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Validation of the yRAFFLE: an implementation of the RAFFLE inventory for loot box engagement in a youth cohort

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Abstract

Background Play is pivotal in human development, and as such the human experience. In young people, play is increasingly taking the form of video gaming—capturing a large share of the entertainment sector and potentially exposing young people to new instances of harmful behaviour. Loot boxes (purchasable items where the contents are chance based, which have structural and psychological similarities to gambling) generate significant income for the sector. They have, however, been understudied in young people. The present research validates a lightly modified version of the Reasons and Facilitators for Loot box Engagement (RAFFLE) inventory in a youth population – the youth RAFFLE (yRAFFLE).

Results Five hundred six young people were recruited from urban and rural schools, including both sexes and ages 10 to 14. The psychometric properties, internal and convergent validity of yRAFFLE were assessed. Through confirmatory factor analysis, a seven-factor (*Enhancement, Progression, Social Pressure, Distraction/Compulsion, Altruism, Fear of Missing Out,* and *ReSale)* solution was established, confirming the same factor structure previously observed in an adult cohort. Inspection of standard fit measures showed the seven-factor solution to fit above benchmarks and the original RAFFLE. Cronbach's alpha for the whole scale was 0.95 and subscales ranged from 0.73 to 0.89. yRAFFLE was highly correlated with the Video Game Addiction questionnaire. Finally, yRAFFLE showed measurement invariance to sex, location, and age.

Conclusions The finalised yRAFFLE is a robust measure of 23 items for the motivations for loot box engagement in young people, that acts a parallel to its counterpart in adults. The yRAFFLE functions as a methodological tool to capture, measure, and understand young people's engagement with loot boxes.

Keywords Loot boxes, Video games, Gambling, Young people, Scale validation

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Introduction

Play provides a vital experience in human development which involves learning about the self and the rules that allow us to navigate our social and material worlds [1]. Play is also now an integral part of the way in which children and young adults navigate the digital world through engagement with online gaming and social media. Current estimates suggest that 89% of children are playing video games [2], with 75% of 12–17 year olds and 69% of 8–11 year old engaging in online forms of video gaming [2]. For many children and young people, online gaming confers both benefits and rewards in a range of health, psychosocial and learning outcomes [3–5], though the extent of these benefits may be limited to intrinsic motivations link to well-being rather than gaming particularly [6]. Whilst many young online gamers derive these benefits, there are a proportion of young online gamers who experience difficulties with 'problematic gambling'. Neurodivergent children and young people, and those experiencing social issues (such as difficulties with social relationships, poor behavioural control, and social anxiety) may be particularly at risk especially with videogames that employ highly rewarding and chance-based features [7].

The proliferation and popularity of online gaming has generated revenue for the wider gaming industry that has risen steadily year on year; as a sector video gaming is predicted to be worth $321 billion by 2026 [8]. The broader gaming sector contains blockbuster "AAA" games and international production studios, but the monetisation of play has seen the introduction and widespread adoption of "in app" purchasing across a wide variety of platforms and consoles. Revenue derived solely from "in app" purchasing and micro transactions, often seen as additional content, is predicted to generate $20 billion dollars of net profit by 2025 [9]. Additional content in video games is a growing area of interest for industry and thus important to explore in relations to those engaging in play.

The purchasing of digital items in online games serves a variety of purposes and enhancements for the player. Players are able to change the appearance of their characters by purchasing new "skins" and buy new accessories to fulfil aesthetic value, or they are able to advance further and quicker in a game by buying functional upgrades (i.e. improved weaponry) or better players (e.g. in FC Ultimate Team; formerly known as FIFA) or by skipping levels or challenges, known as *Pay-to-Win* purchases [10]. There are digital items that can be bought for fixed costs where buyers know exactly what they are purchasing, or there are those which are obtained through the purchasing of a "loot box". "Loot boxes" are digital items or containers that offer surprise content, revealed after opening [11], defined as any game-related purchase with a chance based outcome [12]. This process randomises the rewards gained and provides a chanced based element to purchasing.

Loot boxes share psychological and structural similarities with gambling [11, 13, 14]. From a psychological perspective, the payout schedule of occasional, highly prized items is akin to the variable reinforcement schedules observed in gambling, which are known to be linked with compulsive and harmful behaviours. From a structural perspective, the staking of money is the same as gambling—but what is different is the fact that the "winnings" usually do not have explicit monetary value (a legal requirement of gambling in most jurisdictions). Nonetheless, the digital items won within loot boxes can often be traded on both primary markets (i.e. those facilitated by gaming companies such as the 'Steam Marketplace') and secondary "black" markets with players at risk of purchasing 'losses' e.g., worthless items or, if lucky, highly prized items, through variable reinforcement schedules [15]. Such monetisation features are possibly normalising gambling like experiences for children and young people [9, 16–18], presenting a potential "gateway" to gambling related harms.

Loot boxes are currently subject to industry-led (but government mandated) consumer protection measures within the UK [19]. Other countries such as Belgium and China have attempted to regulate loot boxes; albeit with mixed success [20, 21], and legislation is in draft to do so in Spain, Brazil and Australia, see Declerck and Feci [22] for a thorough review of national and international regulation. NHS England [23] recently raised concerns that loot boxes were exposing children and young people to gambling, and research in adults has linked loot boxes with 'problem gambling' [12, 14, 17, 18]. Recent research has also confirmed that for some children and young people, exposure to loot boxes results in emotional and financial harm [24] and increased participation in gambling [25]. However, the underlying mechanisms of how and for whom loot boxes present a risk or cause harm in children and young adults has yet to be fully explored from a neuropsychological perspective and is likely to be a fertile area for future research.

At present, there is limited evidence around loot box engagement within youth and child cohorts. Kristiansen and Severin [26] explored loot box engagement in a representative Danish sample of online gamers aged between 12–16 years, finding a significant positive correlation between loot box engagement and problem gambling severity, with just under half the sample reporting loot box engagement. In a large ($n=2080$) survey of 16–24 year olds, Wardle and Tipping [27] reported that young people who purchased loot boxes were significantly more likely to gamble and experience 'problem gambling'. They concluded that young adults who purchase loot boxes within games should be considered high risk for gambling-related problems. Similar findings have been reported in study of young people in Australia [28].

Few studies have explored or characterised loot box engagement in children and young people in the UK. From the adjacent field of gambling, it is established that context and culture are important factors of both engagement and harm [29, 30]. As knowledge of individual motivations for risky behaviour can be valuable in informing early health and educational interventions [31], understanding motivations for purchase is a priority for informing harm prevention in young people.

Motivations for loot box engagement have been measured but this measure is currently only validated in an adult population. The Reasons and Facilitators of Loot box Engagement (RAFFLE) [32] was developed and tested in two UK samples to better understand and measure motivations for the purchase of loot boxes. RAFFLE identified seven motivations measured across 23 items: enhancement, progression, social pressure, distraction/compulsion, altruism, fear of missing out, and resale. As with other aspects of loot box research, the motivations share some overlap with motivations for gaming and gambling engagement while also representing some divergence. Though it is anticipated that a similar pattern of motivations will be seen in children and in young people, validation for a youth cohort is essential before the measure is employed in empirical settings.

Adapting measures originally developed in an adult population is an instrumental step towards the robust study of a phenomena in a youth cohort [33]. As DeVellis and Thorpe [34] note, the validation of scales are population specific and should one wish to expand beyond the original population revalidation is required. The measurement properties of a scale do not automatically transfer, especially when developmental stages are crossed [35–37]. To further consider the overlap between gambling engagement and loot box motivations, measure of gambling engagement and harm have been adapted for youth or adolescent cohorts and are necessitated by the potentials for misinterpretation, positive bias (see [38]), and technological competence [39]. Validation of the existing RAFFLE tool is an important step towards robust and appropriate analyses of young people's loot box motivation that does not rely on potentially nontransferable measurement attribute of an adult measure.

As part of a cross-sectional survey across educational key stages 2 and 3 (ages 7–11 and 11–14 respectively), we sought to investigate the relationship between a range of social, educational, and psychological variables with gaming and loot box behaviour. In this cross-sectional work we adapted youth version of the RAFFLE scale, originally developed and tested for adults. This 23-item scale probes the motivations for loot box engagement and was developed from qualitative and cognitive interviews with adult loot box purchasers. The present work therefore aims to validate the original RAFFLE scale in a youth cohort with minor revisions to item wording for improved comprehension.

Methodology

A cross-sectional online survey was constructed to investigate the relationship between a range of psychosocial and educational variables and online gaming and loot box engagement in young people in the UK.

Participants

A total of 506 young people completed the survey, including 200 (39.5%) females and 300 (59.3%) males, six (1.2%) participants did not specify. Participants were of both Primary ($n=27$; 5.3%) and Secondary ($n=463$; 91.5%) school level, 16 (3.2%) participants did not specify. 71 (14.1%) participants were aged between 10 and 11, 405 (80.2%) were aged between 11 and 14, while 29 (5.7%) did not specify; age was separated to represent the differences across school levels. Participants were from schools in both rural ($n=140$; 27.7%) and urban ($n=322$, 63.6%) locations, 44 (8.7%) did not specify. Those who did not specify were not excluded from analyses. Participants were recruited either via a school invitation email, a targeted newsletter, social media messages, or via family and friends using snowball sampling. Students were sampled from two primary schools (evenly distributed) and one large comprehensive school in the South of England and were not limited to those that identified as "gamers" to better represent the distribution of videogame experience in this cohort.

Material and methods

Participants were provided with a link to a Qualtrics survey which probed their experiences of online gaming (e.g., trying to control time spent gaming, being deceptive about gaming), personality characteristics, strengths and difficulties (e.g., prosocial behaviour, conduct), and their motivations for engaging with loot boxes using Likert scales – the yRAFFLE inventory. This paper reports on the psychometric development of the yRAFFLE as a component of the wider cross-sectional survey.

yRAFFLE

The yRAFFLE inventory was adapted from [32] RAFFLE inventory. All 23 items were retained but several were reworded for ease of understanding in a cohort of young participants (see Table 1 for reworded items).

Table 1 Raffle and yRAFFLE Items with factor modified from the original RAFFLE validation [32]

Item no	RAFFLE item	yRAFFLE item	Factor
1	To get items that I find **visually appealing**	To get items that **look nice**	Enhancement
2	To get items that make me **feel good about myself**	To get items that make me **feel good**	Enhancement
3	To try and get something personally valuable to me	To try and get something personally valuable to me	Enhancement
4	Because it's fun	Because it's fun	Enhancement
5	Because I like the feeling of winning when I get something good/rare	Because I like the feeling of winning when I get something good/rare	Enhancement
6	For the excitement of seeing what will be inside	For the excitement of seeing what will be inside	Enhancement
7	To get past a **hurdle or sticking point** in the game	To get past a **difficulty or a challenge** in the game	Progression
8	To get items that will be useful/give me an advantage	To get items that will be useful/give me an advantage	Progression
9	Because I've had a failure or defeat in the game	Because I've had a failure or defeat in the game	Progression
10	Because my friends encourage or pressure me to	Because my friends encourage or pressure me to	Social Pressure
11	So that I don't get shamed/made fun of	So that I don't get shamed/made fun of	Social Pressure
12	Because I don't want to feel left out	Because I don't want to feel left out	Social Pressure
13	Because I am bored	Because I am bored	Distraction/Compulsion
14	Because I can't stop myself	Because I can't stop myself	Distraction/Compulsion
15	Because I get an urge to open them	Because I get an urge to open them	Distraction/Compulsion
16	To take my mind of the real world or my day to day life	To take my mind of the real world or my day to day life	Distraction/Compulsion
17	To support good causes	To support **a charity** or good cause	Altruism
18	To support the developer/platform	To support the developer/platform	Altruism
19	Because there is an in-game event taking place	Because there is an in-game event taking place	Fear of Missing Out
20	To get items that I'm collecting	To get items that I'm collecting	Fear of Missing Out
21	Because I don't want to miss the chance to get a limited time item or offer	Because I don't want to miss the chance to get a limited time item or offer	Fear of Missing Out
22	To try and win items that I can make gaming currency out of	To try and win items that I can make gaming currency out of	ReSale
23	To try and win items that I can make real money out of	To try and win items that I can make real money out of	ReSale

Note. Changes between the original RAFFLE and those delivered to a youth cohort are highlighted in bold

Participants rated the frequency of each item being the reason they purchased a Loot Box, responding: "Never", "Occasionally", "Often", or "Always" placed on a 1 – 4 scale, where 1 represents "Never" and 4 "Always". As with the RAFFLE inventory scores are summed, and higher scores indicate greater motivation to engage with loot boxes. To adapt the RAFFLE measure for a youth cohort two young people (a convenience sample to augment the authors' expertise) with lived experience of loot box engagement were consulted in the rephrasing of items. Making of the input from the young people and the wider research team, the following changes were made to 4 items (see Table 1); "that I find visually appealing" was changed to "that look nice" (item 1), the word "myself" was deleted from item no. 2, "To get past a hurdle or sticking point in the game" was changed to "To get past a difficulty or a challenge in the game" (item 7), the words "or charity" were added to "to support good causes" (item 17) to exemplify. These minimal changes were performed to simplify or clarify language and meaning.

Gaming addiction

The Video Game Addiction Questionnaire [40] was used to assess Gaming Addiction. The Video Game Addiction Questionnaire measures the risk of addictive gaming behaviour according to the proposed/provisional DSM–IV criteria for pathological gambling disorder and was developed in a sample of respondents aged between 8 and 18 years. An answer of "Yes" or "Sometimes" to any of at least 6 out of 11 questions indicates a risk for problematic gaming. The scale had an internal reliability of $\alpha = 0.79$ ($\omega = 0.80$), and is thus widely considered as acceptable [41]. It is worthy of note that current calls exist for a move away from pathologized views of gambling as "Problem" vs "Non Problem" to harms based approach rooted in public health models [42, 43].

Analyses

Confirmatory Factor Analysis was conducted in JAMOVI [44] using the SEM package. The seven factor structure was pre-specified using the structure identified and validated in the original RAFFLE inventory development [32]: *Enhancement*, *Progression*, *Social Pressure*,

Table 2 Summary of fit indices

Model	*χ2*	*df*	*p* Value	*SRMR*	*CFI*	*RMSEA*	*TLI*
yRAFFLE	338.00	209	< .001	.042	.998	0.04	0.998
RAFFLE	18,948.52	253	< .0001	.066	.89	0.08	0.87
Benchmark	-	-	> .05	< .08	> .90	< 0.07[a]	> 0.90

Note. Benchmark values are given by Hooper et al. [46] and compared to the original RAFFLE inventory for adult populations reported in [32]

[a] The Benchmark value for *RMSEA* was informed bySteiger [47]

Distraction/Compulsion, *Altruism*, *Fear of Missing Out*, and *ReSale*. Following the assumptions made by Lloyd et al. [32, 45] and those recommended by Hooper et al. [46], Diagonally weighted Least Squares was used. Goodness-of-fit indices are compared to both the original inventory and the benchmarks given by Hooper et al. [46] and Steiger [47], displayed in Table 2. Internal reliability was assessed using Cronbach's alpha, and convergent validity was assessed using the Video Game Addiction Questionnaire.

Availability of data and materials

The data supporting the conclusion of this article are available in the OSF repository, [https://osf.io/ut7k4/?view_only=ff73862528e54ebdb2e9d68d8226496a]. To make use of the scale presented and validated here, please contact the authors for reproduction rights.

Results

Confirmatory Factor Analysis (CFA)

A seven-factor solution was successfully fit. Fit indices are summarised and compared to both RAFFLE and benchmarks in Table 2. As is typical in large samples [46, 48] Chi-square was significant ($\chi^2=338$, $df=209$, $p<0.001$) and thus more informative fit indices were included, utilising both incremental and absolutes indices of fit.

Inspection of Standardised Root Mean Square Residual (*SRMR*) value indicates good fit, being lower than both the 0.08 benchmark and the value of 0.066 reported in the original RAFFLE – being the most well suited to Likert-type response [46]. This indicates yRAFFLE to be well fitting in a population of young participants. Following this: Comparative Fit Index (*CFI*) was greater than both the benchmark and the original, Root Mean Square Error of Approximation (*RMSEA*) was 0.04 lower than both the benchmark and the original, and the Tucker-Lewis Index (*TLI*) was also greater than both the benchmark and the original.

Reliability and convergent validity

Cronbach's alpha for the total scale indicated excellent (0.95) internal consistency and the subscales all indicated good to excellent (0.73 to 0.89) [41]. Table 3 contains a summary of all reliability measures. The original RAFFLE measure reported Cronbach's alpha had good (0.87) internal consistency with individual subscales all adequate to good (0.60 to 0.82). Additionally, McDonald's Omega further corroborated this (0.95).

Table 3 Validity and reliability metrics for yRAFFLE, overall and subscale descriptives

yRAFFLE Measure	Gaming Addiction	Cronbach's α	
		yRAFFLE	RAFFLE
Total Score	0.525***	.948	.843
Enhancement subscale	0.490***	.890	.789
Progression subscale	0.438***	.823	.787
Social Pressure subscale	0.382***	.853	.718
Distraction/Compulsion subscale	0.513***	.827	.751
Altruism subscale	0.242***	.749	.687
Fear of Missing Out subscale	0.454***	.863	.702
ReSale subscale	0.409***	.729	.563

Note. $N=506$. *** $p<.001$, one-tailed. Cronbach's α is compared to the original RAFFLE inventory for adult populations [32]

In examining convergent validity Spearman's Rank correlation coefficient was employed due to the violation of normality assumptions in Gaming Addiction (measured with the Video Game Addiction Questionnaire) ($W=0.96$, $p<0.001$) and yRAFFLE ($W=0.90$, $p<0.001$). There are highly significant correlations with the Gaming Addiction inventory between both the overall scale ($r_s=0.525$, $p<0.001$) and each of the sub scales, ranging from $r_s=0.24$ to $r_s=0.51$ and all significant at $p<0.001$ (see Table 3 for full summary).

Measurement invariance

Measurement invariance across three multi-group factors was assessed: sex, location, and age. School level was not assessed for measurement invariance as it was predicated by age. Invariance was assessed by comparing fit indices for configural, metric, and scalar models using the semTools package [49] in R [50], where change in *CFI* should be lower than 0.01 and change in *RMSEA* lower than 0.015 [51]. Measurement invariance was found across all three of the multi-group factors assessed (see

Table 4 Assessment of measurement invariance

Multi-Group Factor	Invariance Model	*CFI*	*RMSEA*	*ΔCFI*	*ΔRMSEA*
Sex	Configural	0.889	0.090		
	Metric	0.886	0.090	0.004	0.000
	Scalar	0.883	0.089	0.002	0.001
Location	Configural	0.887	0.092		
	Metric	0.885	0.091	0.002	0.001
	Scalar	0.885	0.089	0.000	0.002
Age	Configural	0.893	0.088		
	Metric	0.892	0.087	0.001	0.001
	Scalar	0.890	0.086	0.002	0.001

Note. Measurement invariance is supported by $\Delta CFI \leq 0.01$ and $\Delta RMSEA \leq 0.015$ [51]

Table 5 Summary scores for whole yRAFFLE measure and subscales

yRAFFLE Measure	Mean Score	*SD*
Total Score	1.62	0.59
Enhancement subscale	1.88	0.79
Progression subscale	1.65	0.78
Social Pressure subscale	1.36	0.63
Distraction/Compulsion subscale	1.43	0.64
Altruism subscale	1.62	0.73
Fear of Missing Out subscale	1.65	0.76
ReSale subscale	1.48	0.72

Note. $N = 506$

Table 4), suggesting that yRAFFLE performs uniformly across the sex, location, and age of respondents.

Subscale scores

Subscales were explored in relation to the Video Game Addiction Questionnaire (see Table 3) with the *Distraction/Compulsion* subscale being most strongly correlated with Gaming Addiction ($r(504) = 0.53$, $p < 0.001$) and the *Altruism* subscale being most modestly correlated ($r(504) = 0.22$, $p < 0.001$). Table 5 captures the magnitude of response for each subscale in addition to the overall yRAFFLE scale, showing *Enhancement* as the highest scored motivator for loot box engagement.

Discussion

This study sought to test the psychometric validity of the RAFFLE scale [32] on a youth cohort after minor revisions to item wording for improved comprehension – creating the yRAFFLE (youth Reasons and Facilitators of Loot box Engagement). This work forms part of a larger study investigating the relationships between loot box purchasing, gaming, personality and psychosocial functioning in Key Stage 2 & 3 adolescents (Lloyd et al., in prep.). The impetus to validate and develop the yRAFFLE as a youth measure of motivations of loot box purchasing, stems from the growing research base that links loot box engagement with problematic gaming and gambling [17, 18, 52, 53] in adulthood. As childhood becomes progressively more digitalised, the exposure to in-game micro transactions and loot boxes occurs at an increasingly younger age [9], with implications for the normalisation of gambling like behaviours [17, 18]. In the work presented, we offer a tool for examining the motivations for purchasing loot boxes and thus an opportunity to understand a potentially risky behaviour before it elicits harm.

The work presented in this paper supports the 23-item yRAFFLE, with seven subscales of "enhancement"; "progression"; "social pressure"; "distraction/compulsion"; "altruism"; "fear of missing out"; and "resale". Our analysis also reveals that in a youth cohort the motivations to purchase loot boxes are comparable to those seen in adults [17, 18, 32, 52, 53], and are significantly correlated with a measure of problematic gaming developed for children and young people. Young people appear to have been motivated to purchase loot boxes for varying reasons. On close inspection there are several factors that stand out as particularly strong motivations according to the yRAFFLE.

Young gamers purchase loot boxes to enhance the gaming experience creating a heightened sense of enjoyment, pleasure and excitement, contributing added elements of surprise to the game. Studies also reveal "Enhancement" is an important motivator for both gambling behaviours [54] and gaming behaviours [55].

Loot boxes also facilitate game progression through improved skills or tools, or through skipping difficult activities. This allows players to achieve better scores, teams or ratings, or to beat opponents [56]. Drawing on self-determination theory, it is likely that desire for a sense of competence and/or achievement lies at the root of this motivation [57, 58], which was observed at a similar level of magnitude as motivations cited as enhancement, again similar to gaming related motivations.

Social pressure as a purchase motivation for loot boxes was also significantly correlated with the problem gaming measure, but with an albeit slightly less strong relationship than those seen for progression and enhancement. As a motivator for loot box purchasing in the RAFFLE and the yRAFFLE, this factor represents a more negative force on behaviour to that seen in the wider literature on social gaming and gambling, the latter of which is more associated with teamwork, sharing experiences and affiliation [56, 59]. While the qualitative work that underpinned the development of the RAFFLE did identify both positive and negative social motivations, the subscale that emerged during scale development included items related to peer pressure, fear of being made fun of, and feeling left out [32].

Distraction/compulsion was the yRAFFLE factor with the strongest correlation to problematic gaming and is perhaps the most concerning motivation for loot box purchasing in this youth sample. Items that probe this factor cover the inability to control impulsive urges for purchasing loot boxes and the role of these play in distraction from day to day worries or to relieve boredom. For some, escapism and distraction are healthy coping mechanisms for gamers [60–62] and adults at low risk of gambling harms [32, 45, 63]. However, for other players with existing vulnerabilities/psychosocial difficulties [64], or when linked with compulsion and or gambling issues, escape-motivated behaviours may present as risks [65]. Impulsivity was positively correlated with both loot box purchasing and problem gambling in an international survey of 16–18 year olds [14] and replicates Close et al.'s [52] pre-registered findings that distraction/compulsion in the RAFFLE inventory most strongly correlated with loot box engagement and negative outcomes.

Two items of the yRAFFLE probe altruistic motivations for loot box purchasing. This factor had the weakest correlation with 'problematic gaming' in our cohort. Zendle et al. [14] investigated loot box engagement and 'problem gambling' in a cohort of older adolescents and reported that 11% of their sample cited altruistic type reasons for their purchasing behaviour. Additionally, the weak correlation between altruistic motivations and 'problematic gambling' is consistent with the original RAFFLE development [32] finding weak correlations with risky loot box purchasing. Altruistic motivations are thus likely to represent a relatively benign aspect of engagement with loot box mechanics.

The "fear of missing out" or "FoMO" subscale of yRAFFLE probed motivations for purchasing in relation to loot box purchasing, this could be related to limited time offers, special events and acquisition of desirable in-game merchandise or digital items. Research has shown that FoMO is associated with a range of online activity, in particular engagement with social media [66, 67]. However, "fear of missing out", as probed in our measure diverges from the social nature of FoMO as characterised by research on social media and other online behaviour. This factor significantly correlated with 'problematic gaming' at a similar magnitude to those observed for progression, enhancement and distraction/compulsion. There is evidence that people who experience gambling harms perceive a greater impact of gambling advertising on their behaviour [68] and, by extension, we might expect that advertisements of limited time offers/events create an additional FOMO push to purchase loot boxes in impressionable or vulnerable young people.

Our final domain probed motivations for loot box purchasing related to "resale" and was moderately associated with the Video Game Addiction Questionnaire [40]. While this was a motivator for some respondents, the relatively less common motivation aligns with other research in the field,Zendle et al. [14] reported that fewer than 1% of their sample of older adolescents acquired digital items in order to sell within the game or to "cash out". Resale therefore represents a small, but not negligible motivation for loot box engagement, and thus represents the final aspect of a holistic understanding of loot box engagement.

In summary, the yRAFFLE comprises seven subscales, and like the adult version of the measure, the motivations represented in the domains have similarities and divergence from, motivations for gaming and gambling. Both intrinsic motivations (enhancement, progression, social approval) and extrinsic motivations (profit through resale) of the individual are represented. Like the RAFFLE, the y RAFFLE also probes the role of external influences on purchasing behaviour (limited time offers). The "distraction/compulsion" subscale was most strongly associated with loot box purchasing, again replicating the findings of the RAFFLE development study, with potential clinical utility for early intervention to prevent problematic gambling behaviours.

Strengths and limitations

The original version of the RAFFLE underwent extensive and robust testing which included people with lived experience of loot box engagement, who were consulted throughout the development of the measure. Young people with lived experience ($n=2$) helped rephrase the original wording of the measure to ensure it was suitable for young people – whilst this sample might appear limited, it should be noted that the original RAFFLE had already undergone extensive cognitive testing for item wording. The model showed good fit in the confirmatory factor analysis phase, and good to excellent reliability and validity.

We did not measure loot box spend in this study, so we are unable to relate motivations for purchase to actual economic impact. This study used a convenience sample of willing schools in the Southwest and Southeast of England, we do not therefore make claims to the geographical representativeness of our sample of young people. Future research should be conducted in order to validate the yRAFFLE in other locations and languages.

Conclusion

The present work validates the RAFFLE measure [32] for use with young people. After minor changes to wording, yRAFFLE preforms above acceptable benchmarks and as well as the RAFFLE measure does in adult populations. Loot boxes are an important aspect of the video game industry, and represent the continued digitalisation of play. Engagement with loot box mechanics may also represent a gateway to gambling [17, 18]. The present work thus offers a tool for assessing motivations, a core step in the continued conceptual model of the route from loot box engagement in young people to gambling behaviours. yRAFFLE is a validated for use in both sexes, rural and urban settings, and ages 10–14.

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Authors' contributions
H.L, J.C, S.S, L.N, and J.L made substantial contributions to the conception of the work; H.L made substantial contributions to the design of the work; H.L made substantial contributions to the acquisition of data; H.L and R.S made substantial contributions to the analysis of the data; H.L, R.S and J.C made substantial contributions to the interpretation of data; H.L and R.S drafted the work; H.L, R.S, J.C, S.S, L.N, and J.L have substantively revised it; All authors reviewed the manuscript.

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Data availability
Survey data that support the findings of this study have been deposited in an OSF repository—https://osf.io/ut7k4/?view_only=ff73862528e54ebdb2e9d68d8226496a.

Declarations

Ethics approval and consent to participate
Ethical clearance for this study was obtained from The Faculty Research Ethics and Integrity Committee at the University of Plymouth, UK. As participants were under the age of 16, informed consent to participate in the presented research was provided by the parent or guardian of all participants. Research was carried out in compliance with the Helsinki Declaration (https://www.wma.net/policies-post/wma-declaration-of-helsinki/).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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