



The PMDWell framework: A confirmatory factor analysis of video game players' wellbeing^{☆,☆☆,☆☆☆}

Szymon Zbigniew Olejarnik^{a,b,*} , Daniela M. Romano^{a,c} 

^a Digital Future Research Institute, De Montfort University, Leicester, United Kingdom

^b Horizon Centre for Doctoral Training, School of Computer Science, University of Nottingham, Nottingham, United Kingdom

^c Department of Information Studies, University College London, London, United Kingdom

ARTICLE INFO

Keywords:

Video games

Wellbeing

Psychological wellbeing

Physical wellbeing

Economic wellbeing

ABSTRACT

Despite the video game moral panics that have sprung up since the early 1990s, videogames remain a popular medium, increasing in capacity and market value every year. With the growth in the number of digital game players came the growth of uncertainty over the impacts of video games on wellbeing. The new generations are growing up surrounded by ubiquitous, always-available digital technology and increasingly practice digitally mediated socialisation. The cultural shift suggests a change in the conceptualisation of wellbeing that can explain the phenomena of video game playing deaths.

A Player Multidimensional Wellbeing scale (PMDWell) is presented. The scale was derived from a conceptual framework drawn from existing literature on video game specific influences on wellbeing, and tested of 443 participants aged 13 to 65 worldwide. Teenagers were included due to the prevalence of gamers in the younger population. The scale constructs were validated using confirmatory factor analyses, ranging from good to excellent model fits, validity and reliability. We concluded that player wellbeing is a multidimensional construct with internal (social functioning, mental health) and external (physical health, life circumstances) dimensions.

Compared to other measures of wellbeing, PMDWell offers a broader understanding of wellbeing in the digital era that can be used to promote and maintain good health and perhaps highlight the lifestyle changes needed to optimise wellbeing and improve mental health. Future research could seek to replicate our validation in wider populations to enable demographic comparisons, especially comparing adolescents and young adults.

1. Introduction

Video games have established themselves as a prominent form of media, with 2.58 billion players worldwide (Clement, 2024a). With the COVID-19 pandemic, our work and entertainment have shifted online, and the number of players worldwide has increased by 20 %, from 1.84 billion in 2019 to 2.31 billion in 2021 (Clement, 2024a), indicating that now, one in four people engages in some form of video gaming. Yet, despite its increasing popularity, video gameplay, especially if online and excessive, is still a controversial topic, with debates ranging from stereotyping gamers as middle-aged men living in basements (Engelstätter & Ward, 2022) to discussing how violent video games play

increase verbal aggression and hostility (Olejarnik & Romano, 2023). Engaging in gameplay after experiencing a frustrating event has been found to restore competencies, affect and vitality (Tyack et al., 2020, pp. 1–15). Playing games like *Animal Crossing: New Horizons* and *Plants vs Zombies* can increase affective wellbeing (Johannes et al., 2021). Despite these seemingly positive influences, alarming news come from the sudden deaths of excessive gamers due to pulmonary embolism, cerebral haemorrhage or a fatal cardiac arrhythmia in both teens and adults (Kuperczko et al., 2022), highlighting how gamer lifestyle choices can lead to catastrophic physical consequences.

The video game market has undergone exponential growth since its inception. In the 1980s and 1990s, video games were a luxury, and they

[☆] This work was supported by the UKRI Engineering and Physical Sciences Research Council [grant number EP/S023305/1].

^{☆☆} During the preparation of this work, the authors used Grammarly (<https://www.grammarly.com/>) for proofreading and spell checking. The authors reviewed and edited the content as needed and take full responsibility for the publication's content.

^{☆☆☆} All data created during this research are openly available from the University of Nottingham data repository at <https://doi.org/10.17639/nott.7588>.

^{*} Corresponding author. Digital Future Research Institute, De Montfort University, Leicester, United Kingdom.

E-mail addresses: szymon.olejarnik@nottingham.ac.uk (S.Z. Olejarnik), daniela.romano@dmu.ac.uk (D.M. Romano).

could only be truly experienced on an arcade cabinet, a video game console, or a personal computer. Today, the new generation is growing up surrounded by ubiquitous, always-available technology. This phenomenon has become so apparent that the Internet has coined a term to describe this new generation of digital natives – iPad kids (Elder, 2023), referring to a generation of children whose parents have been heavily involved in exposing them to technology from a young age. Whilst this term encompasses access to a wide variety of media, it is especially true for video games. Adolescents increasingly experience digitally mediated socialisation, often in the context of video games (Wartella, 2002), with 70 % of British children reporting playing multiplayer games, and 60 % reporting playing multiplayer games with someone they knew (Ofcom, 2024). Overall, 89 % of British 11–18 year olds reported playing games at least once a week in 2024 (Ofcom, 2024). Although British adolescents spent less time playing Minecraft and Roblox daily in 2024 compared to 2022, the 2024 statistics appear to be higher than in 2019 (Qustodio, 2025). With more children being exposed to video games, and for longer relative to pre-pandemic levels, parental concern regarding video game use rises. Between 2017 and 2024, parental concern over the violent content contained in video games their children played rose from 29 % to 50 % (Ofcom, 2017, 2024). In 2024, 37 % of parents had doubts over the risk-benefit ratio of video games, and 23 % of parents believed that the benefits did not outweigh the risks of video game engagement (Ofcom, 2024). These trends are surprising, as subscription to parental controls appears to be high - 83 % of American parents only allow their children to play upon permission, and 78 % of parents set specific screen time limits (Vance, 2020) to better control adolescent exposure to video games. Despite controlled use of video games being on the rise, parents are still weary over how video game engagement could influence their children.

We speculate that as we experience a digital cultural shift, away from analogue towards online socialisation using video games, there also must be a shift in the conceptualisation of wellbeing in the context of video games, to include physical health and life circumstances. We investigate a multidimensional scale that reframes the concept of wellbeing to consider both internal and external influences on wellbeing in the digital era. We tailor this conceptualisation by selecting facets of wellbeing that have been previously shown to be influenced by video games, and as such could be key components of player wellbeing.

1.1. Defining wellbeing in the digital era

Different fields of research have varying views on what constitutes wellbeing. The American Psychological Association defines wellbeing as “a state of happiness and contentment, with low levels of distress, overall good physical and mental health and outlook, or good quality of life” (APA, 2018). This definition takes a middle-ground in the eudaimonic vs hedonic wellbeing debate. From a eudaimonic point of view, wellbeing focuses on feeling good, contentment, and life satisfaction (Ryff & Singer, 2008). On the other hand, the hedonic perspective would consider wellbeing as happiness and pleasure of all aspects of life (Ryan & Deci, 2001), derived not only physically, but also psychologically from attaining one’s goals (Diener et al., 1998). In cyberpsychology, the definition is supplemented by additional factors linked to wellbeing and the increasing engagement with digital technologies, such as the availability of digital information and social connections that modern ubiquitous digital devices provide. Specific focus has been placed on the latter, with theories suggesting highlighting how social capital (as an improvement in wellbeing due to greater social connections) and social isolation (as a reduction in wellbeing due to smartphone addiction and social attention displacement) (Ostic et al., 2021) can arise. A recent development in this area is the concept of digital flourishing. Aligned with eudemonic wellbeing, it describes digitally mediated positive perceptions of experiences and behaviour in social interactions, with support for authentic self-disclosure, civil participation, positive social comparison, connectedness and self-control (Janicke-Bowles et al.,

2023). At its core, cyberpsychology focusses on how digital technologies can mediate eudemonic wellbeing, putting social interactions at its core.

Other fields of study consider how human wellbeing is influenced by factors outside their psyche. The Organisation for Economic Co-operation and Development (OECD) defines wellbeing as meeting basic needs and extraneous goals to thrive (OECD, 2013), considering an individual’s resources, their quality of life and socioeconomic systems (OECD, 2011). Additionally, the Council on Social Work Education (CSWE) has focused on individual resources, coining the term “economic wellbeing” to describe meeting the most basic survival needs and possessing sustainable income and assets to prosper (CSWE, 2016). Research into internet addiction (Zhou et al., 2022) and gaming disorder (Irsalowitz et al., 2022) has shown that a greater extent of technology addiction is linked to lower economic wellbeing. Thus, we speculate that one might need to consider both the psychological and physical states of the individual interacting with their environment (both physical and digital) when studying wellbeing in the context of video games.

In the context of video games, we must also consider a younger demographic. In 2024, 38 % of game players in the United States were aged 5–26 (Clement, 2024b), and 85 % of the United Kingdom’s 16–25-year-olds engage with video games. This percentage decreases with age, reaching just 25 % of UK 65+ year olds who are gamers (Clement, 2025a). In 2025, the market penetration of online gaming among 16- to 24-year-olds in the UK reached 80 % (Clement, 2025b). Thus, most of the gameplay in the UK happens online.

Among American players, 48 % indicated that being with friends is one of the motivations for gameplay (Clement, 2022). Kowert et al. (2015) suggest that adolescents and young adults exhibit differential wellbeing due to the nature of their engagement with video games: adolescents tend to thrive socially, as video games are perceived as a shared peer activity, whereas young adults experience lower life satisfaction and increased loneliness. Despite wellbeing remaining stable during the transition from adolescence to adulthood for most individuals (Chen & Page, 2016), social connectedness is a better predictor of wellbeing outcomes in adulthood (Olsson et al., 2013), suggesting that across the player demographic, wellbeing is not impacted in the same manner and that quality of life and social functioning have a role in wellbeing.

We aim to overcome the differential outlooks on wellbeing that depend on the field of study and implement concepts from public policy, social policy, and economics, in addition to the pure psychological or cyberpsychology definition of wellbeing, to gain a deeper understanding of both internal and external facets of individual wellbeing in the digital era. As such, we will define wellbeing as:

A state of happiness and contentment resulting from good mental and physical health, correct social functioning and good life opportunities.

This definition takes into account the psychological aspects of wellbeing, such as mental health and social functioning, but also considers physical health and opportunities surrounding the individuals that are external to them. In our definition, we assume that a person who ‘has wellbeing’ is happy and content with both internal and external aspects of their life, including the use of digital technologies to engage in positive and meaningful social interactions with others.

In the following sections, we construct a conceptual framework of video game player wellbeing, informed by past research indicating which wellbeing facets are influenced by engagement with video games. This approach was taken, as should an aspect of wellbeing be influenced by video games, it ought to be a key component of player wellbeing. We then construct a novel scale for measuring wellbeing in video game players, grounded in the rendered conceptual framework.

1.2. Mental health of gamers

Barr and Copeland-Stewart (2021) conducted an opinion poll among gamers and found that half of the sample (51 %) reported a positive impact, primarily due to the relaxing nature of gaming. In casual

players, video game engagement has been shown to reduce symptoms of psychological and physiological distress (Desai et al., 2021). Casual players spend less time playing video games compared to regular players, where casual gameplay is infrequent and requires no significant time investment (2024). The increased video gameplay during the COVID-19 pandemic was related to lower levels of psychological distress, even when accounting for the perceived severity of COVID-19 (Formosa et al., 2022). Engaging in gameplay after experiencing a frustrating event has been found to restore competencies, affect and vitality (Tyack et al., 2020, pp. 1–15).

However, Goh et al. (2019) found that escapism mediated by low self-esteem is related to decreased wellbeing in highly engaged gamers, suggesting that playing games, motivated by the desire to escape real life and its problems, negatively impacts wellbeing. In more dedicated players, especially in those at risk or with gaming disorder, video games can have a more debilitating effect on their mental health. Players who meet the criteria for gaming disorder report significant depression and anxiety symptoms, alongside lower life satisfaction (Bargeron & Hormes, 2017). Resilience and life satisfaction mediate the relationship between empathy and gaming disorder (Turan, 2021), suggesting that the impacts of gaming disorder might be amplified by poor life satisfaction. Addicted players also experience increased psychological distress (Shabih et al., 2021).

However, the negative effects of gaming are not always related to exposure. At 14 hours per week, despite reductions in self-realisation and optimism scores, life satisfaction scores of eSports players improve their mental health relative to baseline (Yamaguchi, 2023). eSports players only report experiencing moderate stress after 26 hours of gameplay exposure per week (Rudolf et al., 2022), despite exhibiting craving symptoms and neglect of personal needs and responsibilities in line with gaming disorder pathology (Abbasi et al., 2023). When accounting for improvements, the threshold for the beneficial effects of gaming on wellbeing appears to be around 21 hours per week, after which point the positive benefits are non-existent (Egami et al., 2022).

The relationship between video gameplay and mental health has received attention from psychological researchers in recent years. The literature appears to present a mixed picture, highlighting factors such as engagement frequency, the context, and the gamers' motivation. Casual and professional players appear to be more resilient if gameplay is kept under 21 hours per week. Higher exposure, low self-esteem and poor life satisfaction relate to a negative impact on the mental health of players.

1.3. Social functioning and social capital

As seen in the previous section, social functioning and gamers' wellbeing are positively related. This connection is reviewed in more detail in this section. Depping et al. (2018, pp. 87–100) suggested a feed-forward mechanism for how video games influence both social capital and wellbeing: playing video games increases social capital, which in turn increases wellbeing. Crucially, this positive change in wellbeing could be facilitated by increases in bonding offline social capital with friends (Perry et al., 2018). The type of game and the nature of engagement also play a role in increasing or decreasing social capital. Violent video games can decrease social satisfaction and pro-sociality (Shoshani et al., 2021); the more violent video games individuals played, the more verbal aggression and hostility they exhibited (Olejarnik & Romano, 2023). In contrast, *World of Warcraft* players reported an increase in wellbeing mediated by increased social capital and decreased loneliness (Mandryk et al., 2020). For *Destiny* players, online social capital served both bridging and bonding functions. A general sample of gamers showed a positive relationship between social gameplay and a decrease in loneliness (Burke & Lucier-Greer, 2021).

Bridging social capital can also increase the wellbeing of social players when playing with strangers (Vella et al., 2015). This would support the theoretical approach of Przybylski et al. (2010) that argued

that wellbeing can be improved if video gameplay satisfies the needs of competence, autonomy, and relatedness, further supporting the notion that wellbeing arises, at least partially, from social functioning. Addicted players found it easier to meet people online, despite having fewer offline friends, which suggests lower offline social capital (Porter et al., 2010). With gameplay, the online social capital may increase, resulting in greater psychosocial wellbeing, but this could also lead to a displacement of social attention to the online sphere (Tushya et al., 2023).

The age of the player has been suggested to play an important role in the wellbeing outcomes moderated by social functioning (Vella et al., 2013). Adolescents perceived gaming as a shared activity that positively impacted their wellbeing, while young adults exhibited an opposite pattern; their life satisfaction decreased (Kowert et al., 2015). If gameplay is social in nature, it increases the bridging and bonding social capital of players, decreasing their loneliness and thus increasing players' wellbeing. Similarly to wellbeing, there appear to be groups resilient to the negative impacts of video games on social functioning: adolescents, and non-addicted players who maintain their offline social capital.

1.4. Physical health

Although physical health has been explored in the context of video gameplay, the relationship between the two remains unclear. Experimental studies found that addicted players are more likely to report higher body mass index scores and higher consumption of unhealthy foods (Israelowitz et al., 2022). Adults with gaming disorder were also more likely to report lower subjective health outcomes and heart disorders similar to alcohol and nicotine addictions (Shiue, 2015). These effects are not limited to addicted players. A single gameplay session exceeding 3 hours can result in greater negative physical symptoms, such as physical problems or pain, despite not meeting the diagnostic criteria for gaming disorder (Leung et al., 2024). In healthy, non-addicted players, higher hourly engagement with video games has been associated with higher body mass index scores and lower subjective health status scores. However, there is insufficient evidence to link this to a sedentary lifestyle (Pelletier et al., 2020). In adolescents, video gameplay was negatively associated with physical activity (Fitzpatrick et al., 2019). These results suggest a linear relationship between video gameplay and physical health, where engagement increases, physical health declines, either subjectively or indirectly through body mass, regardless of addiction status.

Although the majority of studies report video games having a negative impact on physical health, some studies suggest otherwise. In matched player and non-player samples, there was no difference in body mass index or subjective health outcomes (Stockdale & Coyne, 2018). In adolescent samples, no relationship was found between physical activity and gaming disorder (Alagoz & Keskinilic, 2022). A review of studies using video games that promote physical activity (for example *Dance Dance Revolution*) found that video games improved over half of physical therapy activity outcomes in their players (Primack et al., 2012). In children, playing active video games was shown to be a significant alternative to traditional physical activity (McDougall & Duncan, 2008).

There is a two-sided argument regarding physical health; excessive video game use could put the individual at risk of declining physical health. Still, video games designed with physical activity in mind can lead to improved physical health outcomes.

1.5. Life circumstances

We consider life circumstances as factors related to wellbeing that are influenced by external circumstances, such as social availability and embeddedness, occupational circumstances, and financial circumstances. In the literature, increased video game engagement and the risk of developing gaming disorder have been linked to closer familial bonds

(Tan et al., 2023), suggesting that a greater perception of security in social connections may be associated with greater engagement with video games. Players reported no association between online video gameplay and the subjective perception of their social connectedness (Domahidi et al., 2018). Online gameplay can also enhance familial ties, offering conversational topics and opportunities for meaningful time spent together (Wen et al., 2011). These positive results appear to be limited to the family sphere. In adolescents, online video gameplay was associated with smaller, lower-quality social circles outside the video game context (Kowert et al., 2014). Online gaming can lead to stronger social circles, extending beyond the family, when online connections transition to the offline sphere (Trepte et al., 2012).

Excessive engagement with video games in the form of gaming disorder has been linked to lower economic wellbeing (Israelowitz et al., 2022). These findings have not been replicated in a university student sample, where a higher socioeconomic background was associated with a higher risk of developing gaming disorder (Raouf et al., 2022). Only 23.7 % of sampled players with gaming disorder reported experiencing financial difficulties due to their engagement with video games (Porter et al., 2010). With regards to in-game spending habits, they do not appear to be predictors of wellbeing of mobile gamers (Petrovskaya & Zendle, 2023). In traditional, console gamers, in-game spending was linked to experiencing peer pressure, suggesting a social aspect of monetary behaviours in the context of video games (Wang & Zaman, 2019). However, if video games incorporate aspects of financial literacy, such as spending in-game currency, they can enhance player financial self-efficacy (Maynard et al., 2012).

Regarding occupational wellbeing, players reported that video games do not have a negative impact on their employment; instead, they positively contribute to their wellbeing as a source of relaxation after work (Smith & Weston, 2022). This is echoed in unemployed players, whose job-seeking behaviours increase if self-determination is the motivation for engagement (Lee & Chen, 2023), and in disabled employees, who reported improvements in employment due to improvements in mental and physical health resulting from video game engagement (Redepenning et al., 2024). Parental employment status or socioeconomic status also appears not to be related to problematic video game engagement, as maternal employment status was not a significant predictor of developing gaming disorder (Toker & Baturay, 2016). However, employees could be at risk of developing a gaming disorder via stress caused by organisational politics (Choi et al., 2017). Excessive engagement in the form of gaming disorder has been theorised to result in worse employment outcomes (Ramesh & Igor, 2016). Although the directionality is unclear, a relationship exists between employment status (e.g., student, unemployed) and the risk of developing gaming disorder in the context of massively multiplayer online role-playing games (Hussain, Griffiths, & Kuss, 2012).

Video games can promote closer familial ties while simultaneously reducing the number of social circles outside the family if online gameplay does not result in offline connections. Gamers can have any socioeconomic background. In-game spending is often linked to peer pressure rather than the video game itself, and video games can serve as a source of economic education. Video games can also serve as a source of relaxation after work for those employed and can increase the self-determination of those seeking employment.

1.6. Measures of wellbeing and the need for a new measuring instrument for gamers

As seen in the previous sections, the conceptualisation of wellbeing itself is different across disciplines. Psychology stresses the mental aspect of wellbeing, while fields like economics consider factors outside the individual. In particular, we have reviewed how external factors, such as social embeddedness, life circumstances, and physical health, might be key components of players' wellbeing.

There are measuring instruments to probe wellbeing, for example,

the Warwick-Edinburgh Mental Well-Being Scale (Tennant et al., 2007). The validated tools are not broad enough in scope to study multidimensional wellbeing, including both internal and external factors affecting the individual video game player. Some multidimensional wellbeing frameworks and measuring instruments do exist (for example, the 8 dimensions of wellness framework (Stoewen, 2017)), however, they have not gone through rigorous testing on reliability and validity of the probed constructs, constituting a lack of validation for use in psychological research. Some measures of individual wellbeing dimensions have been designed to be administered as standalone measures, making them too long to be helpful in the context of multidimensional wellbeing. A good example of this is the Social Functioning Scale (Birchwood et al., 1990), initially developed for use in schizophrenic patients. Although this scale probes many different aspects of social functioning, the scale comprises 77 items, making it impractical for use as part of a global wellbeing measurement toolbox. Even when short forms of such measurements are available, they might contain questions that are too controversial. A good example of this is the Social Functioning Questionnaire (Tyrer et al., 2005). Although it comprises only seven items, making it a good candidate for the wellbeing measurement toolbox, it contains an item probing the participant's sexual life. Bearing in mind the need to probe the transitional period of wellbeing between adolescence and adulthood, providing such sexual life questions to underage players might not be appropriate.

It is therefore evident that there is a clear lack of theoretical frameworks and measuring instruments that are comprehensive, relevant and appropriate for use in certain video game player demographics. Considering the previously reviewed findings on a wide array of wellbeing dimensions relevant to video game players, we posit that a multidimensional approach to wellbeing, considering internal and external wellbeing, is necessary to target this gap. We have therefore devised the Player's Multidimensional Wellbeing framework (PMDWell), as shown in Fig. 1, to consider both internal and external facets of wellbeing that could be relevant when considering video game players.

We focus on four primary dimensions of wellbeing that ought to be of relevance when looking at video game players: social functioning, mental health, physical health and life circumstances. While social functioning and mental health have been studied extensively in the past, there are few accounts of the impacts of video games on physical health and life circumstances. Some results suggest that both physical health and life circumstances could have a bearing on the wellbeing of players. Specifically, video gameplay was negatively associated with physical activity (Fitzpatrick et al., 2019), and increased (and possibly pathological) levels of engagement with video games were related to unemployment and lack of work-seeking behaviours (Lee & Chen, 2023). As such, we posit that player wellbeing also encompasses physical health and life circumstances.

The conceptual framework, presented in Fig. 1, was informed by drawing on the literature cited above, and was constructed in two stages. First, we included wellbeing dimensions that were shown to be highly influenced by engagement with video games, as such of particular importance to video game player wellbeing - social functioning and mental health. Last, we chose wellbeing dimensions that have shown to be unequally influenced by engagement with video games, but which could be crucial components of player wellbeing - physical health and life circumstances. This yielded a conceptual framework of wellbeing, comprised of four dimensions specifically relevant to video game players: social functioning, mental health, physical health and life circumstances.

1.7. This study

Based on the conceptual framework of wellbeing that is relevant to video game players presented in the previous section, we pose the following research question:

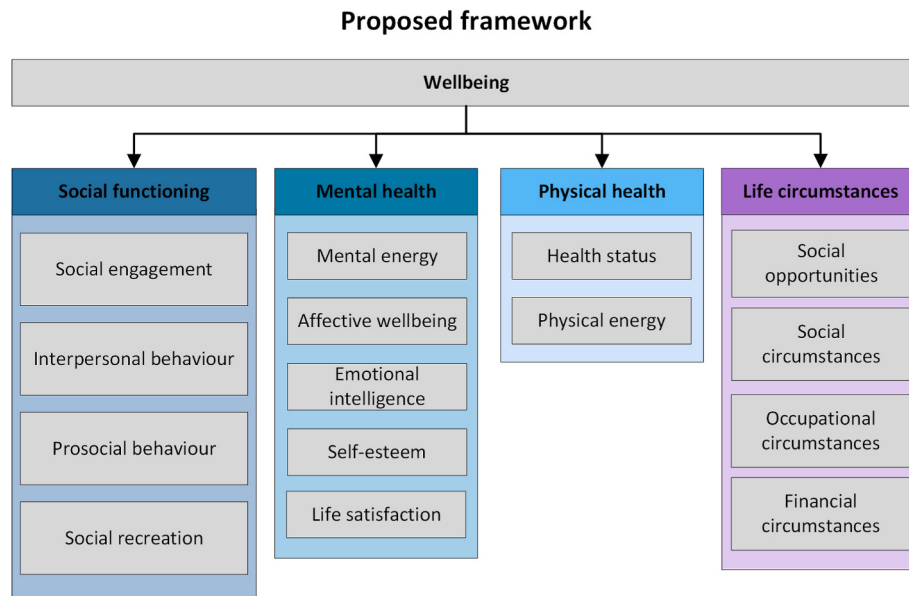


Fig. 1. A diagram of the proposed Player's Multidimensional Wellbeing framework (PMDWell).

RQ: Based on the conceptual framework on multidimensional wellbeing, can we construct a scale specific to video game players that comprises social functioning, mental health, physical health, and life circumstances?

To answer this research question, we construct a novel measure of wellbeing specifically for video game players. We first consider the two dimensions of wellbeing that appear to be of high relevance when considering video game players, such as social functioning and mental health, and formulate the following hypothesis:

H1. Social functioning and mental health will be significant constructs of the multidimensional wellbeing scale for video game players.

We will extend the psychological conceptualisation of wellbeing to consider external wellbeing, such as physical health and life circumstances of the players, in light of mixed findings in the literature and formulate the following hypothesis:

H2. Physical health and life circumstances will be significant constructs of the multidimensional wellbeing scale for video game players.

2. Method

2.1. Participants

A total of 461 participants were recruited for the study. The inclusion criteria were being aged 13 and above and being a regular video game player (e.g. at least 3 hours of gameplay per week). Upon the inspection of the demographics, $N = 8$ participants reported spending fewer than 3 hours per week on playing video games. Furthermore, $N = 10$ participants reported spending more than 100 hours per week playing video games. As such, $N = 18$ participants were excluded from the sample due to the implausibility of this high level of engagement, leading to the final sample size of 443. Amongst those, there were 276 males, 139 females, 25 non-binary individuals, and 3 others, ranging in age from 13 to 63 ($M = 28.5$, $SD = 9.12$). The geographical demographics of participants are shown in Table 1. Volunteers were recruited through social media (Facebook, TikTok, Discord, and Reddit), survey exchange platforms (SurveyCircle), and recruitment platforms (Prolific).

To explore the extent of video game engagement in the present sample of 443, descriptive statistics for gameplay hours per week and video game addiction scores were computed. The frequency histograms for these variables are shown in Fig. 2. Gameplay hours per week had the

Table 1

Geographical demographics of participants in the study, split by continent.

Continent	N
Africa	65
Asia	32
Australia and Oceania	12
Europe	158
North America	148
South America	26
Did not answer	2

descriptive statistics of $M = 26.3$, $Mdn = 20.0$, $SD = 19.8$. Here, the sample shows a positive skew, with most participants reporting playing around 20 hours per week. This could signify that most of the sample would be at risk of video game addiction when assessing against engagement levels. Video game addiction scores had the descriptive statistics of $M = 16.6$, $Mdn = 16.0$, $SD = 5.67$. This shows that behaviourally, most participants reported less frequent symptoms of video game addiction. Considering that high engagement/high addiction players were a minority in the sample, they remained a part of the sample to enable better representativeness of the overall gaming population. As such, despite somewhat high hourly engagement with video games, the present sample represents a mostly healthy demographic of video game players.

This study was reviewed and approved by De Montfort University Faculty of Computing, Engineering and Media (CEM) Ethics Chair with the approval number: 630465, dated April 16, 2024. Participation in the study was voluntary, and written informed consent was obtained from all individual participants included in this study. In particular, participants were given the right to withdraw at any point.

2.2. Materials

The study was carried out on the participants' devices using a researcher-hosted instance of LimeSurvey. LimeSurvey allows for the randomisation of questions and item order.

2.2.1. Demographics questionnaire

The demographics questionnaire collected data on basic demographics (age, gender, ethnicity), as well as data on extended

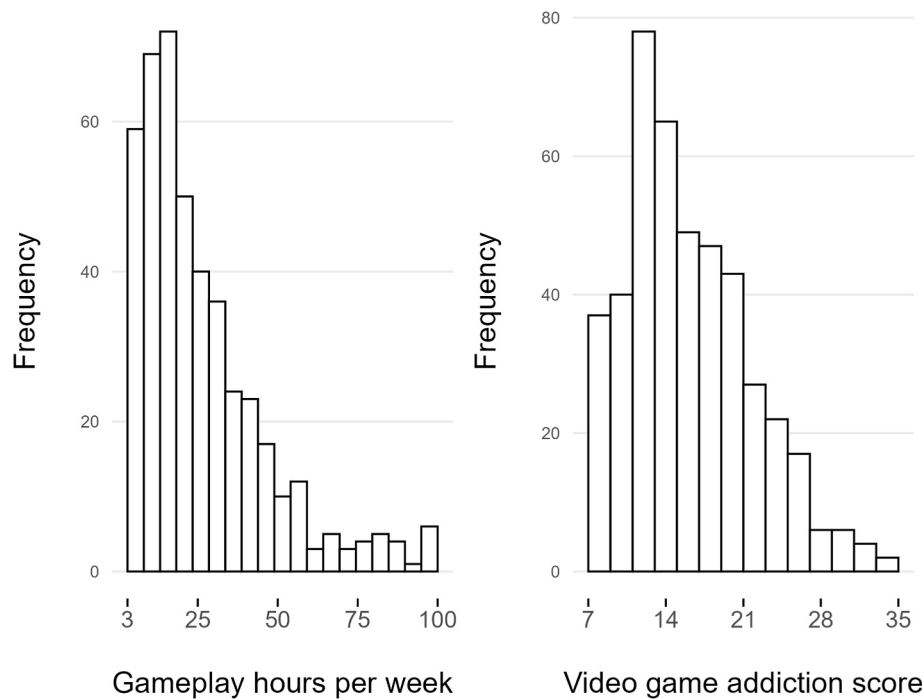


Fig. 2. Frequency histograms of gameplay hours per week and video game addiction scores in the present sample.

demographics (gameplay hours per week, country of origin, parental highest education level, own occupational group, own highest education level, type of school attended at age 11–16, neurodivergence status, type of neurodivergence). Extended demographics were collected as part of a larger study. Parental highest education level, own occupational group, own highest education level, type of school attended at age 11–16 were collected as proxies for socioeconomic status and went unused in this study. Neurodivergence status and type of neurodivergence went unused in this study. Gameplay hours per week was only used for the statistics of the sample; it went unused in the main analysis.

2.2.2. The 7-item gaming addiction scale for adolescents (GASA) (Lemmens et al., 2009)

The 7-item GASA scale (Lemmens et al., 2009) was used to measure behavioural video game addiction, to compare it against hourly video game use data. It comprised 7 items measuring 7 aspects of video game addiction: salience, tolerance, mood modification, relapse, withdrawal, conflict and neglect duties. It used a 5-point Likert scale with labels of “Never – Always”, with the score range of 7–35. This scale was only used for descriptive statistics of the sample; it went unused in the main analysis.

2.2.3. The Player’s multidimensional wellbeing scale (PMDWell) for gamers

Based on the conceptual framework devised earlier, we constructed the Player’s Multidimensional Wellbeing scale (PMDWell), its structure is shown in Table 2. The scale has been constructed in two stages. We first attempted to locate existing scales for the wellbeing dimensions of interest. If such existed and their wording was satisfactory and appropriate for a wide range of demographics, items would be either extracted, or the scale included as a whole. If no suitable scale had been located, we would self-devise items for the remaining wellbeing dimensions. This approach was employed as to avoid constructing new subscales where ones already exist.

The PMDWell scale for gamers is shown in Supplemental Material. It comprised 77 items, measuring wellbeing across four dimensions and 15 subdimensions. It used a 5-point Likert scale with various scale descriptions (Never – Always for frequency-based questions; Strongly

Table 2

Structure of the PMDWell scale, including dimensions and subdimensions, type of data, number of items and source.

Dimension	Number of items	Source
Social functioning	14	
Social engagement	5	Self-devised
Interpersonal behaviour	2	Social Functioning Scale (SFS) (Birchwood et al., 1990)
Prosocial behaviour	4	Adult Prosocialness Behavior Scale (APBS) (Caprara et al., 2005)
Recreation	3	Self-devised
Mental health	36	
Mental energy	4	Self-devised, Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS) (Tennant et al., 2007)
Affective wellbeing	20	Positive and Negative Affect Schedule-Short Form (PANAS-SF) (Watson et al., 1988)
Emotional intelligence	4	MacLeod (n.d.)
Self-esteem	4	WEMWBS (Tennant et al., 2007)
Life satisfaction	4	Satisfaction With Life Scale (SWLS) (Diener et al., 1985)
Physical health	7	
Physical activity	1	Self-devised
Physical energy	5	Self-devised
Health problems	1	Self-devised
Life circumstances	20	
Social opportunities	3	Self-devised
Social (family and friends)	10	Family Adaptability, Partnership, Growth, Affection, and Resolve (Family APGAR) (Smilkstein, 1978)
Occupational	3	Self-devised
Financial	4	Self-devised
TOTAL	77	

Disagree – Strongly Agree for agreement-based questions, Very slightly or not at all – Extremely for intensity-based questions). Where the items collected categorical data, responses were converted onto a 5-point Likert scale. The scores were calculated based on the rules of the

original scales, accounting for reverse scoring, and the total score for the composite scale range was 75–385. For individual dimensions, the scores were 13–70 for social functioning, 36–180 for mental health, 6–35 for physical health, and 20–100 for life circumstances.

2.3. Procedure

A short advertisement was posted on various online platforms calling for participants. It contained a link to the study information sheet. The participants had to read the participant information sheet and provide their consent to participate in the study before any survey items were presented. If the participant was under 18 years old, the informed consent was obtained from the parent/legal guardian of the participant before progressing. After informed consent, participants were directed to the demographic questionnaire, which also included a check for inclusion criteria. If the participant was aged below 13 years or above 65 years or indicated that they did not play video games regularly, they were automatically screened out and debriefed. If they fulfilled the study inclusion criteria, they then proceeded to the PMDWell. The PMDWell consisted of three pages to reduce scrolling and participant fatigue, and the order of the items was randomised. After the presentation of the PMDWell, the participants were presented with the 7-item GASA scale. The overall participation time was approximately 10–12 min. Once participants had responded to all the items, the experiment concluded, and they were thanked for their participation. If the participant was recruited via Prolific, they were given a token of appreciation of £2.00.

2.4. Data analysis strategy

Confirmatory factor analysis (CFA) will be used to test the theoretical constructs of the PMDWell. This is because we had clear expectations of the factor structure based on the conceptual framework grounded in past literature, presented in the Introduction. This approach was preferred to exploratory factor analysis (EFA), as EFA aims to arrive at the factor structure based on factor loadings. As the factor structure had already been established based on past literature, CFAs will be conducted on all the dimensions of the scale using IBM AMOS 29.

For each of the wellbeing dimensions, a CFA model was constructed, considering the subdimensions as latent variables and the individual questionnaire items as indicators loading onto the latent variables. We have opted not to investigate cross-paths due to the assumption that the indicators should not be correlated and instead should be standalone indicators of the latent factors. Upon producing the model, the model fit indices were checked for compliance with thresholds. For Root Mean Square Error of Approximation (RMSEA), we followed the thresholds of $<.050$ = good, $<.080$ = acceptable, $<.100$ = marginal, $>.100$ = poor (Fabrigar et al., 1999). For the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), we followed the thresholds of $>.950$ = excellent, $>.900$ = good, $<.900$ = poor (Hu & Bentler, 1998). For the Standardised Root Mean Square Residual, we followed the thresholds of $<.080$ for acceptable fit (Byrne, 1994). If the initial model fit indices fell below the benchmarks, the factor loadings were reviewed to remove the poorest-performing indicators from the model. Indicators with factor loadings of $<.40$ would be progressively removed (Williams et al., 2010), until the model fit was optimised. Special cases for constructs with fewer indicators were set out to allow for CFA analyses to be conducted. If a construct had only two indicators, one with a factor loading below the threshold, it would be retained if its exclusion did not significantly change the model, assuming the model fit was satisfactory. This process was repeated until satisfactory model fits were reported. Following model construction, the reliability and validity of the constructs were computed. Reliability was computed as Composite Reliability (CR) and the threshold of $>.600$ was used as a cutoff point for good validity (Fornell & Larcker, 1981). Validity was computed as Average Variance Extracted (AVE), and the threshold of $>.500$ was used as a cutoff point for good reliability (Fornell & Larcker, 1981). Finally,

we computed internal reliability for the whole PMDWell scale, as well as for each subdimension. Omega total (ω_t) was used for the entire scale (to establish reliability as a composite measure), and correlated factors omega (ω_{cf}) was used for the individual dimensions, as it accounts for correlation paths that were included in the CFA models to improve model fits (Cho, 2025). For omega values, we used the cut-off point of $\omega >.700$ for sufficient internal reliability (Nunnally & Bernstein, 1994).

3. Results

Before conducting the confirmatory factor analysis (CFA), we conducted a reliability test on the whole scale using the omega total. The omega total (ω_t) is a measure of internal consistency reliability, as it provides a more accurate estimate of reliability, as compared to Cronbach's alpha. The internal reliability of the scale pre-CFA showed sufficient internal reliability, $\omega_t = .955$.

3.1. Social functioning

The final CFA model for social functioning is displayed in Fig. 3, which contains the corresponding error variances and the standardised factor loadings.

The initial model comprised 4 latent factors and 14 indicators, resulting in a poor model fit across the fit indices: $\chi^2(71) = 381.9$, $p < 0.001$, $CFI = .810$, $TLI = .756$, $RMSEA = 0.098$, $SRMR = .079$. Upon investigating the factor loadings, indicators SOCENG1, SOCENG3, and REC1 were removed from the model to improve its fit, resulting in a final model comprising 4 latent factors and 11 indicators. In addition, REC2 had to be normally scored and REC3 had to be reverse scored due to negative factor loadings.

The final CFA model, Fig. 3, yielded overall acceptable model fits, $\chi^2(38) = 119.3$, $p < 0.001$, $CFI = .929$, $TLI = .898$, $RMSEA = .070$, $SRMR = .053$. The CFI, RMSEA and SRMR indices suggest good model fits, while the TLI indicates that the model is marginally acceptable. The internal reliability of the *Social functioning* subdimension, measured as correlated factors omega, fell just below the acceptable threshold, $\omega_{cf} = .578$.

We then further investigated construct reliability and validity, see Table 3. *Social engagement* demonstrated good reliability ($CR = .732$) and below acceptable validity ($AVE = .480$). *Interpersonal behaviour* yielded poor reliability ($CR = .435$) and below acceptable validity ($AVE = .283$). *Prosocial behaviour* showed good reliability ($CR = .724$) and below acceptable validity ($AVE = .406$). *Social recreation* showed below acceptable reliability ($CR = .667$) and acceptable validity ($AVE = .516$).

Here, we must note the shortcomings of this model. Whilst the final model has been optimised to maximise the model fit indices, with most of the statistics reporting acceptable model fit, there are shortcomings in other aspects of this dimension. The internal reliability of this dimension fell below the acceptable threshold. Although some constructs had satisfactory CR values (specifically *Social engagement* and *Prosocial behaviour*), their AVE fell below the acceptable threshold. *Social recreation* reported acceptable validity but fell short of acceptable reliability. *Interpersonal behaviour* had the lowest validity and reliability, which could possibly be attributed to this construct comprising only two indicators, where CR and AVE are best calculated from at least three indicators. Bearing in mind that a) further removal of indicators and constructs did not meaningfully change the performance statistics, b) the model fit indices suggested an acceptable model fit, and c) there is a body of literature cited above to support the constructs contained within the dimension, we decided to keep the model as is. We note, however, that future research ought to use the *Social functioning* dimension shown here with caution, and we welcome further testing of this dimension to better establish its validity and reliability.

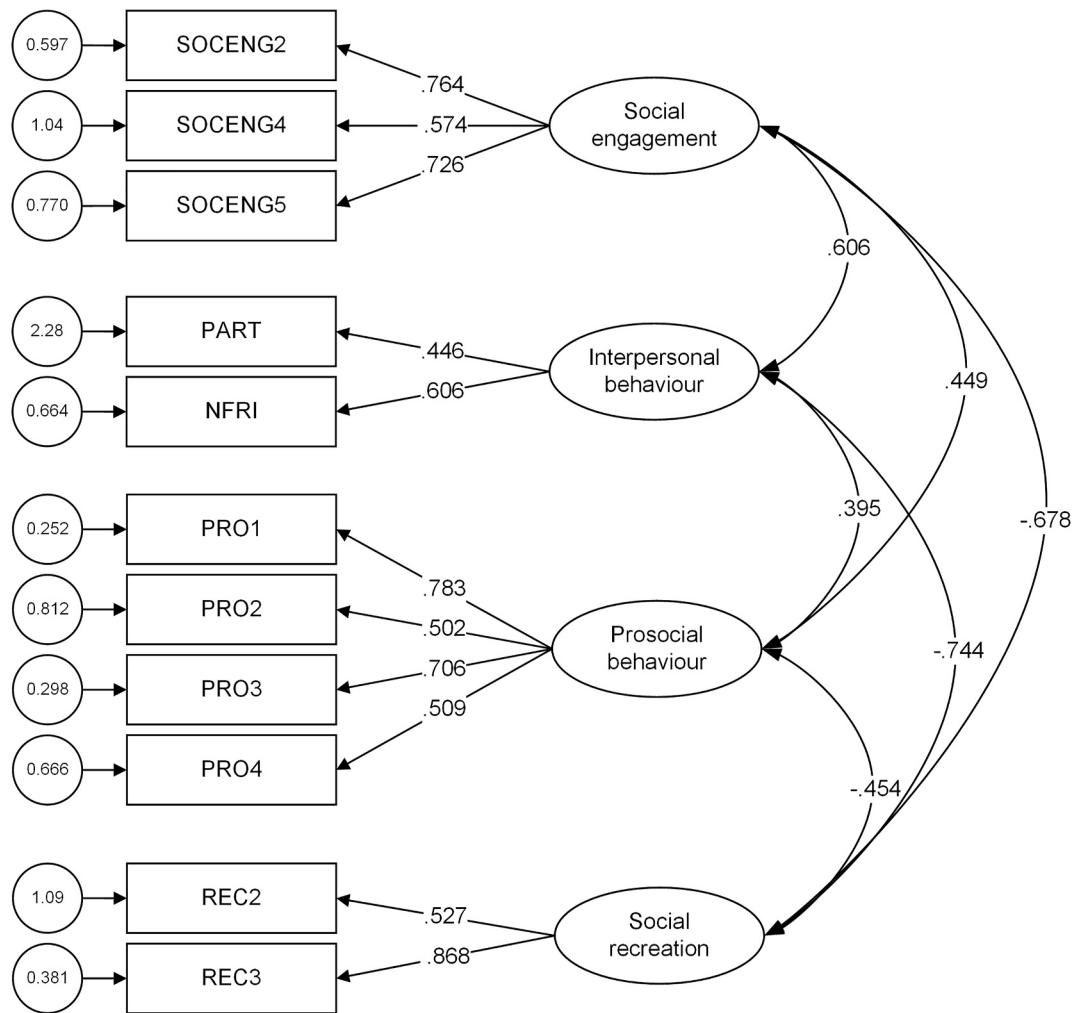


Fig. 3. Final Confirmatory Factor Analysis model of social functioning subdimension. Data collected using the PMDWell, including error variances and factor loadings.

Table 3

Reliability and Validity of the latent factors of the Social functioning subdimensions.

Social Functioning Latent Factors	Composite reliability (CR)	Average variance extracted (AVE)
Social engagement	.732	.480
Interpersonal behaviour	.435	.283
Prosocial behaviour	.724	.406
Social recreation	.667	.516

3.2. Mental health

The final CFA model for mental health is displayed in Fig. 4, which contains the corresponding error variances and the standardised factor loadings.

The initial model comprised 5 latent factors and 36 indicators, resulting in a poor model fit across the fit indices: $\chi^2(584) = 3462.2$, $p < 0.001$, $CFI = .690$, $TLI = .666$, $RMSEA = .104$, $SRMR = .123$. Upon investigation of the factor loadings, indicators MENTENE4, EMOTINT1, EMOTINT2, EMOTINT3, EMOTINT4, AFFECT2, AFFECT4, AFFECT6, AFFECT7, AFFECT8, AFFECT11, AFFECT12, AFFECT13, AFFECT15, AFFECT16, AFFECT18 and AFFECT20 were removed from the model to improve the model fit, yielding the final model of 4 latent factors and 18 indicators. The final CFA model resulted in a good model fit across the fit

indices, $\chi^2(129) = 407.3$, $p < 0.001$, $CFI = .947$, $TLI = .937$, $RMSEA = .069$, $SRMR = .045$. The CFI and TLI indices suggest that the model is close to achieving an excellent fit, whilst the $RMSEA$ and $SRMR$ indices suggest an acceptable fit. The internal reliability of the *Mental health* subdimension, measured as correlated factors omega, was above the acceptable threshold, $\omega_{cf} = .945$.

We then further investigated construct reliability and validity, see Table 4. *Mental energy* returned acceptable reliability and below acceptable validity ($CR = .699$, $AVE = .438$). *Life satisfaction* demonstrated acceptable reliability and validity ($CR = .852$, $AVE = .593$). *Self-esteem* demonstrated acceptable reliability and validity ($CR = .894$, $AVE = .737$). *Social recreation* demonstrated acceptable reliability and validity ($CR = .919$, $AVE = .587$).

Whilst the reliability and validity of *Mental energy* were marginal, the remaining constructs yielded overall good reliability and validity. Although much less problematic than constructs within the *Social functioning* dimension, *Mental energy* should be studied further to better determine its validity and reliability as a part of mental health. Bearing in mind the good model fit indices, we have decided to keep *Mental energy* as a construct in the model, considering its marginality and usefulness in explaining the mental capacity of participants to conduct basic and extraneous daily tasks. As such, we found that our proposed questionnaire effectively captures data related to mental health.

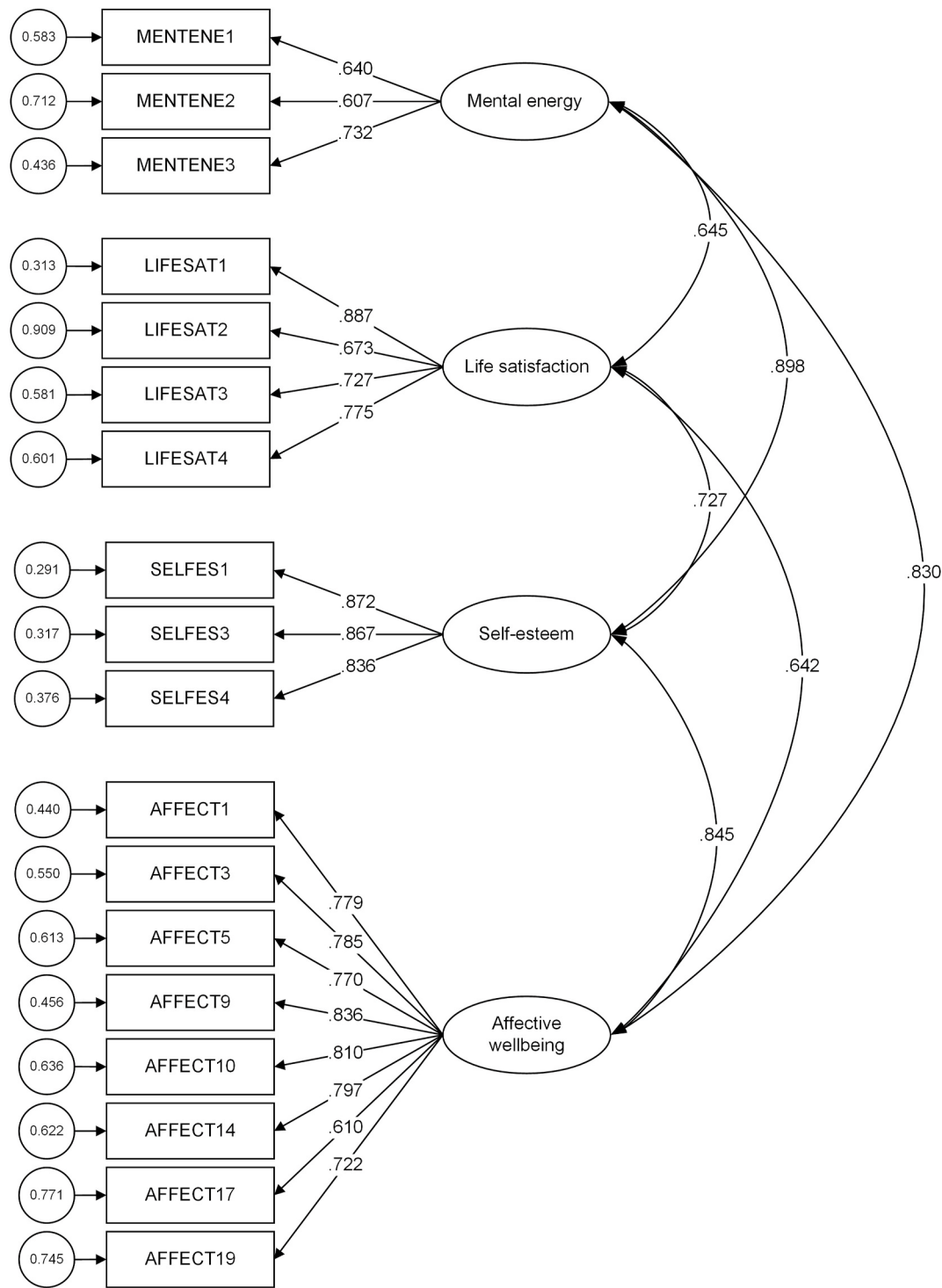


Fig. 4. Final Confirmatory Factor Analysis model of mental health data collected using the PMDWell, including error variances and factor loadings.

Table 4		
Reliability and Validity of the latent factors of the Mental health subdimensions.		
Mental Health Latent Factors	Composite reliability (CR)	Average variance extracted (AVE)
Mental energy	.699	.438
Life satisfaction	.852	.593
Self-esteem	.894	.737
Affective wellbeing	.919	.587

3.3. Physical health

The final CFA model for physical health is displayed in Fig. 5, which contains the corresponding error variances and the standardised factor loadings.

The initial model comprised 2 latent factors and 7 indicators, which resulted in poor model fit across the fit indices, $\chi^2(13) = 91.9, p < 0.001$, $CFI = .902$, $TLI = .842$, $RMSEA = .117$, $SRMR = .079$. Upon investigating the factor loadings, indicator PHYSACT was removed from the model to improve the model fit, resulting in a final model comprising 2

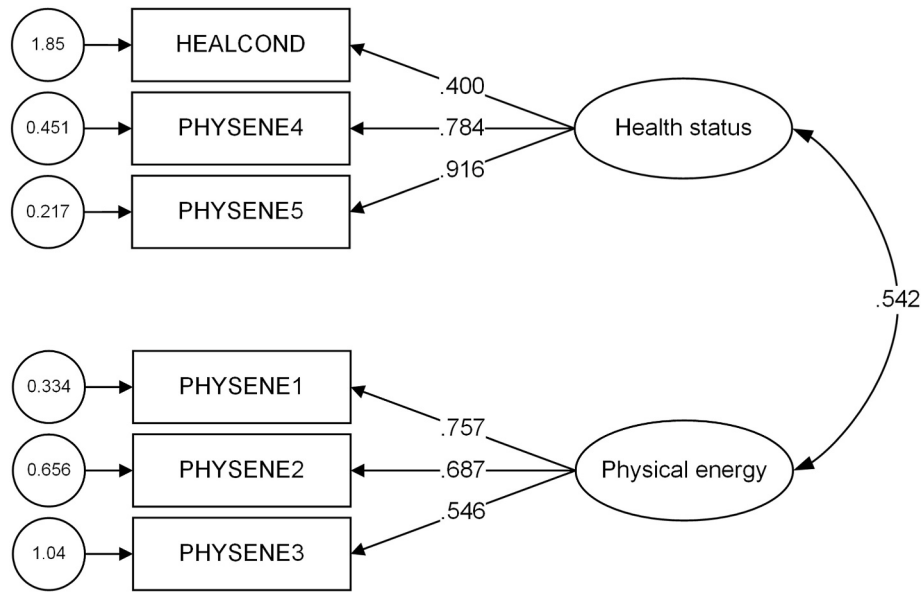


Fig. 5. Final Confirmatory Factor Analysis model of physical health data collected using the PMDWell, including error variances and factor loadings.

latent factors and 6 indicators. The final CFA model resulted in overall acceptable model fit, $\chi^2(8) = 49.0$, $p = 0.005$, $CFI = .946$, $TLI = .898$, $RMSEA = .108$, $SRMR = .049$. The CFI index suggests good fit, approaching excellent fit. The TLI fit index suggests poor fit, approaching good fit. The $RMSEA$ fit index suggests poor fit. The $SRMR$ fit index suggests acceptable fit. Although the $RMSEA$ index exceeds the acceptable threshold, this may be due to the low degrees of freedom due to small number of indicators. We deemed the TLI and $RMSEA$ results as acceptable in light of the CFI and $SRMR$ indices to preserve the ability to assess the player's physical health via their health condition. The internal reliability of the *Mental health* subdimension, measured as correlated factors omega, was above the acceptable threshold, $\omega_t = .783$.

We further investigated construct reliability and validity, see Table 5.

Health status showed acceptable reliability and validity ($CR = .761$, $AVE = .538$). *Physical energy* showed acceptable reliability and below acceptable validity ($CR = .705$, $AVE = .448$). Although the validity index is below the desirable AVE threshold for *Health status*, the reliability index exceeding the CR threshold suggests that the construct is well-defined, also considering some good model fit indices statistics. Regardless, *Physical health* should be further investigated to better estimate its validity as a dimension of wellbeing in video game contexts. As such, we found that our proposed questionnaire captures data related to physical health to an acceptable level.

3.4. Life circumstances

The final CFA model for life circumstances is displayed in Fig. 6, which contains the corresponding error variances and the standardised factor loadings.

The initial model comprised 4 latent factors and 20 indicators, resulting in a poor model fit across the fit indices: $\chi^2(164) = 903.5$, $p < 0.001$; $CFI = .804$; $TLI = .773$; $RMSEA = .101$, $SRMR = .106$. Upon investigating the factor loadings, the latent variable of *Social*

Table 5
Reliability and Validity of the latent factor of the Physical health subdimension.

Physical Health Latent Factors	Composite reliability (CR)	Average variance extracted (AVE)
Health status	.761	.538
Physical energy	.705	.448

Opportunities was split into two latent variables: *Embeddedness (Friends)* and *Embeddedness (Family)*. Furthermore, *FIN4* was removed, resulting in a final model comprising 5 latent factors and 19 indicators. The final CFA model yielded an excellent model fit across all fit indices, $\chi^2(160) = 296.7$, $p < 0.001$, $CFI = .977$, $TLI = .972$, $RMSEA = .037$, $SRMR = .041$. The CFI and TLI indices indicate an excellent fit, while the $RMSEA$ index suggests a good fit and the $SRMR$ index suggests an acceptable fit. The internal reliability of the *Life circumstances* subdimension, measured as correlated factors omega, was above the satisfactory threshold, $\omega_{cf} = .866$.

We further investigated construct reliability and validity, see Table 6.

Social availability returned acceptable reliability and validity ($CR = .801$, $AVE = .586$). The *Embeddedness friends* returned acceptable reliability and below acceptable validity ($CR = .825$, $AVE = .493$). The *Embeddedness family* model returned acceptable reliability and validity ($CR = .834$, $AVE = .514$). *Occupational circumstances* returned acceptable reliability and validity ($CR = .820$, $AVE = .604$). *Financial circumstances* returned acceptable reliability and validity ($CR = .793$, $AVE = .567$). Although the validity for *Embeddedness friends* was just below the acceptable threshold, the remaining constructs returned acceptable reliability and validity, leading us to believe that the construct is well-defined. Whilst it is possible that the validity decreased due to repeating the same items for the friends dimension, its inclusion should be further studied to determine its validity as a construct of *Life circumstances*. Overall, we found that our proposed questionnaire effectively captures data related to life circumstances.

3.5. Impact on the questionnaire

After the confirmatory factor analyses, the questionnaire had been reduced from 77 items to 54 items, a reduction of 23 items. The total number of items per dimension, subdimension and for the entire scale is presented in Table 7. We conducted the reliability analysis on the post-CFA scale. The internal reliability of the scale dropped slightly post-CFA when measured in omega total, but remained above the acceptable threshold, $\omega_t = .946$.

4. Discussion

This study was motivated by the vast research gap in the field of video game psychology on the wellbeing of video gamers. Based on a

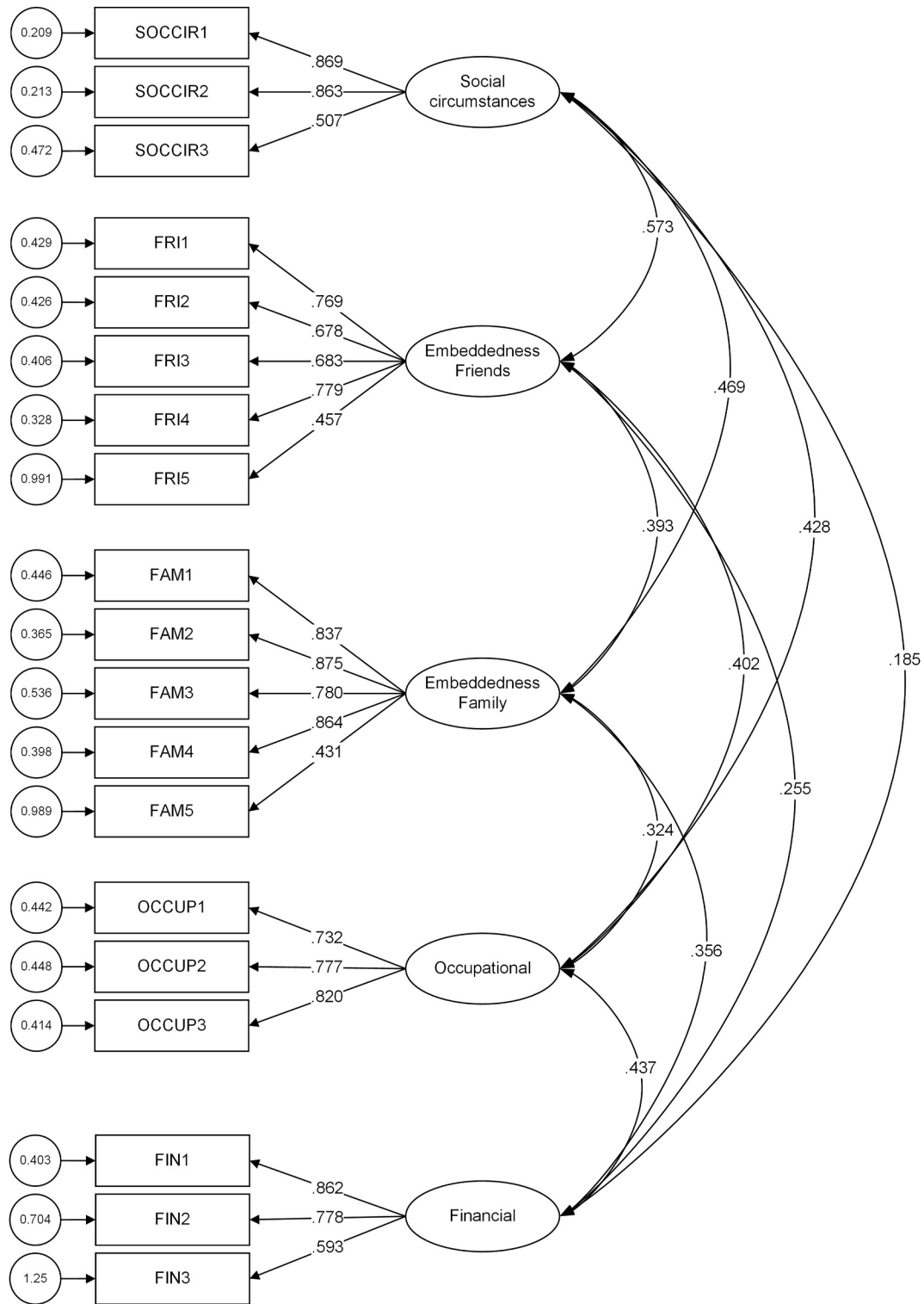


Fig. 6. Final Confirmatory Factor Analysis model of life circumstances data collected using the PMDWell, including error variances and factor loadings.

conceptual framework drawn from past literature investigating how video games impact wellbeing, we introduced the Player Multidimensional Wellbeing scale (PMDWell) to probe wellbeing dimensions that ought to be of particular importance when looking at video game players: social functioning, mental health, physical health and life circumstances. We predicted that social functioning and mental health (H_1), as well as physical health and life circumstances (H_2) would be significant constructs of the PMDWell.

The confirmatory factor analyses revealed that after reducing the number of items across the PMDWell from 77 to 54, the probed dimensions of wellbeing yielded acceptable to excellent model fits. All models reported an overall acceptable range of model fits. *Social functioning* returned good model fits, with the exception of a marginal *TLI* index, although many of the validity and reliability statistics fell below the acceptable range, especially the *Interpersonal behaviour* and *Social recreation* subdimensions, possibly explainable by both constructs

Table 6

Reliability and Validity of the latent factors of the Life circumstances subdimensions.

Life Circumstances Latent Factors	Composite reliability (CR)	Average variance extracted (AVE)
Social availability	.801	.586
Embeddedness friends	.825	.493
Embeddedness family	.834	.514
Occupational circumstances	.820	.604
Financial circumstances	.793	.567

Table 7

Structure of the PMDWell post-CFA, including dimensions and subdimensions, number of items pre-CFA, removed items and number of items post-CFA.

Dimension	Items pre-CFA	Removed item number	Items post-CFA
Social functioning	14		11
Social engagement	5	1, 3	3
Interpersonal behaviour	2		2
Prosocial behaviour	4		4
Recreation	3	1	2
Mental health	36		18
Mental energy	4	4	3
Affective wellbeing	20	2, 4, 6, 7, 8, 11, 12, 13, 15, 16, 18, 20	8
Emotional intelligence	4	1, 2, 3, 4	0
Self-esteem	4	2	3
Life satisfaction	4		4
Physical health	7		6
Physical activity	1	1	0
Physical energy	5		5
Health problems	1		1
Life circumstances	20		19
Social circumstances	3		3
Embeddedness	10		10
Occupational	3		3
Financial	4	4	3
TOTAL	77		54

comprising of only two indicators. Whilst the model was reasonably fitted, and its structure appears to be supported by past literature, we advise researchers to exercise a degree of caution when using the *Social functioning* dimension of the PMDWell until its validity and reliability can be established. *Mental health* returned good model fit indices, and mostly good validity and reliability. Replications of this study should focus on the *Mental energy* subdimension to establish its validity. *Physical health* returned mixed model fits depending on index, though reliability and validity were mostly intact. Replications of this study should focus on the *Physical energy* subdimension to establish its validity. *Life circumstances* returned the best results, with good model fits and mostly acceptable reliability and validity, except for *Embeddedness friends*, which fell just below the desired validity threshold. The internal reliability of all four dimensions remained above the acceptable threshold, and the composite internal reliability remained strong.

Overall, the results of this study provide an affirmative answer to our research question and both the hypotheses. We were able to construct a multidimensional wellbeing scale based on the conceptual framework grounded in past literature on how video games influence wellbeing, with the revised conceptual framework shown in Fig. 7. We also found initial evidence for social functioning, mental health, physical health and life circumstances being significant constructs of the multidimensional wellbeing scale. This is a novel contribution to the field of video game psychology, which to date has mostly been concerned about psychological wellbeing when investigating video game players. With

this study, we suggest that external wellbeing, that is physical health and life circumstances, ought to be recognised and probed as a part of player wellbeing.

4.1. Novel scale or toolbox

Instead of formulating a completely novel scale from scratch, the PMDWell was conceived as a conceptual framework grounded in the literature, choosing relevant questionnaire items from already validated scales when available, and devising new items when none were available; see Table 2 for a detailed list of items from literature or self-devised. This choice was motivated by innovation over replication of past research - we wanted to avoid producing items that are already abundant in the literature, for example scales that probe social functioning or mental health subdimensions.

Whilst this approach may appear more practical, rather than conceptual, it addresses the limitations of the existing wellbeing scales specifically in the context of video game psychology. There are existing links in the literature between the wellbeing dimensions of the PMDWell. For example, there is the notion that good mental health often arises from good social functioning (Mandryk et al., 2020; Perry et al., 2018), or that psychological and physical health are linked (Prince et al., 2007), which need to be verified in the context of video game engagement, considering the narrow focus of video game psychology on psychological wellbeing. Thus, we posit that the PMDWell is a new framework that not only shifts the focus away from the psyche towards the physical and external in video game psychology but also provides clearer boundaries for player wellbeing dimensions without diminishing the possible interactions across the dimensions. Despite the integrative approach to the construction of the PMDWell, we believe that, considering the lack of suitable multidimensional wellbeing scales in video game psychology and with the addition of the new items, the PMDWell is a novel scale, rather than a mere toolbox.

4.2. Theoretical implications

This study investigates the relationship between video gameplay and wellbeing. We can now suggest that there is merit in probing player multidimensional wellbeing beyond mental health alone. We believe that the theoretical framework and measuring instrument we presented and initially validated in this paper will be useful not only in exploring the multidimensional wellbeing of video game players but also in unravelling the relationships and causation between video games and wellbeing.

We have corroborated the validity of probing social functioning with regards to video game use (Vella et al., 2015; Martončík & Lokša, 2016; Perry et al., 2018; Burke & Lucier-Greer, 2021; Tushya et al., 2023), as well as probing mental health (Bargeron & Hormes, 2017; (Abbasi et al., 2023); Egami et al., 2022; Johannes et al., 2021; Rudolf et al., 2022; Shabih et al., 2021; Tyack et al., 2020, pp. 1–15; Yamaguchi, 2023) to suggest that these facets of wellbeing should be influenced by video gameplay.

The importance of this study, however, lies in its consideration of physical health and life circumstances surrounding the players. Research into the physical health of video game players has been very mixed, from studies showing poorer health outcomes for high engagement or addicted players (Shiue, 2015; Fitzpatrick et al., 2019; Isralowitz et al., 2022; Leung et al., 2024; Pelletier et al., 2020) to studies failing to replicate such findings (Alagoz & Keskinilic, 2022; McDougall & Duncan, 2008; Primack et al., 2012; Stockdale & Coyne, 2018). Our validation has shown that it is appropriate to probe the health condition and physical energy of players to unravel the nature of the influence of video games on physical health: do they cause poorer health outcomes, do they attract players with poor health outcomes, or do they not influence physical health at all? We also suggest that it is appropriate to probe the external life circumstances of the player. Research suggests

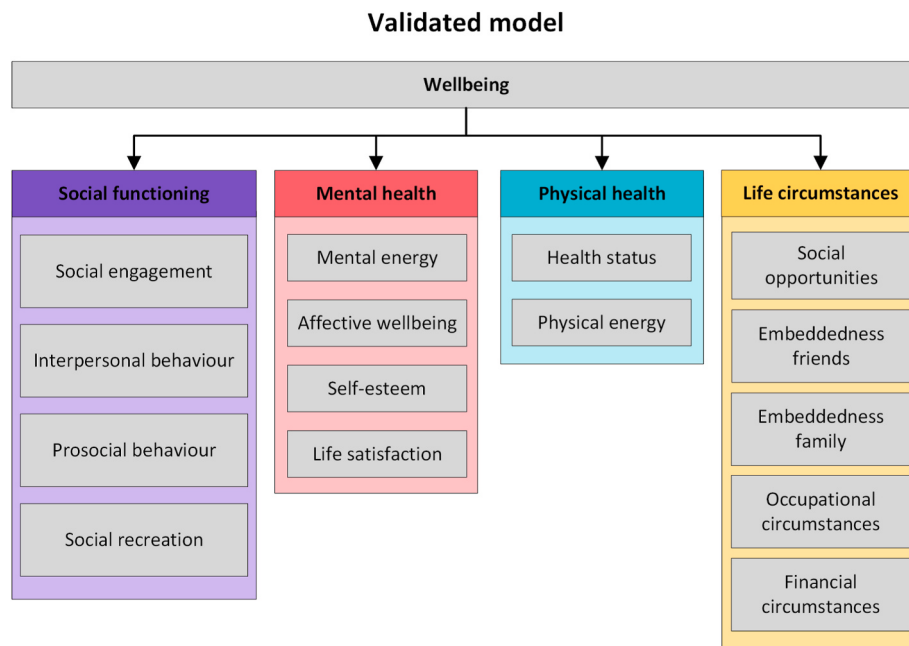


Fig. 7. A diagram of the validated PMDWell framework.

video games have a positive impact on social connectedness with the family (Tan et al., 2023; Wen et al., 2011), though this does not extend outside the family (Kowert et al., 2014) unless friendships transition offline (Trepte et al., 2012) or is not explicit to the players themselves (Domahidi et al., 2018). Economic wellbeing seems to be somewhat linked to video games negatively (Isralowitz et al., 2022), though this has been challenged by this relationship only impacting around a quarter of players (Porter et al., 2010). Financially, there is either no impact of video games on spending patterns (Wang & Zaman, 2019) or a positive effect of financially oriented video games on financial literacy (Maynard et al., 2012).

4.3. Advantages of the PMDWell framework

The PMDWell framework has several advantages. It defines player wellbeing as multidimensional, presenting both internal and external dimensions of wellbeing. This is a novel approach within video game psychology, where investigations often focus on psychological wellbeing of the player. We believe that encompassing more wellbeing dimensions within one scale can allow for broader understanding of player wellbeing. Moreover, this framework considers external wellbeing, especially aspects of it that the player can change, like finances or occupation, as a key part of player wellbeing, a notion previously unaccounted for in video game psychology literature, for factors outside the individual can allow us to understand player wellbeing much more broadly than what the approaches to date have accounted for. This framework also offers some practical flexibility. After testing the PMDWell on a range of ages (13–65) and in different continents, there is potential for it to be a more universal framework for use in video game psychology research across all ages and cultures. As the PMDWell dimensions were validated separately, there is potential to use it as a composite or a partial measure, allowing researchers to pick and choose dimensions of player wellbeing they are interested in.

4.4. Limitations and future research

It is essential to acknowledge that this study has several limitations, both in terms of methodology and execution.

This study employed a mostly Western sample with vast access to technology and video games. It would have been more desirable to also

account for the less developed areas of the world that are only experiencing a technological revolution to see how this introduction to the world of video games loads onto the players' wellbeing, or whether it results in a recency effect, as opposed to a sustained long-term effect on wellbeing. This study also does not account for the differential impacts dependent on age, as theorised by Kowert et al. (2015). The mean age of the sample indicated that an average participant in this study was a young adult. Future work could collect more data from adolescents to conduct this comparison. In addition, this study relied entirely on self-report, probing the players' subjective wellbeing. This approach not only does not capture objective wellbeing (Voukelatou et al., 2021), it also does not account for other domains in which wellbeing could be displayed, such as behavioural or physiological wellbeing. This could introduce issues of bias and researcher effects, where integrating other measures of wellbeing in the future could reveal if the PMDWell scale is susceptible to such biases.

The biggest limitation of this study lies in some of the PMDWell constructs reporting poor reliability and validity. Whilst the overall results of the CFA analyses were satisfactory, some constructs in the *Social functioning*, *Mental health* and *Physical health* subdimensions returned poor reliability and validity indices. Investigating these constructs further, their removal either did not improve the respective models, or reduced the comprehensiveness of the final PMDWell scale. Some constructs, for example *Interpersonal behaviour*, had quite poor performance, possibly caused by including only two indicators, which is a minimum to conduct a CFA analysis appropriately. Whilst our motivation to keep these problematic constructs, bearing in mind the overall model fit indices, was to arrive at a more comprehensive framework of player wellbeing, the problematic constructs could undermine the soundness of the PMDWell scale. We posit that researchers ought to treat these constructs with caution until further validation can confirm their reliability and validity.

Future research should first aim to address the methodological shortcomings of this study. The paramount concern for future studies should be the poor performance of some of the constructs. We propose that both small-scale studies on a single dimension of the framework and large-scale studies on the whole framework, would be helpful in firmly establishing the explanatory power of the PMDWell to allow for necessary changes to be made. This would also further validate the scale for use in video game players. Future research should also seek to validate

the use of the PMDWell in more diverse samples, for example adolescents or non-Western players. Implementing changes to make the scale administrable to younger and non-Western players would facilitate more comparisons between the different player demographics.

CRedit authorship contribution statement

Szymon Zbigniew Olejarnik: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Daniela M. Romano:** Writing – review & editing, Supervision, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chbr.2025.100806>.

Data availability

All data created during this research are openly available from the University of Nottingham data repository at <https://doi.org/10.17639/nott.7588>.

References

- Abbasi, A. Z., Khan, M. K., Naeem, F., Albashrawi, M., Ting, D. H., & Kumar, S. (2023). Gamers' subjective well-being: The role of peripheral and core elements of eSport videogame addiction. *Current Psychology*, 42(36), 32230–32243. <https://doi.org/10.1007/s12144-022-04222-4>
- Alagoz, N., & Keskinilic, A. U. (2022). The relationship between internet and game addiction and the levels of physical activity of the secondary education students. *EBSCOhost*. <https://doi.org/10.5455/medscience.2021.12.405>
- APA. (2018). Well-being. In *APA dictionary of psychology*. <https://dictionary.apa.org/well-being> (accessed May 15, 2024).
- Bargeron, A. H., & Hormes, J. M. (2017). Psychosocial correlates of internet gaming disorder: Psychopathology, life satisfaction, and impulsivity. *Computers in Human Behavior*, 68, 388–394. <https://doi.org/10.1016/j.chb.2016.11.029>
- Barr, M., & Copeland-Stewart, A. (2021). Playing video games during the COVID-19 pandemic and effects on players' well-being. *Games and Culture*, 17(1), 122–139. <https://doi.org/10.1177/15554120211017036>
- Birchwood, M., Smith, J., Cochrane, R., Wetton, S., & Copestake, S. (1990). The social functioning scale. The development and validation of a new scale of social adjustment for use in family intervention programmes with schizophrenic patients. *The British Journal of Psychiatry: The Journal of Mental Science*, 157, 853–859. <https://doi.org/10.1192/bjp.157.6.853>
- Burke, B., & Lucier-Greer, M. (2021). Comparing video game engagement measures as related to individual and relational well-being in a community sample of adult gamers. *Computers in Human Behavior Reports*, 4, Article 100136. <https://doi.org/10.1016/j.chbr.2021.100136>
- Byrne, B. M. (1994). *Structural equation modeling with EQS and EQS/Windows: Basic concepts, applications, and programming*. Thousand Oaks, CA: Sage.
- Caprara, G. V., Steca, P., Zelli, A., & Capanna, C. (2005). A new scale for measuring adult's prosocialness. *European Journal of Psychological Assessment*, 21, 77–89. <https://doi.org/10.1027/1015-5759.21.2.77>
- Chen, X., & Page, A. (2016). Stability and instability of subjective well-being in the transition from adolescence to young adulthood: Longitudinal evidence from 20991 young Australians. *PLoS One*, 11(5), Article e0156399. <https://doi.org/10.1371/journal.pone.0156399>
- Cho, E. (2025). Reliability and omega hierarchical in multidimensional data: A comparison of various estimators. *Psychological Methods*, 30(1), 40–59. <https://doi.org/10.1037/met0000525>
- Choi, Y., Koo, J., & Lee, S. (2017). How do workplace issues affect employees' video game addiction? *Journal of Groups in Addiction & Recovery*, 12(1), 3–12. <https://doi.org/10.1080/1556035X.2016.1166468>
- Clement, J. (2022). *Most popular reasons for playing video games according to gamers in the United States as of August 2022*. Statista. <https://www.statista.com/statistics/239310/reasons-why-female-online-gamers-play-games-in-the-united-states/>. (Accessed 20 March 2025).
- CSWE. (2016). Working definition of economic well-being. *Council on Social Work Education*. <https://www.cswe.org/centers-initiatives/economic-wellbeing-clearinghouse/working-definition-of-economic-wellbeing/>. (Accessed 28 May 2024).
- Depping, A. E., Johanson, C., & Mandryk, R. L. (2018). Designing for friendship: Modeling properties of play, In-Game social capital, and psychological well-being. *Proceedings of the 2018 annual symposium on computer-human interaction in play*. <https://doi.org/10.1145/3242671.3242702>
- Desai, V., Gupta, A., Andersen, L., Ronnestrand, B., & Wong, M. (2021). Stress-reducing effects of playing a casual video game among undergraduate students. *Trends in Psychology*, 29(3), 563–579. <https://doi.org/10.1007/s43076-021-00062-6>
- Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49(1), 71–75. https://doi.org/10.1207/s15327752jpa4901_13
- Diener, E., Sapyta, J. J., & Suh, E. (1998). Subjective well-being is essential to well-being. *Psychological Inquiry*, 9(1), 33–37. https://doi.org/10.1207/s15327965pli0901_3
- Domahidi, E., Breuer, J., Kowert, R., Festl, R., & Quandt, T. (2018). A longitudinal analysis of Gaming- and non-gaming-related friendships and social support among social online game players. *Media Psychology*, 21(2), 288–307. <https://doi.org/10.1080/15213269.2016.1257393>
- Egami, H., Rahman, M. S., Yamamoto, T., Wakabayashi, T., & Egami, C. (2022). *Causal effect of video game play on mental well-being: A quasi-experimental study among Japanese population*. OSF. <https://doi.org/10.31234/osf.io/8y7cf>
- Elder, Z. (2023, April 30). iPad kids, the bane of the next generation. *Index - Feiten en Cijfers over Onze Samenleving*. <https://thsindex.org/2023/04/20/ipad-kids-the-bane-of-the-next-generation/>. (Accessed 28 May 2024).
- Engelstätter, B., & Ward, M. R. (2022). Video games become more mainstream. *Entertainment Computing*, 42, Article 100494. <https://doi.org/10.1016/j.entcom.2022.100494>
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3), 272–299. <https://doi.org/10.1037/1082-989X.4.3.272>
- Fitzpatrick, C., Burkhalter, R., & Asbridge, M. (2019). Adolescent media use and its association to well-being in a Canadian national sample. *Preventive Medicine Reports*, 14, Article 100867. <https://doi.org/10.1016/j.pmedr.2019.100867>
- Formosa, J., Johnson, D., Türkay, S., & Mandryk, R. L. (2022). Need satisfaction, passion and well-being effects of videogame play prior to and during the COVID-19 pandemic. *Computers in Human Behavior*, 131. <https://doi.org/10.1016/j.chb.2022.107232>, 107232–107232.
- Formell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.2307/3151312>
- Goh, C., Jones, C., & Copello, A. (2019). A further test of the impact of online gaming on psychological wellbeing and the role of play motivations and problematic use. *Psychiatric Quarterly*, 90(4), 747–760. <https://doi.org/10.1007/s11126-019-09656-x>
- Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, 3(4), 424–453. <https://doi.org/10.1037/1082-989X.3.4.424>
- Hussain, Z., Griffiths, M. D., & Baguley, T. (2012). Online gaming addiction: Classification, prediction and associated risk factors. *Addiction Research and Theory*, 17(3), 359–371. <https://doi.org/10.3109/10666359.2011.640442>
- Israelowitz, R., Romem Porat, S., Zolotov, Y., Yehudai, M., Dagan, A., & Reznik, A. (2022). Gaming disorder and psycho-emotional wellbeing among Male university students and other young adults in Israel. *International Journal of Environmental Research and Public Health*, 19(23). <https://doi.org/10.3390/ijerph192315946>, Article 23.
- Janicke-Bowles, S. H., Buckley, T. M., Rey, R., Wozniak, T., Meier, A., & Lomanowska, A. (2023). Digital flourishing: Conceptualizing and assessing positive perceptions of mediated social interactions. *Journal of Happiness Studies*, 24(3), 1013–1035. <https://doi.org/10.1007/s10902-023-00619-5>
- Johannes, N., Vuorre, M., & Przybylski, A. K. (2021). Video game play is positively correlated with well-being. *Royal Society Open Science*, 8(2), Article 202049. <https://doi.org/10.1098/rsos.202049>
- Kowert, R., Domahidi, E., Festl, R., & Quandt, T. (2014). Social gaming, lonely life? The impact of digital game play on adolescents' social circles. *Computers in Human Behavior*, 36, 385–390. <https://doi.org/10.1016/j.chb.2014.04.003>
- Kowert, R., Vogelgesang, J., Festl, R., & Quandt, T. (2015). Psychosocial causes and consequences of online video game play. *Computers in Human Behavior*, 45, 51–58. <https://doi.org/10.1016/j.chb.2014.11.074>
- Kuperczko, D., Kenyeres, P., Darnai, G., Kovacs, N., & Janszky, J. (2022). Sudden gamer death: Non-violent death cases linked to playing video games. *BMC Psychiatry*, 22(1), 824. <https://doi.org/10.1186/s12888-022-04373-5>
- Lee, Y.-H., & Chen, M. (2023). Seeking a sense of control or escapism? The role of video games in coping with unemployment. *Games and Culture*, 18(3), 339–361. <https://doi.org/10.1177/15554120221097413>
- Lemmens, J. S., Valkenburg, P. M., & Peter, J. (2009). Development and validation of a game addiction scale for adolescents. *Media Psychology*, 12(1), 77–95. <https://doi.org/10.1080/15213260802669458>
- Leung, J., Saunders, J. B., Stjepanović, D., Tisdale, C., McClure-Thomas, C., Connor, J., Gullo, M., Wood, A. P., & Kai Chan, G. C. (2024). Extended hours of video game play and negative physical symptoms and pain. *Computers in Human Behavior*, 155, Article 108181. <https://doi.org/10.1016/j.chb.2024.108181>
- 2024 Computer Hope. (2024). What is casual gaming? In *Computer Hope*. <https://www.computerhope.com/jargon/c/casual-gaming.htm>. (Accessed 4 October 2024).
- Clement, J. (2024a). Number of video gamers worldwide 2019–2029. Statista. <https://www.statista.com/statistics/748044/number-video-gamers-world/>. (Accessed 28 May 2024).

- Clement, J. (2024b). Distribution of video gamers in the United States in 2023, by generation. Statista. <https://www.statista.com/statistics/189582/age-of-us-video-game-players/>. (Accessed 20 March 2025).
- Clement, J. (2025a). Gaming penetration in the united kingdom (UK) from 2013 to 2024, by age group and gender. Statista. <https://www.statista.com/statistics/300513/gaming-by-demographic-group-uk/>. (Accessed 20 March 2025).
- Clement, J. (2025b). Share of gaming audiences who ever play games online in the united kingdom (UK) as of November 2024, by age group. Statista. <https://www.statista.com/statistics/301350/online-gaming-in-the-uk-by-age/>. (Accessed 20 March 2025).
- MacLeod, C. (n.d.) How emotionally intelligent are you? In *Mindtools*. <https://www.mindtools.com/axbwm3m/how-emotionally-intelligent-are-you> (accessed 20 September 2024).
- Mandryk, R. L., Frommel, J., Armstrong, A., & Johnson, D. (2020). How passion for playing world of warcraft predicts In-Game social capital, loneliness, and wellbeing. *Frontiers in Psychology*, 11. <https://www.frontiersin.org/articles/10.3389/fpsyg.2020.02165>.
- Martončík, M., & Lokša, J. (2016). Do world of Warcraft (MMORPG) players experience less loneliness and social anxiety in online world (virtual environment) than in real world (offline)? *Computers in Human Behavior*, 56, 127–134. <https://doi.org/10.1016/j.chb.2015.11.035>
- Maynard, N. W., Mehta, P., Parker, J., & Steinberg, J. (2012). Can games build financial capability? Financial entertainment: A research overview. *Working papers*. Article WR-963-SSA. <https://ideas.repec.org/p/ran/wpaper/wr-963-ssa.html>.
- McDougall, J., & Duncan, M. J. (2008). Children, video games and physical activity: An exploratory study. *International Journal on Disability and Human Development*, 7(1), 89–94. <https://doi.org/10.1515/IJDHD.2008.7.1.89>
- Nunnally, J. C., & Bernstein, I. H. (1994). The assessment of reliability. *Psychometric Theory*, 3, 248–292.
- OECD. (2011). *How's life? Measuring well-being*. Paris: OECD Publishing.
- OECD. (2013). Economic wellbeing. In *OECD framework for statistics on the distribution of household income, consumption and wealth*. Paris: OECD Publishing. <https://doi.org/10.1787/9789264194830-en>.
- Ofcom. (2017). Children and parents: Media use and attitudes report. Ofcom, 22–30. <https://www.ofcom.org.uk/siteassets/resources/documents/research-and-data/media-literacy-research/children/childrens-media-literacy-2017/children-parents-media-use-attitudes-2017.pdf?v=322847#page=29.10>. (Accessed 30 July 2025).
- Ofcom. (2024). Children and parents: Media use and attitudes report. Ofcom, 21–23. <https://www.ofcom.org.uk/siteassets/resources/documents/research-and-data/media-literacy-research/children/childrens-media-use-and-attitudes-2024/childrens-media-literacy-report-2024.pdf?v=368229#page=21.12>. (Accessed 30 July 2025).
- Olejarnik, S. Z., & Romano, D. (2023). Is playing violent video games a risk factor for aggressive behaviour? Adding narcissism, self-esteem and PEGI ratings to the debate. *Frontiers in Psychology*, 14. <https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1155807>.
- Olsson, C. A., McGee, R., Nada-Raja, S., & Williams, S. M. (2013). A 32-Year longitudinal study of child and adolescent pathways to well-being in adulthood. *Journal of Happiness Studies*, 14(3), 1069–1083. <https://doi.org/10.1007/s10902-012-9369-8>
- Ostic, D., Qalati, S. A., Barbosa, B., Shah, S. M. M., Galvan Vela, E., Herzallah, A. M., & Liu, F. (2021). Effects of social media use on psychological well-being: A mediated model. *Frontiers in Psychology*, 12, Article 678766. <https://doi.org/10.3389/fpsyg.2021.678766>
- Pelletier, V. H., Lessard, A., Piché, F., Tétreau, C., & Descarreaux, M. (2020). Video games and their associations with physical health: A scoping review. *BMJ Open Sport & Exercise Medicine*, 6(1). <https://doi.org/10.1136/bmjsem-2020-000832>
- Perry, R., Drachen, A., Kearney, A., Krigstein, S., Nacke, L. E., Sifa, R., Wallner, G., & Johnson, D. (2018). Online-only friends, real-life friends or strangers? Differential associations with passion and social capital in video game play. *Computers in Human Behavior*, 79, 202–210. <https://doi.org/10.1016/j.chb.2017.10.032>
- Petrovskaya, E., & Zendle, D. (2023). The relationship between psycho-environmental characteristics and wellbeing in non-spending players of certain Mobile games. *Royal Society Open Science*, 10(1), Article 221129. <https://doi.org/10.1098/rsos.221129>
- Porter, G., Starcevic, V., Berle, D., & Fenech, P. (2010). Recognizing problem video game use. *Australian and New Zealand Journal of Psychiatry*, 44(2), 120–128. <https://doi.org/10.3109/00048670903279812>
- Primack, B. A., Carroll, M. V., McNamara, M., Klem, M. L., King, B., Rich, M., Chan, C. W., & Nayak, S. (2012). Role of video games in improving health-related outcomes: A systematic review. *American Journal of Preventive Medicine*, 42(6), 630–638. <https://doi.org/10.1016/j.amepre.2012.02.023>
- Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Phillips, M. R., & Rahman, A. (2007). No health without mental health. *The Lancet*, 370(9590), 859–877. [https://doi.org/10.1016/S0140-6736\(07\)61238-0](https://doi.org/10.1016/S0140-6736(07)61238-0)
- Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology*, 14(2), 154–166. <https://doi.org/10.1037/a0019440>
- Qustodio. (2025). Average daily time spent by children in the united kingdom (UK) on leading gaming apps from 2019 to 2024 (in minutes). In *The Digital Dilemma*, 41. https://static.qustodio.com/public-site/uploads/2025/01/16120043/Digital_Dilemma_2024_Qustodio_Data_Report.pdf?gl=1*1b46m40*_gcl_au*NDM4Nzc3OTMwLjE3NDQyMDgwMjU. (Accessed 30 July 2025).
- Ramesh, K., & Igor, M. (2016). The gaming addiction problem and its economic and social consequences: A comprehensive, dynamic approach. *Advanced Engineering Technology and Application*, 5(3), 69–77. <https://doi.org/10.18576/aeta/050304>
- Raouf, S. Y. A., Gabr, H. M., Al-Wutayd, O., & Al-Batanony, M. A. (2022). Video game disorder and mental wellbeing among university students: A cross-sectional study. *Pan African Medical Journal*, 41(1). <https://doi.org/10.11604/pamj.2022.41.89.31322>. Article 1.
- Redepenning, D. H., Bell, M., Adenaiye, O., & Dicianno, B. E. (2024). Relationship between employment and adaptive video gaming in individuals with physical disabilities. *Disability and Rehabilitation: Assistive Technology*, 0(0), 1–8. <https://doi.org/10.1080/17483107.2024.2339427>
- Rudolf, K., Soffner, M., Bickmann, P., Froböse, I., Tholl, C., Wechsler, K., & Grieben, C. (2022). Media consumption, stress and wellbeing of video game and eSports players in Germany: The eSports study 2020. *Frontiers in Sports and Active Living*, 4. <https://doi.org/10.3389/fspor.2022.665604>
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52(1), 141–166. <https://doi.org/10.1146/annurev.psych.52.1.141>
- Ryff, C. D., & Singer, B. H. (2008). Know thyself and become what you are: A eudaimonic approach to psychological well-being. *Journal of Happiness Studies*, 9, 13–39. <https://doi.org/10.1007/s10902-006-9019-0>
- Shabih, F., Gohar, A., Ahmed, F., & Danish, H. (2021). Effect of video game addiction on the physical and mental wellbeing of adolescents of karachi. *Journal of Fatima Jinnah Medical University*, 15(3). <https://doi.org/10.37018/BIYK3428>. Article 3.
- Shiue, I. (2015). Self and environmental exposures to drinking, smoking, gambling or video game addiction are associated with adult hypertension, heart and cerebrovascular diseases, allergy, self-rated health and happiness: Japanese general social survey, 2010. *International Journal of Cardiology*, 181, 403–412. <https://doi.org/10.1016/j.ijcard.2014.12.071>
- Shoshani, A., Braverman, S., & Meirow, G. (2021). Video games and close relations: Attachment and empathy as predictors of children's and adolescents' video game social play and socio-emotional functioning. *Computers in Human Behavior*, 114, Article 106578. <https://doi.org/10.1016/j.chb.2020.106578>
- Smilkstein, G. (1978). The family APGAR: A proposal for family function test and its use by physicians. *Journal of Family Practice*, 6(6), 1231–1239.
- Smith, T., & Weston, A. (2022). Perceived impact of video gaming on employment: Implications for vocational rehabilitation counseling. *Archives of Physical Medicine and Rehabilitation*, 103(12), Article e184. <https://doi.org/10.1016/j.apmr.2022.08.935>
- Stockdale, L., & Coyne, S. M. (2018). Video game addiction in emerging adulthood: Cross-sectional evidence of pathology in video game addicts as compared to matched healthy controls. *Journal of Affective Disorders*, 225, 265–272. <https://doi.org/10.1016/j.jad.2017.08.045>
- Stoewen, D. L. (2017). Dimensions of wellness: Change your habits, change your life. *Canadian Veterinary Journal*, 58(8), 861–862.
- Tan, S. C., Lian, T. C., & Kadirvelu, A. (2023). An exploration study of family functioning, parent-child relationship, and online game addiction among Malaysian young adolescents. *International Journal of Advances in Science Engineering and Technology*, 11(1), 1–6. [https://iraj.in/journal/IJASEAT/paper_detail.php?paper_id=19432&name=An Exploration Study of Family Functioning, Parent-Child Relationship, and Online Game Addiction Among Malaysian Young Adolescents](https://iraj.in/journal/IJASEAT/paper_detail.php?paper_id=19432&name=An%20Exploration%20Study%20of%20Family%20Functioning,%20Parent-Child%20Relationship,%20and%20Online%20Game%20Addiction%20Among%20Malaysian%20Young%20Adolescents).
- Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Welch, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The warwick-edinburgh mental Well-being scale (WEMWBS): Development and UK validation. *Health and Quality of Life Outcomes*, 5(1), 63. <https://doi.org/10.1186/1477-7525-5-63>
- Toker, S., & Baturay, M. H. (2016). Antecedents and consequences of game addiction. *Computers in Human Behavior*, 55, 668–679. <https://doi.org/10.1016/j.chb.2015.10.002>
- Trepte, S., Reinecke, L., & Juechems, K. (2012). The social side of gaming: How playing online computer games creates online and offline social support. *Computers in Human Behavior*, 28(3), 832–839. <https://doi.org/10.1016/j.chb.2011.12.003>
- Turan, M. E. (2021). Empathy and video game addiction in adolescents: Serial mediation by psychological resilience and life satisfaction. *International Journal of Progressive Education*, 17(4), 282–296. <https://doi.org/10.29329/ijpe.2021.366.17>
- Tushya, Chhabra, D., & Abraham, B. (2023). Social networking or social isolation? A systematic review on socio-relational outcomes for members of online gaming communities. *Games and Culture*, Article 15554120231201760. <https://doi.org/10.1177/15554120231201760>
- Tyack, A., Wyeth, P., & Johnson, D. (2020). Restorative play: Videogames improve player wellbeing after a need-frustrating event. *Proceedings of the 2020 CHI conference on human factors in computing systems*. <https://doi.org/10.1145/3313831.3376332>
- Tyrer, P., Nur, U., Crawford, M., Karlsen, S., McLean, C., Rao, B., & Johnson, T. (2005). The social functioning questionnaire: A rapid and robust measure of perceived functioning. *International Journal of Social Psychiatry*, 51(3), 265–275. <https://doi.org/10.1177/0020764005057391>
- Vance, P.E. (2020, October 28). When it comes to kids and video games, parents remain the “Final Boss”. *Entertainment Software Rating Board*. <https://www.esrb.org/blog/when-it-comes-to-kids-and-video-games-parents-remain-the-final-boss/>. (Accessed 28 May 2024).
- Vella, K., Johnson, D., & Hides, L. (2013). Positively playful: When videogames lead to player wellbeing. *Proceedings of the first international conference on gameful design, research, and applications* (pp. 99–102). <https://doi.org/10.1145/2583008.2583024>
- Vella, K., Johnson, D., & Hides, L. (2015). Indicators of wellbeing in recreational video game players. *Proceedings of the annual meeting of the Australian special interest group for computer human interaction* (pp. 613–617). <https://doi.org/10.1145/2838739.2838818>

- Voukelatou, V., Gabrielli, L., Miliou, I., Cresci, S., Sharma, R., Tesconi, M., & Pappalardo, L. (2021). Measuring objective and subjective well-being: dimensions and data sources. *International Journal of Data Science and Analytics*, 11(4), 279–309.
- Wang, W., & Zaman, L. (2019). Social spending: An empirical study on peer pressure and player spending in games. In X. Fang (Ed.), *HCI in games* (pp. 215–233). Springer International Publishing. https://doi.org/10.1007/978-3-030-22602-2_17.
- Wartella, E. (2002). New Generations—New media. *Nordicom Review*, 23(1–2), 23–36. <https://doi.org/10.1515/nor-2017-0316>
- Wen, J., Kow, Y. M., & Chen, Y. (2011). Online games and family ties: Influences of social networking game on family relationship. In P. Campos, N. Graham, J. Jorge, N. Nunes, P. Palanque, & M. Winckler (Eds.), *Human-computer interaction – interact 2011* (pp. 250–264). Springer. https://doi.org/10.1007/978-3-642-23765-2_18.
- Williams, B. A., Onsman, A., & Brown, G. T. (2010). Exploratory factor analysis: A five-step guide for novices. *Journal of Emergency Primary Health Care*, 8(3), 1–13. <https://doi.org/10.33151/ajp.8.3.93>
- Yamaguchi, S. (2023). The relationship between playing video games on mobile devices and well-being in a sample of Japanese adolescents and adults. *SAGE Open Medicine*, 11, Article 20503121221147842. <https://doi.org/10.1177/20503121221147842>
- Zhou, M., Zhu, W., Sun, X., & Huang, L. (2022). Internet addiction and child physical and mental health: Evidence from panel dataset in China. *Journal of Affective Disorders*, 309, 52–62. <https://doi.org/10.1016/j.jad.2022.04.115>