 or older Study 2: N = 113 (age: 21.0±2.39; gender: 12.1% women) University students who participated in an online survey, and indicated familiarity with loot boxes	Cross-sectional study Data collection date Study 1: Feb to Mar 2018 Data collection date Study 2: Mar to Apr 2018	Risky Loot Box Index [16] Obtaining loot boxes Spending on loot boxes	Internet Gaming Disorder Scale [30] Financial subscale of the Domain-Specific Risk-Taking [32] Gambling Related Cognitions Scale [33] Darke and Freedman Beliefs Around Luck Scale [34] Problem Gambling Severity Index [17]
Zendle and Cairns (2019)	USA	N = 1172 (age: 237 aged 18–24, 342 aged 25–29, 300 aged 30–34, 148 aged 35–39, 150 aged 40+; gender: 751 men, 372 women, 50 other) Participants who regularly played one of the 10 most globally popular games that feature loot boxes	Cross-sectional study Data collection date: None	Spending on loot boxes	Problem Gambling Severity Index [17]
Brady and Prentice (2019)	Ireland	N = 25 (age: 24.56±3.50; gender: 25 men) Participants who played FIFA football games	Experimental study Data collection date: None	Loot box openings by using actual games	Game Addiction Scale [35]
Zendle and Cairns (2018)	Global (online)	N = 7422 (age: 3589 aged 18–24, 2066 aged 25–29, 1061 aged 30–34, 444 aged 35–39, 262 aged 40+; gender: 6,612 men, 694 women, 116 other). Participants who were gamers aged 18 or older	Cross-sectional study Data collection date: None	Spending on loot boxes	Problem Gambling Severity Index [17]
Macey and Hamari (2019)	Global (online)	N = 582 (age: 11 aged 14 or younger, 146 aged 15–17, 182 aged 18–21, 96 aged 22–25, 69 aged 26–29, 31 aged 30–33, 12 aged 34–37, 11 aged 38–41, 10 aged 42–45, 2 aged 46–49, 1 age 50+; gender: 535 boys/men, 32 girls/women, 4 other) Participants who had played video games and had watched eSports, and gambled or purchased loot boxes within the past 12 months	Cross-sectional study Data collection date: None	Spending on loot boxes	Problem Gambling Severity Index [17]

purchase loot boxes [43]. Similarly, compared to non-purchasers, participants who bought loot boxes were more likely to play a wide variety of video games (e.g., massively multiplayer online games, shooting games, and sports-themed games), reported significantly higher frequencies of video game engagement and extended gaming sessions (i.e., played

video games ≥ 7 h in one session), experienced severe problem gaming symptoms, and were significantly more likely to meet the proposed criteria for Internet gaming disorder [12, 49].

In addition, a regression analysis showed that the presence of Internet gaming disorder symptoms significantly predicted

Fig. 1 Flowchart of study selection

risky loot box use and purchasing [16]. Another study found a negative and unexpected relationship between loot box use and eSports; both average weekly hours and average monthly money spent purchasing loot boxes were found to have significant negative moderate relationships with eSports engagement (weekly hours: $p < .001$; $\Delta = -.180$, $\tau = -.131$, $p = .002$; monthly money: $p < .001$; $\Delta = .149$, $\tau = .148$, $p = .002$) [38]. As noted, there was a positive relationship between Internet gaming disorder-related symptoms and engagement with or investment in loot boxes; however, the negative relationship between eSports engagement and loot box purchasing was unexpected.

Loot Boxes and Gambling

Fourteen of the 20 studies reported a positive relationship between loot boxes and gambling. Correlational analyses indicated that loot box spending was significantly associated with scores on the Problem Gambling Symptom Index (PGSI; $r = .33$, Spearman's $\rho = 0.33$, Spearman's $\rho = 0.30$, $r = .28$, Spearman's $\rho = 0.14$) [17, 41, 42, 44, 45, 52] and the Canadian Adolescent Gambling Inventory (CAGI; Spearman's $\rho = 0.347$) [10, 28]. In addition, it was shown that the more people displayed severe problem gambling symptoms, the more money they spent on loot boxes. For example,

individuals with problem gambling behaviors were found to spend significantly more money on loot boxes than those with moderate-risk ($t(378) = 4.57, p < .001$), low-risk ($t(358) = 6.19, p < .001$), and non-problem gambling behaviors ($t(709) = 11.00, p < .001$); those with moderate-risk gambling behaviors also spent significantly more than those with low-risk ($t(336) = 2.40, p = .017$) and non-problem gambling behaviors ($t(687) = 4.31, p < .001$) [44].

Furthermore, the results of a pairwise comparison showed the effects of problem gambling on loot box spending (low-risk gamblers vs. non-problem gamblers: $d = .429$, moderate-risk gamblers vs. non-problem gamblers: $d = .568$, and problem gamblers vs. non-problem gamblers: $d = .548$) [11, 40]. In relation to a specific multiplayer game, *Heroes of the Storm*, which recently removed loot boxes from its online store, Zendle [39] conducted an analysis of players ($n = 112$) both before and after the loot box removal. The study showed that, after loot boxes were removed from the game, those who showed symptoms of gambling disorder appeared to spend significantly less money in-game compared with other groups. This finding indicated that those with gambling disorder symptoms spent more money in-game on loot boxes than any other player group.

In addition to the association between loot box purchases and gambling symptoms, loot box purchases were found to be related to gambling behavior and harms caused by problematic gambling. For example, Li et al. [12] showed that individuals who purchased loot boxes were also more likely to report a significantly higher frequency of online gambling, more extended online gambling sessions (i.e., gambled online ≥ 7 h in one session), and higher rates of problem gambling. Wardle and Zendle [51] found that loot box purchasers were more likely to have gambled on any form of gambling in the past year compared to non-purchasers (62.8%, 95% CI = 58.2–67.4% versus 39.7%, 95% CI = 38.0–41.4%, respectively). Rockloff et al. [50] also found an association between loot box purchasing and gambling in their sample of adolescents and adults. Those who either bought or sold loot boxes had positive attitudes toward gambling or loot boxes, gambled more frequently, had more gambling-related problems, and experienced more harms due to gambling as measured by the Short Gambling Harms Screen [19]. Furthermore, Brooks and Clark [16] examined the relationships among loot box purchasing, gambling symptoms, and gambling-related cognitive distortion. They showed that gambling-related cognitive distortion—as measured by the Gambling Related Cognitions Scale (GRCS) [33]—and problem gambling symptoms—as measured by the PGSI [17]—were significantly positively related to risky loot box use—as measured by the Risky Loot-Box Index, with correlations of $r = .491$ for the GRCS, and $r = .518$ for the PGSI.

Zendle et al. [41] examined certain variables as moderators to identify possible underlying mechanisms in the relationship

between loot box use and gambling symptoms. They showed that near-misses—i.e., some loot boxes show players a variety of rare items that players could have won upon opening that loot box, which typically implies that players have not won the valuable items from opening the loot box, thus being called “near-misses”—when buying loot boxes ($b = 0.064, t(1196) = 2.902, R^2$ change = 0.005, $p = 0.004$), being able to use in-game currency to buy loot boxes ($b = 0.068, t(1196) = 3.08, R^2$ change = 0.006, $p = 0.002$) and being able to use loot box contents to gain a gameplay advantage ($b = 0.069, t(1196) = 2.855, R^2$ change = 0.006, $p = 0.0044$), all significantly strengthened the relationship between loot box spending and problem gambling. However, the presence of crate and key mechanics ($b = 0.040, t(1196) = 1.877, R^2$ change = 0.002, $p = 0.06$) or exclusive items ($b = 0.008, t(1196) = 0.310, R^2$ change = 0.001, $p = 0.756$) did not significantly moderate the relationship between loot box spending and problem gambling. Similarly, in another study by Zendle et al. [10], the loot box being available for a limited time ($b = 0.014, t(1151) = 3.079, R^2$ change = 0.007, $p = 0.002$) and free loot box giveaways ($b = 0.014, t(1151) = 3.002, R^2$ change = 0.002, $p = 0.007$) significantly strengthened the relationship between loot box spending and problem gambling. Thus, as noted above, there appears to be a positive relationship between gambling and engagement with, or investment in, loot boxes.

Loot Boxes and Other Variables

Excessive gaming and gambling symptoms and behaviors accounted for most of the variables associated with loot boxes. However, loot boxes have also been found to be associated with other variables. For example, regarding the relationship between loot box spending and mood, loot box spending was significantly associated with positive mood ($r = .163$), negative mood ($r = .140$), and psychological distress ($r = .138$ as measured by the Kessler Psychological Distress Scale) [44]. In addition, DeCamp [48] showed that being bullied in one’s neighborhood was associated with more loot box purchasing ($\beta = 0.057, p < .001$). Meanwhile, Li et al. [12] examined the relationships between loot box purchasing, problem video gaming, and mental distress among other related variables. While controlling for the direct and indirect effects of gaming frequency and extended gaming sessions, their results indicated that loot box purchasing increased problem video gaming which led to increased mental distress. Furthermore, Hall et al. [45] compared loot box spending for isolated and non-isolated participants during the COVID-19 pandemic. They found no evidence of differences in spending on loot boxes between participants in self-isolation/quarantine and those who were not. However, contamination concern was weakly associated with loot box spending (Spearman’s $\rho = .163$) and Risky Loot Box Index score (Spearman’s $\rho = .247$).

In addition, King et al. [43] have examined the effects of online gamers' perceived value of purchasable items in the game *Fortnite* [22], and gaming-contingent self-worth [24], on loot box spending. These findings showed that important predictors of loot box spending were one's intention to purchase game items (odds ratio = .272), the visual authority value (odds ratio = -.164), and one's reward orientation (odds ratio = .066). Thus, those who intend to buy loot boxes (e.g., I intend to buy game items in the future) and those whose self-esteem is enhanced through gameplay (e.g., when I do better in the game, I feel better in general) tend to buy loot boxes, while those who value better game character visuals (e.g., I can adorn my game characters to be more fashionable or stylish) and attention from others (e.g., I am more noticed by others) are less likely to purchase loot boxes. Furthermore, Larche et al. [46] used the online survey platform Qualtrics to examine the moods and physiological states of college students according to the grade of opened loot boxes; these were rated in order of the probability of winning a better item as "Legendary," "Epic," and "Rare." This study showed that rarer loot boxes were subjectively more arousing, positively valenced, and more likely to induce the urge to open more boxes.

Regarding gender differences and loot box purchasing, the research findings have been inconsistent. For example, Kristiansen and Severin [53] showed that male gamers were markedly more engaged in loot boxes than female gamers (obtained loot box = χ^2 241.7, bought loot box or key to unlock loot box = 128.7, sold item from loot box = 70.1, $p < .001$). DeCamp [48] found that female gamers had significantly lower amounts of loot box purchasing ($\beta = -0.528$, $p < .001$), and Wardle and Zendle [51] showed that among young people (aged 16–24), those who purchased loot boxes were disproportionately more likely to be male than those who had not. However, King et al. [43] did not find gender differences in loot box purchasing.

In relation to physiological state while purchasing and opening loot boxes, Brady and Prentice [47] examined the relationships among addictive gaming symptoms—as measured by the Gaming Addiction Scale (GAS) [35]—heart rate (HR), and galvanic skin response (GSR) while gaming and opening loot boxes in 25 adult male participants. A prior study on gambling [54] showed that the gamer's physiological arousal increased while opening a loot box. However, Brady and Prentice [47] showed that, in relation to baseline measurements, participants' GSR increased, while their HR remained unchanged, when they opened loot boxes. In addition, a study on gambling found that those with gambling disorder were less sensitive to rewards based on GSR readings, indicating that problem gamers are less sensitive when they open loot boxes [55]. Relatedly, Brady and Prentice [47] found a statistically significant and moderately strong negative correlation between the GAS score and GSR when the prize in a loot box

was displayed ($\rho = -.43$, $p = .03$). There was also a strong negative correlation between GAS score and HR while playing the game ($\rho = -.56$, $p = .01$), opening a loot box ($\rho = -.46$, $p = .02$), and when the prize in a loot box was displayed ($\rho = -.46$, $p = .02$).

Regarding motivations for purchasing loot boxes, Zendle et al. [10] identified the following reasons as to why gamers may buy loot boxes: to gain gameplay advantages (21.9%), gain specific items and characters and create a collection (19.2%), and experience the fun, excitement, and thrills of opening the loot box itself (16.0%).

Methodological Quality

The mean score on the Quality Assessment Tool was 39.7% (range 21.4–64.3%). There were no studies with excellent quality, four studies had good quality, fifteen studies had fair quality, and two studies had poor quality (see Table 2).

Discussion

The present study conducted a review of the literature to clarify the characteristics of people who purchase loot boxes with real money and identify factors that may encourage or buffer loot box spending. Specifically, for characteristics of people purchasing loot boxes, this review focused on the relationships between (a) loot boxes and gaming, (b) loot boxes and gambling, and (c) loot boxes and other variables.

Ten of the 20 reviewed studies reported a relationship between loot boxes and gaming. Overall, this review found a positive relationship between Internet gaming disorder-related symptoms and engagement with, or investment in, loot boxes—as loot boxes are essentially a component of Internet games. Therefore, specific focus on curbing excessive loot box use could help to increase the effectiveness of treatment for gaming disorders. At present, regarding the treatment of gaming disorders, Stevens et al. [14] found that cognitive-behavioral therapy was highly effective at reducing Internet gaming disorder symptoms and depression at post-test through meta-analyses. However, in the cognitive-behavioral model of Internet gaming disorder, the cognitive, affective, and behavioral problems related to loot box purchasing have not been addressed, and generalized treatment components for such purchasing have not been established [56]. Cognitive-behavioral treatment approaches focused on loot box use, such as behavior modification through self-monitoring to reflect on the advantages and disadvantages of one's own loot box purchasing, should be considered. In the future, components focusing on loot box purchasing for dealing with Internet gaming disorder could be effective at reducing gaming problems related to loot boxes.

Table 2 Studies' quality assessments by the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total y's (%)	Quality rating
Decamp et al. (2021)	y	y	y	y	n	n	n	y	y	n	n	n	o	y	7 (50.0%)	Fair
Hall et al. (2021)	y	y	o	n	n	y	o	n	n	n	n	n	o	n	3 (21.4%)	Poor
Ide et al. (2021)	y	n	n	n	n	n	n	y	n	n	n	n	o	y	3 (21.4%)	Poor
Rockloff et al. (2021)	y	y	o	n	n	n	n	y	n	n	n	n	o	y	4 (28.6%)	Fair
Close et al. (2020)	y	y	y	y	n	n	n	y	n	n	n	n	o	y	6 (42.9%)	Fair
Drummond et al. (2020)	y	y	y	y	y	n	n	y	y	n	y	n	o	y	9 (64.3%)	Good
King et al. (2020)	y	y	y	n	n	n	n	n	n	n	n	n	o	y	4 (28.6%)	Fair
Kristiansen and Severin (2020)	y	y	n	n	n	n	n	y	y	n	n	n	o	y	5 (35.7%)	Fair
Wardle and Zendle (2020)	y	y	y	y	n	n	n	y	n	n	n	n	o	y	6 (42.9%)	Fair
Zendle (2020)	y	y	y	y	y	n	n	y	y	n	y	n	o	y	9 (64.3%)	Good
Zendle et al. (2020)	y	y	y	y	n	n	n	y	n	n	n	n	o	y	6 (42.9%)	Fair
Larche et al. (2019)	y	y	y	n	n	y	y	y	y	n	n	n	o	n	7 (50.0%)	Fair
Zendle (2019)	y	y	y	y	n	y	o	y	y	n	n	n	n	y	8 (57.1%)	Good
Zendle et al. (2019)	y	y	y	n	n	n	n	y	y	n	n	n	o	y	6 (42.9%)	Fair
Li et al. (2019)	y	y	y	n	n	n	n	y	n	n	n	n	o	y	5 (35.7%)	Fair
Brooks and Clark (2019) Study 1	y	y	y	y	n	n	n	y	y	n	y	n	o	y	8 (57.1%)	Good
Brooks and Clark (2019) Study 2	y	y	y	y	n	n	n	y	y	n	n	n	o	n	6 (42.9%)	Fair
Zendle and Cairns (2019)	y	y	o	o	y	n	n	y	n	n	y	n	o	n	5 (35.7%)	Fair
Brady and Prentice (2019)	y	y	y	n	n	n	n	y	y	n	n	n	o	n	5 (35.7%)	Fair
Zendle and Cairns (2018)	y	y	n	n	n	n	n	y	y	n	n	n	o	n	4 (28.6%)	Fair
Macey and Hamari (2019)	y	y	y	y	n	n	n	y	n	n	n	n	o	y	6 (42.9%)	Fair

y yes, n no, o other

In this review, it was noted that the relationship between eSports engagement and loot box purchasing was unexpectedly negative [38]. Unlike general gaming, certain skills and techniques are required for eSports engagement. For example, according to a systematic literature review on the psychological aspects of eSports [57], eSports players try to be highly knowledgeable about the video game, think strategically and make fast and smart decisions, are motivated to keep moving forward (i.e., do not think about past performance), are able to separate daily life from performance, avoid being distracted and stay focused, cope adaptively with harassment, maintain a growth mindset (i.e., positive attitude), and warm-up before a performance, either physically or mentally. Furthermore, compared to recreational gamers, albeit eSports gamers were reported to have significantly higher average game times on weekdays and weekends, the latter had significantly lower psychological symptoms [58]. In other words, the negative relationship between eSports gaming and loot box purchases may be due to eSports gamers playing games in a healthier manner than recreational gamers. In the future, it would be important to assess loot box use, and ways to prevent its problematic use, by identifying adaptive aspects and protective factors in professional gamblers and eSports players.

Fourteen of the 20 studies reported a positive relationship between loot boxes and gambling. Positive correlations were

shown between high gambling severity and investment in, and engagement with, loot boxes; variables related to loot box use during gameplay (e.g., near-misses when buying loot boxes) mediated this relationship. Thus, loot box engagement was associated with not only symptoms of gambling disorder but also the interactions among these gambling symptoms and other game-related factors. In addition, one study showed a positive correlation between gambling-related cognitive distortions and risky loot box use [16]. In treatment for gambling disorder, addressing cognitive distortions is an important component for reducing gambling disorder behaviors. Considering the gambling-like nature of loot boxes, a study remarked that cognitive distortions about loot boxes in the context of gaming may promote their excessive use [44]. Therefore, if cognitive distortions about loot box engagement can be clarified and measured, the early detection of signs or behaviors leading to excessive loot box engagement could be used in the prevention and treatment of Internet gaming disorders.

In addition to gaming and gambling, the relationships among loot box engagement and other variables, such as mood, gender, physiological state, and motivation, have been examined. However, because there have been only a small number of studies on these variables in relation to loot box purchases and the findings have been inconsistent, we are

unable to draw any conclusions about these relationships. Future studies should aim to identify the characteristics of people who excessively purchase loot boxes and identify factors that may contribute to or buffer this behavior.

Through this review, we found that while there were many cross-sectional questionnaire studies that examined the relationship between loot box engagement and spending, gaming, gambling, and other variables, there were few studies that used experimental designs. However, one experimental study [47] examined dynamic physiological processes and changes, such as physiological states, during gaming and opening loot boxes. In the cognitive-behavioral model of Internet gaming disorder, the cognitive, affective, and behavioral processes related to gameplay have been shown to be interrelated, and cognitive-behavioral therapy for Internet gaming disorder could provide skills and coping mechanisms to address these issues [56]. Therefore, to develop effective cognitive-behavioral interventions focused on gamers' loot box use, more research is needed on the cognitive, affective, and behavioral processes that are associated with loot box engagement and spending money on loot boxes. For example, an important diagnostic criterion for gambling disorder is “chasing” (i.e., after losing money in gambling, the person often returns another day to get even). Considering the gambling-like nature of loot boxes [9], clarifying the mechanism underlying chasing loot boxes could be a new treatment direction focused on loot box engagement.

Limitations

First, we excluded studies that were not available in English. As high prevalence estimates of Internet gaming disorder have been found in Asia and North America and many studies on the topic might have been published in non-English language journals, this exclusion may be a limitation in this review [3]. Second, although we identified the relationships between loot box engagement and gaming, gambling, and other variables, it remains unclear as to whether these relationships are common across game genres (e.g., massive multiplayer online role-playing games, puzzles) or limited to a specific genre. Thus, future research on trans-genre or nontrans-genre characteristics of loot boxes is needed. Third, we assessed the methodological quality of the included articles by the Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies [36] and found that the methodological quality of the articles was relatively low. For example, all outcome measures in the 20 studies reviewed were self-report measures. To improve methodological quality, blinded assessors and logs of purchases and logins could be used, which would allow for more objective measurement. Furthermore, because undesirable responses might be given in online surveys (e.g., short time for answering the

questionnaire), it is important to establish satisfactory measures as exclusion criteria.

Conclusion

The present review clarified the relationships between loot box engagement and gaming, gambling, and other variables, such as mood, gender, physiological state, and motivation, and partially identified the characteristics of people who purchase loot boxes using real money. Specifically, those who spend more money in-game on loot boxes exhibit Internet gaming-related and/or gambling disorder symptoms and behaviors.

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Declarations

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