Smart Learning Environments

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Behavioural design of gamification elements and exploration of player types in youth basketball training

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Abstract

In Mainland China, the sports training process of most players is highly homogenized, the convergence of which makes them ineffectively be identified with their individual and specific profile and difficult for them to play the sports according to their strengths and characteristics. Moreover, existing sports training software does not differentiate between player types to provide customized persona. Therefore, efficient and personalized methods need to be provided to guide players towards more autonomous sports training. Current research shows that gamification design in the process of sports training can transform players' unique conscious behaviors into habits, thus increasing their autonomy. However, the current gamification design in sports training is only based on uniform gamification elements and does not take into account the player's motivation and gamification experience, which is one of the main reasons for the homogenization of sports training. Therefore, this study aimed to identify factors that contribute to the design of gamification systems in the field of sports training, as well as to determine the relationship between players' gamification experiences during sport. It will help the researchers to explore in depth the possibilities of learning environments for youth basketball training with the development of gamified experiences. This design-driven study performed both offline and online questionnaire research (N = 198), which was analyzed with the method of a 7-point Likert scale as well as the assistance of SPSS, identified potential for the establishment of a framework for analysing preferences for gamification design elements in the context of basketball training for young players. Based on the results, this paper finds that there is a correlation between immersion and achievement in gamification experiences and proposes a framework for gamification system design in the field of sports training and offers insight that may enable the development of gamification designs that can motivate players.

Keywords: Physical education, Motivational design, Basketball training, Gamification

Introduction

Gamification has been employed to increase motivation in numerous contexts, including learning (Araya et al., 2019), virtual reality (Hassan et al., n.d.), and healthcare (Johnson et al., 2016). Gamification is most frequently used in research on learning

environments and was reported to frequently lead to favourable outcomes (Koivisto & Hamari, 2019). These favourable outcomes have led to gamification becoming increasingly common in the field of sports training. A key focus of both virtual (Tsai et al., 2022) and real (Cmentowski & Krueger, 2021) training contexts is identifying methods that can be implemented in training to motivate players and identifying a means of adapting training methods and strategies to suit the needs of different individuals. This approach achieved quality feedback in different training scenarios. Research has revealed that some behaviours that players engage in when training for sports—such as exhibiting competitiveness, chasing each other, and socialising—are similar to those they engage in when playing games. This revelation has led numerous studies to abandon traditional approaches to physical education and adopt instead a game-centric approach to teaching (Soriano-Pascual et al., 2022). However, this game-centric approach does not increase the long-term motivation of students participating in physical training.

Several forms of sports training software, including the basketball training program Homecourt (Estrada-Oliver & Mercado-Gual, 2022), are currently on the market. Such software has been developed to provide players who lack a professional training environment as well as professional training supervision and coaching. It has been used numerous times to examine and test the basic athletic movements of basketball players (Chow et al., 2023; Estrada-Oliver & Mercado-Gual, 2022; Lim, 2020). This goes some way towards demonstrating the viability of sports training software as an option for sports training and that the market has a need for such software. Studies have investigated the use of training software to train arm movement when shooting in basketball and the use of VR for basketball training (Bustamante & Burillo, 2016; Li & Zhang, 2021; Putranto et al., 2023). However, such software still remains limited in its ability to provide personalised training recommendations for players. Although numerous studies have designed game-based training model for motivating players to train (Hardy et al., 2015; Yu et al., 2018), their designs have been insufficiently individualized or customisable. This has led to such software having the same results as in-person training in terms of physical performance but much less favourable results in terms of mental and emotional performance. In in-person training, a coach can both correct a player's physical movements and determine which type of player they are to identify the most suitable position in a team or training style for them and thus ensure they continue to feel motivated to train over the long term.

Sports training software remains inadequate because it is not individualised and therefore does not lead players to feel motivated to continue working toward their training goals. In addition, research regarding how the gameplay of sports training software can be customised to motivate players to continue training has been lacking. In the present study, a gamification approach was employed to classify players on the basis of their sports motivation and psychology and to determine the associations between player types and the dimensions of gamification design to determine which gamification elements can be used to individualise player training.

This study recruited 198 participants and employed utterance judgment questions to (1) identify the participants' player types; (2) analyse their preferences for different gamification designs (displayed as storyboards); and (3) assess their preferences, perceived achievement, and immersion with respect to each gamification design. The participants'

user bias and perceived achievement and immersion were also investigated to determine how the gamification designs could be personalised for each player type, the association between player type and choice of gamification scenario preferences, which player types were most likely in basketball, and the association of a player's type with their preferences and perceived sense of achievement and immersion. The results of the analyses were used to develop a gamification design for sports training that would be supported by research. The conceptual framework for the design of an individualised experiential educational system is represented by a set of storyboards that have undergone design validation.

The organisation of this paper is as follows: Sect. 2 provides background for the study, that is, brief descriptions of various types of game users and basketball players, the gamification categories that were employed to select gamification elements, the gamification experience, the dimensions that were investigated, and previous research work related to sports training. Section 3 describes how the study was conducted, how the storyboard representing the sports gamification design was created, the development and verification of the questionnaire, and the demographic information of the participants. Section 4 presents the data and analytical results derived from the questionnaire and describes the limitations of the study and suggestions for future research. Finally, Sect. 5 presents some discussion topics.

The results of this study indicate the young basketball players' motivation points them more towards the socialiser type. Perceived achievement was stronger than perceived immersion in the gamification experience for all players during gamified sports training. In addition, a set of gamification design elements for game-based software for the training of young basketball players is proposed that can lead to players undergoing efficient and high-quality training. The present study presents an innovative approach to and novel perspective on basketball training as well as insight into how sports gamification systems can be designed. Directions for further research in this area are offers on the basis of the study's findings.

Background

The following section introduces the background of this research. The section includes a discussion of physical education, a taxonomy of gamification, and categories of playful experiences.

Physical education

Social concern for young people's physical fitness and health has grown considerably over recent years (Kemel et al., 2022). Numerous resources have been developed to improve the quality and effectiveness of young people's participation in sports activities. Such resources include an artificial intelligence movement-assisted program for golf training (Li & Cui, 2021), tactical football training (Kurach et al., 2020), and a framework for training movement standardisation for shooting in basketball (Li & Zhang, 2021).

Physical education has gradually evolved, with numerous teaching methods being proposed for ensuring that players learn about sports effectively (Rocliffe et al., 2023). Traditional methods for teaching physical education involve either a teacher-centred approach (TCA) or a student-centred approach (SCA; González-Espinosa et al., 2021).

Both of these approaches have drawbacks with respect to training. Through a TCA, the student is taught to understand the main points and techniques the teacher intends them to learn. In this form of training, students are not encouraged to think independently or develop their own body of knowledge. Through an SCA, the teacher provides instruction that is based on the student's experience. This form of instruction is better than a TCA because it avoids the student being passive (Serin, 2018), but has some limitations. Teachers sometimes can only focus on issues that are relevant to the majority of students and fail to address the problems experienced by individual students, which results in training that is to some extent less effective for students. Game-centred approaches (GCAs) to teaching have gained attention because both teachers and students have realised the importance of efficiency in physical education (Storey & Butler, 2012). GCAs (Dyson et al., 2004) combine games and sports to enable students an interactive experience and cognitive understanding of sports. Training conducted using this approach was reported to briefly increase student interest.

Gamification taxonomy

Gamification is the application of game-like features to designs employed in nongame contexts (Huang & Soman, n.d.). In the field of physical education (Bitrián et al., 2020), gamification can be used to increase motivation to participate in and interest in sports. Gamification can be employed to increase both the likelihood that a person will use a system (Kamalodeen et al., 2021), which is achieved through external expressions (e.g., leaderboards and coins), and their motivation to continue using the system, thereby increasing user stickiness (Pulido et al., 2014). When gamification is implemented, users are consistently driven and encouraged by gamified activities, which lead them to continue to participate in the activities (Deterding et al., 2011).

The identification of gamification elements in a gamified design can be difficult (Nand et al., 2019). Therefore, scholars have proposed gamification frameworks involving various classification systems that can be applied to aid in such identification (Azouz & Lefdaoui, 2018; Mora et al., 2015). However, few studies (Martí-Parreño et al., 2016; Sanchez-Mena & Marti-Parreño, 2016; Toda et al., 2019), that is, fewer than 10, have focused on gamification classification frameworks in the field of education and that include information regarding the learning environment.

Toda et al. (2019) defined a taxonomy of gamification for the field of education by considering other frameworks for classifying gamification. They classified gamification elements into five aspects, namely performance, ecological, social, personal, and fictional aspects, with 21 subdivisions. These aspects can be used to systematically evaluate gamification platforms and to analyse such platforms' service orientation, strengths, and weaknesses. This taxonomy of gamification elements comprehensively links users' interactions and motivations and has assisted researchers and designers in developing gamification designs (Khaldi et al., 2023).

In the current study, the five aspects of the gamification framework of Toda et al. (2019) were adopted as a theoretical foundation for the gamification design platform, which was used to design storyboards that incorporated gamification elements (Oliveira et al., 2022).

Gameful experience in sports training

Whether gamification is successful is determined by the level of engagement a user experiences (Eppmann et al., 2018). Högberg et al. (2019) proposed a tool for analysing the gamification experience. The present study adopted their proposed tool for the construction of user profiles. The tool comprises 56 questions that test the seven dimensions of the gamification experience proposed by Högberg et al., namely achievement, challenge, competition, guidance, immersion, playfulness, and social experience. Högberg et al. reported achievement and immersion to be particularly crucial dimensions of the gamification experience. Achievement leads to the effects of gamification persisting over the long term. Immersion leads users to enter a mind-flow state, which enables them to maintain focus over a long period. The present study focused on the measurement of these two dimensions because they reflect not only whether a user experienced positive feeling during use of a gamification program but also whether the effects of the program persist when the program is no longer being used, which is a crucial goal behind using gamification in sports training contexts.

Numerous studies have reported on gamification in a sports context. For example, one study (Menendez-Ferreira et al., n.d.) proposed an improved education model based on two software systems, with the model gamifying sports training. Young people's character is evaluated by a coach on the basis of their sportsmanship, tolerance, ability to follow directions, and teamwork, with these evaluations earning them skill points that can be applied to improve their speed, resistance, strength, defences, and skills. By gaining skill and attribute points, the player can improve their character's performance in the game.

The author of *Motivations in Sports and Fitness Gamification* (Stålnacke Larsson, 2013) investigated the factors of gamification that motivate users to continue participating in sports and fitness activities. The author interviewed six users of sports or fitness programs and discovered that intrinsic motivation gradually increases when an individual has extrinsic motivation. Larsson employed Zichermann and Cunningham's (2011) categorisation of gamification program elements to identify extrinsic motivators for continued participation in sports activities and designed questions related to motivation and use-related perceptions to ask users about their perceptions of sports and fitness apps. The apps Nike + FuelBand; Nike + Running (iPhone version); Fitbit One; Fitox One Zombies, Run! (iPhone version); and Adidas MiCoach (iPhone version) were employed to explore whether extrinsic rewards can effectively motivate users. The results revealed that most people began fitness activities due to extrinsic motivations and that they were motivated to exercise when they could see their progress and results. In addition, Larsson's findings regarding the number of times the participants ran after they stopped using the app indicated that the participants required intrinsic motivation to maintain their participation in running or fitness activities. The author of the book concluded from the users' responses in the interviews that extrinsic reward systems, such as achievement points, had a positive effect on most participants, were key drivers of their continued participation in fitness activities, and slowly led users to develop intrinsic motivation and thereby increased user stickiness (Stålnacke Larsson, 2013). The book discussed its methods for data recording, data visualisation, how users can be led to feel a sense of accomplishment, the provision of customised services, and

how socialisation can be used as a motivating factor. Although these methods served as a guide for the current study, Stålnacke Larsson's small number of participants may have led to nonrobust experimental results; also, he focused on intrinsic and extrinsic drivers in fitness and running rather than in basketball training.

Applying gamification for basketball physical education can highlight the main position of students (Li & Xu, 2021), enabling the development of a harmonious, egalitarian, and pleasant learning environment for physical education. Such an environment can improve the quality of the students' physical education (Lampropoulos et al., 2021) and effectively relieve students' general and school-related stress by enabling them to participate in physical education that is fun and gamified (Zhu et al., 2023).

Research gap and study objectives

Gamification has been widely used in educational environments and in sport education (Khaldi et al., 2023), and research has shown that players' motivation and enthusiasm can be increased by using gamification elements and gamification approaches to common sports training processes (Smiderle et al., 2020). While matching the right gamification elements to each youth player and choosing to play them in the educational environment of sports training is not a simple task, a number of gamification software for sports training are designed to help designers achieve this. However, many of the features and framework models in these software do not share a common understanding of the set of gamification elements that can be used in a gamification system and the knowledge of how to apply them (Barata et al., 2015).

In previous studies, it was inevitable that training approaches for youth players became homogenised. Since recent studies have shown that specialists are interested in using gamification in sports education environments, the construction of personalised profiles of players has not been well taken into account in order to provide youth players with a private training programme (Imran, 2019). In order to address this issue, a design approach for gamification elements in sports training educational environments is proposed and evaluated. We defined categories of youth players based on their underlying motivations and validated them through a survey of gamification experiences. However, previous gamification designs in the field of sports training have not addressed a clear categorisation of user types and the perceived relevance of the experience to guide researchers, sports coaches and designers, among others, to use them more effectively.

For the purpose of this study, the gamification user classification method is used to filter the basic data on the types of adolescent players, and the gamification experience dimensions are used to express the preference biases and perceptions of youth players in a gamification learning environment. An analysis of youth players' motivation will be conducted in this research to generate personalised definitions of gamification design for different player types. Additionally, this study expands the data related to gamification in the field of athletic training to better understand and comprehensively advance the changes/evolution and advancement of this driven technology, both in general and in the field of education. Specifically, it involved identifying the relationship between the distribution of player types among youth players and players' motivation and perceptions in the educational setting of gamification in sports training. Secondary analyses and processing of the collected data were conducted to better understand the

associations between youth players' motivation and psychological and physical attributes, and to answer our three main research questions:

> RQ1: What is the distribution of player types among youth players in the educational environment of gamification in sports training?
> RQ2: What is the relationship between perceived achievement and perceived immersion of youth players in the educational environment of gamification in sports training?
> RQ3: What are the personalised preferences of youth players in the educational environment of gamification in sports training?

As an extension of previous research, the behavioural design of gamification elements in youth basketball training and exploring the distribution of youth player types are important issues. Addressing these issues, we also improve the way existing basketball sport training systems are defined by providing gamified designs based on youth player preferences; and make recommendations on how to personalise individual training profiles in youth players for use by designers, sport training coaches, relatives of youth players and other educational stakeholders.

Study design and methodology

Both intrinsic and extrinsic motivation should be considered when players are training for sports events because they are inextricably linked (Schüler et al., 2023). When a player has intrinsic motivation, the very act of participating in a sports activity is motivation. By contrast, an extrinsic motivator provides incentives for players to engage in sports training on a consistent basis (Zheng et al., 2023). An extrinsic motivator may be an extrinsic reward, such as a good ranking or stylish sports shoes. A focus of the current study was to differentiate players into types on the basis of their intrinsic motivations and to design a research questionnaire to determine the most effective extrinsic motivation design features that can be personalised. The results were used to develop a framework for designing personalised incentive features for gamified training programs for basketball (Pulido et al., 2014). The study design process is illustrated in Fig. 1.

This study investigated gameplay elements designed for gamification in a sporting environment and the association between players' senses of achievement and immersion. The research questions were as follows: which gamification elements can be adopted to

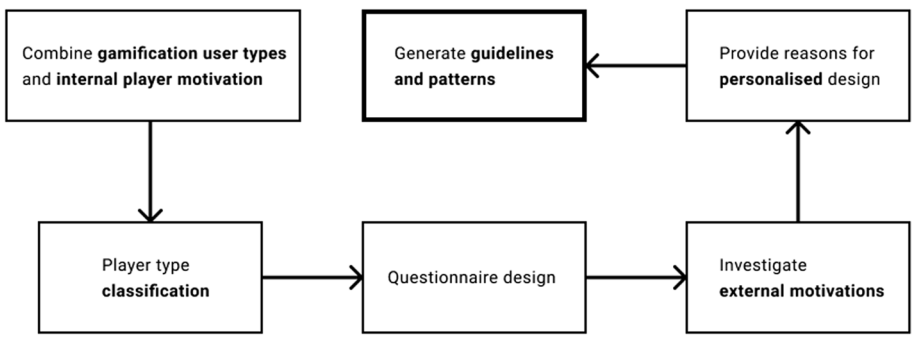

Fig. 1 Study design process

motivate players in a basketball training environment? How are player achievement and immersion associated in the context of gamification programs? How do different types of players differ in their perceptions of achievement and immersion? To answer these questions, a research plan with the following steps was employed: (1) storyboard design, (2) questionnaire design, (3) pilot study, (4) field research, and (5) result analysis and visualisation. The research plan is illustrated in Fig. 2.

Player type

For the classification of player types, it is necessary to select and differentiate methods according to the type and context of the research. In a previous paper (Smiderle et al., 2020), researchers conducted an experiment with 40 undergraduate students in a first-year programming course based on personality traits in an online programming learning environment to study gamification's impact on student learning and behaviour. When they captured the user database samples, they classified the users based on the personality traits. However, such a classification method is not detailed and does not suit the discrimination of player types. In 2020 (Bovermann & Bastiaens, 2020), researchers investigated how five gamified user types related to distance online learning activities in educational sciences. Bartle's player style persona theory was used. This taxonomy classifies users into five categories (Achievers, Explorers, Socialisers and Killers) based on their preferences. This approach has the advantage of systematically selecting the appropriate gamified user type and the mechanics of the target group's learning preferences, interests or experiences in relation to the online learning activity, but would be more specific to the research environment associated with online learning. According to the classification system of Tondello et al. (2016), game users can be classified into six types: achiever, disruptor, free spirit, philanthropists, player, and socialiser. These six user types have been employed in many studies (Rodríguez et al., 2022; Ugur-Erdogmus & Çakır, 2022). However, in the specific context of sports training, the motivations for both designing gamification and for participating in sports training must be considered. In the present study, the participants were presented a description of the philanthropist player type to serve as motivation. Philanthropist players are driven by purpose; they tend to be selfless in that they focus on what will benefit their entire team and share their experiences without expecting anything in return. The other five user types were explained with consideration of the descriptions presented in Table 1.

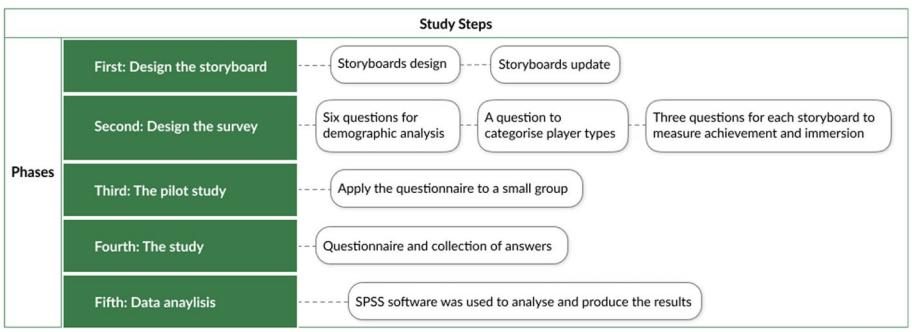

Fig. 2 Research plan

Table 1 Player type descriptions

Player type	Description	
Philanthropist	Features	Collection and trading, gifting, knowledge sharing, and administrative roles
	First description	I enjoy sharing my basketball training experience with others and enjoy leading the team as a leader without expecting anything in return
	Second description	–
	Third description	–
Achiever	Features	Challenges, certificates, learning new skills, quests, levels or progression, and epic challenges (or "boss battles")
	First description	I enjoy playing basketball because I can constantly challenge myself to accomplish new training skills and to win more
	Second description	I can improve my basketball by completing various basketball skills drills and learning new basketball skills. I like to prove myself by facing challenges head on and overcoming the difficulties of training
	Third description	–
Free Spirit	Features	Exploratory tasks, nonlinear gameplay, Easter eggs, unlockable content, creativity tools, and customization
	First description	I like to explore new ways of playing basketball and I like to break the rules of training to show off my unique skills
	Second description	–
	Third description	–
Player	Features	Points, rewards or prizes, leaderboards, badges or achievements, virtual economy, and lotteries or games of chance
	First description	I enjoy participating in basketball events and doing everything I can to win trophies and prizes, and playing well in basketball earns me a lot of praise and admiration from others
	Second description	I like to participate in all kinds of basketball activities and do everything I can to win trophies and prizes. Playing basketball well gives me more opportunities to gain money status and power
	Third description	–
Socializer	Features	Guilds or teams, social networks, social comparison, social competition, and social discovery
	First description	Playing basketball has allowed me to build my own social circle where I have made close friends and feel part of a community
	Second description	–
	Third description	–
Disruptor	Features	Innovation platforms, voting mechanisms, development tools, anonymity, anarchic gameplay
	First description	I like to play basketball with a critical eye, spotting the flaws in the team's training and finding problems with the style of play are my strengths and my favourite things to do
	Second description	I enjoy analysing basketball games and basketball training, challenging authority and not being limited by the rules, advancing individual skills and team skills, commonly known as the "wild card" in basketball
	Third description	I like to analyse basketball games and basketball training and often improve individual skills and team skills by improving team basketball strategies, without being limited by the rules

Three-round selection of sentences for each user motivation was performed to ensure the accuracy of the descriptions. Three sets of interviews were conducted with participants from the same basketball team, with the players asked during each interview if they believed the descriptions of the motivations for each player type to be accurate. Corrections were made on the basis of the concerns the six players raised regarding the descriptions until they agreed that the descriptions were not confusing. The descriptions

of motivations for the six player types that were obtained after the third round of interviews were used as the basis for the questionnaire.

Storyboard

This study identified how gamification categories should be used to present game elements to ensure that the gamified training environment would be realistic when the tests were conducted. According to the literature, storytelling is an effective means of leading a user to feel what they are intended to feel (Santos et al., 2021). Therefore, the current study presented the five dimensions of gamification in the form of storyboards. Based on the dimensions and the researcher's questionnaire design, a Likert scale was used in the design of a questionnaire used to appraise the perceptions of the gamification experience of different types of users from the gamification categorisation perspective.

Five scenarios (Toda et al., 2019) developed with consideration of the five dimensions of gamification (i.e., fictional, personal, performance-related, ecological, and social) were used to design the storyboard. These five dimensions comprise 21 gamification elements. To analyse different users' preferences and the gamification elements, each gamification element was represented using a small scenario. Multiple gamification elements were combined to form a larger storyboard. The storyboard was presented in the form of a story description (Table 2) to ensure that the content of each storyboard scene and which gamification elements were included would be clear.

Truong et al. (2006) reported that storyboards have five characteristics: (i) a level of information, (ii) text inclusion, (iii) character and emotion inclusion, (iv) a number of frames, and (v) time representation. The current study considered these characteristics to create five storyboards on the basis of the dimensions of the gamification categories, with each storyboard comprising three to six interactive scenes. The number of small scenes included on each storyboard was determined by the number of gamification elements under each gamification dimension (Toda et al., 2019). For each scene, images of app prototypes and icons were added to help the participants experience the gamification of the scenes and the concept of the design. The storyboard designs were drawn iteratively with reference to the storyboard descriptions.

To ensure that each storyboard was representative of the target gamification dimensions, the storyboards were validated. Two experts with experience in gamification design and two players evaluated the storyboards and suggested changes. With the exception of a few items, they agreed that the storyboard could be understood by young players and that they accurately represented the target gamification dimensions. The final storyboards are presented in Figs. 3, 4, 5, 6 and 7.

Questionnaire

Once the storyboards had been evaluated and improved, a questionnaire was designed. The questionnaire comprised 56 items presented in three sections, which are described in the following.

The first part of the questionnaire collected demographic data, such as name; age; sex; place of residence; and basketball training background, including the number of years of training and skill level the participant had. A survey to determine which type of

Table 2 Storyboard description

Dimension	Description
Fictional (SF)	The initial page of the gamified basketball training system is represented by this gamification design. Youth basketball fans are presented with a training guide that shows them how to complete all the drills and participate in online competitions. At the same time, they can imitate the highlights of the players by watching the basketball stories of their favorite players and participating in the "Retracing the path of the stars" activity **(game element storytelling)**. Basketball fans can create an avatar in the personal information section and post it on social media or share their training with others **(game element narrative)**
Personal (SP)	This gamification design outlines the objectives and setup. The user's goal is to complete personalised and customised training plans which will be displayed on the app home page on a daily basis **(Game element: Objective)**. When not getting a good rating on the day's training plan, the user can view the coach's recommendations and retrain, with extra points being awarded for additional training time **(Game Element: Renovation)**. After completing a stage chapter, users will have the opportunity to unlock the chapter egg—Retracing the Ballerina Path. This will expose them to new challenges **(Game element: Puzzle)**. Whenever the unlocked chapter is updated with a new basketball drill **(Game Element: Novelty)**, a audible, visual, or vibration notification will be sent to users. **(Game Element: Sensation)**
Performance (SPF)	This gamification design represents the way in which the system responds to the behaviour of basketball fans. The student must complete the corresponding training in his/her personal program in order to advance in the system and become a novice, expert or master **(Game element level)**. When a user completes a training task, he/she will earn sport points **(Game Element Points)** and advance in the progress bar, indicated by stars **(Game Element Progress)**. Basketball training tasks are divided into different levels and when a user completes different levels of tasks, he/she receives different points **(Game element Acknowledgement)**. Also, users receive different points **(Game Element Points)** for completing daily and weekly tasks. When a user wins an online basketball tournament, he/she receives sports coins **(Game Element Points)**, and when he/she gets a sufficient number of sports coins and enters the top three places in the leaderboard he/she receives corresponding medals. **(Game Element Acknowledgement)** The page titled "My Personal Achievements" in the Personal Information section has all this information. **(Game Element Stats)**
Ecological (SE)	This gamification design represents the system's way of attracting young basketball fans to follow the desired behaviour. The hobbyist must choose the basketball training plan to follow, completing daily tasks monthly tasks and stages **(Game Elements imposes choices)**. After matching to a customized basketball training plan, hobbyists can draw random rewards, such as points and small gifts, by completing the stage tasks **(Game Element Chance)**. Different tasks have different time requirements, such as daily tasks need to be completed on the same day, while monthly tasks need to be completed in the same month **(Game Element Pressure Time)**, and if they complete all punch cards at the proposed time, they will get a certain number of points for punching achievement badges **(Game Element Rarity)**. Hobbyists can exchange the points mall for dress-up and physical gifts of sports **(game element economy)**
Social (SS)	This gamification design represents a way of providing social interaction. Users are required to complete a basketball game with other players on the same team, in which they each have their own position and they must help each other out, enabling each to perform disciplined movements in teamwork. **(Game element: Cooperation)**. The winning team with the highest level of coordination **(Game Element: Competition)** will win the title of "Top 10 Team" on the team leaderboard **(Game Element: Reputation)**. Whenever another team overtakes them in the ranking, the user will be notified that their ranking has dropped **(Game element: Social pressure)**

Bold indicates 21 gamification elements

player the participant was, that is, their motivation for training, was also included in this section.

The second part of the questionnaire presented the storyboards that had been designed and asked the participants to respond to two items related to perceived achievement and perceived immersion on a 7-point Likert scale to evaluate their gamification experience (Högberg et al., 2019). The items are listed in Table 3. This study referenced another study (Santos et al., 2021) and employed an item to gauge focus, that is, "I like to play basketball. Please select C for this item to indicate that you are focused on the questionnaire." This item was also used to screen for thoughtless

Fig. 3 Storyboard: performance-related dimension. Frame 1: Welcome to the youth basketball training system! Here you can level up the system by completing different stages of training. First, you will receive a personal training plan tailored for you by the AI, including cycle tasks, chapter tasks and more.; Frame 2: Here, basketball training will be divided into different stages and levels, seeing different chapters of training tasks, completing one task unlocks the next chapter.; Frame 3: You will be awarded with different titles and badges for completing the stages! Frame 4: Completing different basketball training missions, you can earn different points. You'll also earn coins for winning online tournaments!; Frame 5: Be in the top three of the coin ranking to win the basketball trophy!; Frame 6: Finally, you'll have your own personal collection of achievements!

Fig. 4 Storyboard: ecological dimension. Frame 1: In the second part, you will see the form of your training tasks with requirements, you need to follow the basketball training plan, complete the requirements and earn rewards. Follow the basketball assistant to complete the training tasks!; Frame 2: Once you have started training, you will receive your customised basketball training plan which you must follow to complete daily, monthly and stage tasks!; Frame 3: After completing the training phases, you will be randomly entered into a prize draw! You'll get points, good-looking costumes and sports swag!; Frame 4: Don't forget that there is a time limit on our cyclical training tasks, there will be new tasks every day, so complete them within the time limit.; Frame 5: The more you complete, the higher your rank will be.; Frame 6: The points you earn from training and competitions can be exchanged for gifts in the Points Mall! Not only do you get personalized costumes, but you also get real sporting goods!

answers as well as invalid questionnaire responses and to ensure that the participants were focused when reading each item.

Finally, a question was included that determined the participants' storyboard scene preferences, that is, "Which scene is your favourite?" This question was included to

Fig. 5 Storyboard: personal dimension. Frame 1: Next we have our personalised training section, where every basketball fan can have their own unique basketball plan~; Frame 2: First you can view your customised training plan from here, make it your goal to work towards completing it!; Frame 3: When you find that your training is not rated highly by the Little Helpers, don't fret, you can check out the coaching advice and retrain. By retraining the skill, the extra training time added will also earn you new points!; Frame 4: After completing a stage chapter, you will have the opportunity to unlock the chapter egg—Retrace the Ballerina's Path, a section where you can imitate the brilliant moves of your idols.; Frame 5: The content to be unlocked will also be updated from time to time, hopefully giving you more and better training experiences!; Frame 6: when an unlocked training task is updated, it will be accompanied by a sound, visual or vibration notification to give you an extra sense of achievement!

Fig. 6 Storyboard: social dimension. Frame 1: In a part where you can feel the joy of playing and cooperating with others, let's play for the honour of the team!; Frame 2: Start by forming your playing team, each person finding their own different position. Everyone does their bit for their team!; Frame 3: Join your teammates in an online competition and do your best to get a good result!; Frame 4: The team that works best together, after a lot of hard work, will be awarded the title of "Top 10 Team" and will be ranked in the team rankings!; Frame 5: You will also be alerted when another team overtakes yours, so keep working hard!

determine which of the gamification elements the players preferred for each storyboard because such elements might positively affect the participants' motivation. At the end of the questionnaire, a similar question, "Which storyboard is your favourite?" was employed to determine the participants' preferences.

Fig. 7 Storyboard: Fictional Dimension. Frame 1: Finally, take a look at our hidden story line!; Frame 2: When you have completed a chapter of training, a training egg will appear "Retracing the path of a star". You will see in the video animation the inspirational stories of their childhood; Frame 3: At the end of the mimic training, you will be able to see the basketball stars in action and imitate their moves. Come along and try it out~

Table 3 Items regarding gamification experience

Dimension/item	Questions	Item identifier
Accomplishment	Makes me feel that I need to complete things	A01
	Pushes me to strive for accomplishments	A02
	Inspires me to maintain my standards of performance	A03
	Makes me feel that success comes through accomplishments	A04
	Makes me strive to take myself to the next level	A05
	Motivates me to progress and get better	A06
	Makes me feel like I have clear goals	A07
	Gives me the feeling that I need to reach goals	A08
Immersion	Gives me the feeling that time passes quickly	I01
	Grabs all of my attention	I02
	Gives me a sense of being separated from the real world	I03
	Makes me lose myself in what I am doing	I04
	Makes my actions seem to come automatically	I05
	Causes me to stop noticing when I get tired	I06
	Causes me to forget about my everyday concerns	I07
	Makes me ignore everything around me	I08
	Gets me fully emotionally involved	I09

To mitigate the potential problem that the length of the survey could have led to subject fatigue and thereby caused the responses to be unreliable, prior to the start of the formal study, a pilot study was completed to determine the viability of the proposed number of research questions. Once the questionnaires had been retrieved, the data were quantitatively analysed using SPSS Statistics version 25. Because the Chinese version of the gamification experience questionnaire of Högberg et al. has not been empirically tested, a reliability analysis was performed to verify the results. And subsequently, the questionnaire results were subjected to linear regression analysis. Finally, relationship modelling and validation were conducted.

Participants

The final questionnaire was published and disseminated through social networks on June 13, 2022, and the questionnaire was also distributed offline. Participation in the questionnaire was open for 10 days. Participants were recruited through a combination of typical sampling and stratified random sampling, with consumers in different regions of Taiwan and aged 14–25 years targeted. The questionnaires were distributed on

Questionnaire Star's Tiger community, QQ, WeChat, WeChat's circle of friends, at basketball courts, and to youth basketball players through teachers and basketball coaches. Table 4 displays the demographic information of the participants.

This study distributed 198 questionnaires. The attention check item revealed that some players were randomly responding to the questionnaire items. After 58 questionnaires with extremely homogenous ratings were eliminated, the final sample comprised 140 valid questionnaires for analysis.

Results

Because the data related to each variable were collected using a single questionnaire, common bias could have existed. Therefore, Harman's single-factor test was employed to check for such bias (Podsakoff et al., 2003). The findings of the factor analysis revealed that the 21 factors with extracted eigenvalues greater than 1 were not rotated and that the first factor had a loading of 32.524%, which is below the acceptable standard of 40%. These results revealed that the common method bias in this study was nonsignificant and that the experimental results were reliable. The results of the data analyses are listed in Table 5.

The present data and findings regarding the relationships between the variables were employed to explore relationship between achievement and immersion and preference through correlation analysis and linear regression analysis. These methods enabled simple and intuitive identification of the relationships between variables. SPSS 26 software was used to conduct the analyses.

To ensure the findings would be robust, a partial validation of the normality of the data was first conducted. The Kolmogorov–Smirnov test was used because the sample size was larger than 50. This study considered $0.00 < p < 0.05$ to reject the null hypothesis and indicate that the data obtained for perceived achievement and immersion for each storyboard were not distributed normally. The results of the normality test are presented in Table 6.

Table 4 Demographic information

Demographic	Range	Frequency	Percentage (%)
Gender	Male	94	32.86
	Female	46	67.14
Age	Under 14	0	0
	14–16	5	3.57
	17–19	64	45.71
	20–25	71	50.71
Training time	Never	61	47.53
	Under 1 year	23	16.43
	1–3	22	15.71
	3 + years	34	24.29
Skill level	Amateur	118	84.29
	Beginners(coached)	14	10.00
	Participation in events	6	4.29
	National I/II athlete/coach	2	1.43
Total responses		140	100

Table 5 Total variance explained: common method bias

Component	Initial eigenvalue			Sum of squares of extracted loads		
	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%
1	31.548	32.524	32.524	31.548	32.524	32.524
2	10.142	10.456	42.979	10.142	10.456	42.979
3	4.449	4.586	47.566	4.449	4.586	47.566
4	3.078	3.173	50.739	3.078	3.173	50.739
5	2.951	3.043	53.782	2.951	3.043	53.782
6	2.620	2.701	56.482	2.620	2.701	56.482
7	2.387	2.461	58.944	2.387	2.461	58.944
8	2.169	2.236	61.179	2.169	2.236	61.179
9	1.984	2.045	63.225	1.984	2.045	63.225
10	1.859	1.916	65.141	1.859	1.916	65.141

Extraction method: Principal component analysis

Table 6 Normality test

	Kolmogorov–Smirnov			Shapiro–Wilk		
	Statistics	Degree of freedom, df	Significance	Statistics	Degree of freedom, df	Significance
AccPF	0.098	388	0.000	0.944	388	0.000
AccE	0.136	388	0.000	0.908	388	0.000
AccP	0.118	388	0.000	0.955	388	0.000
AccS	0.137	388	0.000	0.948	388	0.000
AccF	0.148	388	0.000	0.906	388	0.000
ImmPF	0.066	388	0.000	0.987	388	0.002
ImmE	0.076	388	0.000	0.983	388	0.000
ImmP	0.082	388	0.000	0.977	388	0.000
ImmS	0.069	388	0.000	0.978	388	0.000
ImmF	0.081	388	0.000	0.966	388	0.000

AccE: Perceived sense of accomplishment for the ecological dimension storyboard; AccF: perceived sense of accomplishment for the fictional dimension storyboard; AccPF: perceived sense of accomplishment for the performance-related dimension storyboard; AccP: perceived sense of accomplishment for the personal dimension storyboard; AccS: perceived sense of accomplishment for the social dimension storyboard; ImmE: perceived sense of immersion for the ecological dimension storyboard; ImmF: perceived sense of immersion for the fictional dimension storyboard; ImmPF: perceived sense of immersion for the performance-related dimension storyboard; ImmP: perceived sense of immersion for the personal dimension storyboard; ImmS: perceived sense of an immersion for the social dimension storyboard

Table 7 Reliability

Cronbach's alpha	Number of items
0.977	92

This study tested the reliability and validity of the sample data through exploratory factor analysis. The findings, which are presented in Tables 7 and 8, indicated that the scale had excellent internal consistency, with the Cronbach's alpha coefficient for each variable being greater than 0.8. The results of the factor analysis revealed a sample significance p-value of < 0.05, which indicated that the sample was suitable for factor analysis. The Kaiser–Meyer–Olkin (KMO) values were higher than 0.8, indicating that the scale z

Table 8 Validity

KMO		0.849
Bartlett test	Approx. Chi-square	44,782.428
	Degree of freedom, df	3570
	Statistical significance	0.000

Table 9 Player type distribution

Player types	Percentage (%)	Female percentage (%)	Male percentage (%)
Philanthropist	6.43	6.52	6.38
Achiever	26.43	26.09	26.6
Free Spirit	8.57	8.7	8.51
Player	4.29	2.17	5.32
Socializer	47.14	52.17	44.68
Disruptor	7.14	4.35	8.51

was valid overall. In addition, the correspondence between the factors and the items was generally consistent with expectations, indicating that the scale had favourable validity.

Player type distribution

Although the present study did not classify player types by using a 7-point Likert scale, the classification of players on the basis of their individual motivations and player types would still have some value. According to Santos et al. (2021) and Marczewski (*Marczewskis Gamification User Type Test Results*, n.d.), the philanthropist player type is generally most common, whereas the disruptor player type is the least common. In the current study, male players were more likely to exhibit a user type related to Hexad than female players were. The most notable finding was that the most common player type in this study's population was the socialiser type (47.14%), whereas the least common type was the player type (4.29%). These findings differed considerably from those reported in the gamification design literature Santos et al. (2021). This difference may have occurred because previous studies have not explored gamification design in the context of physical education. The data were obtained from basketball players' questionnaire responses, and therefore, the preferences of different types of players in the context of physical education could be understood. The finding is reasonable because most basketball players are basketball enthusiasts and playing basketball is a means through which many players socialise (Corti et al., 2023).

A comparison of the proportion of male and female players of each player type revealed that more female than male players were of the socialiser player type. The proportion of male and female players belonging to the philanthropist and free spirit player types was similar. The proportion of male players belonging to the player and disruptor player types was higher than that of female players. The distribution of the participants across player types is presented in Table 9.

Directionality of player type and gamification experience

Mean score analysis was used to detect direct pointing between different player orientation and gamification experiences. Table 10 presents the mean scores that the players awarded each gamification design and a comparison of the scores. The mean scores for perceived immersion were generally lower than those for perceived achievement. This result may be related to the order of items in the questionnaire; the immersion measure was included after the achievement measure. As indicated in Table 10, individuals who were of the player type generally gave higher scores for the perceived achievement dimension than did those of other types.

Correlation between gamification experiences

The relationship between immersion and achievement for each player type was explored. Correlation analysis was performed, and the results regarding the relevance of player immersion and achievement for each of the five storyboards are presented in Table 11. The results indicated that the players of different types exhibited similar behaviour and that the findings differed for the five storyboards. A two-tailed analysis was used to investigate the correlation between perceived achievement and perceived immersion. Pearson correlation analysis of the players' responses revealed that immersion and achievement were significantly correlated for all storyboards. The strongest correlation between perceived achievement and perceived immersion was that for the fictional dimension storyboard ($\beta = 0.597$, Pearson coefficient $= 0.524^{**}$). Additionally, high correlation coefficients were identified for the correlation for the ecological and fictional dimensions of the storyboards. This finding indicated that perceived achievement and perceived immersion had stronger associations with factors related to the environment. The weakest correlation between perceived achievement and perceived immersion was that for the social dimension ($\beta = 0.481$, Pearson coefficient $= 0.374^{**}$).

Preferences of player types

This study considered the player types to be multivalued, unordered categorical variables and perceived achievement and immersion to be continuous variables. Multivariate logistic regression was used to explore the correlations between the variables through an analysis of the significance of the estimated correlation coefficients. Player orientation

Table 10 Perceived achievement and perceived immersion scores under gamification taxonomy

Mean	P	S	F	A	R	D
AccPF	5.1726	5.4779	5.1061	5.5879	6.2019	5.8409
AccE	5.6429	5.5726	5.1742	5.5371	6.0769	5.5341
AccP	5.3631	5.6136	5.5000	5.6300	5.9615	5.4432
AccS	5.0000	5.6982	5.0833	5.8267	6.1538	5.4716
AccF	5.4524	5.4615	4.9015	5.5408	5.9904	5.4830
ImmPF	4.7725	4.3530	4.7138	4.5215	4.9573	5.4697
ImmE	5.2328	4.3288	4.5556	4.6106	5.1453	5.0606
ImmP	5.2857	4.3575	4.6263	4.9901	5.1624	5.4091
ImmS	5.1270	4.4153	4.9697	4.9406	5.3675	5.3838
ImmF	4.7249	4.5572	4.9798	5.0836	5.6410	4.9899

Table 11 Pearson correlations

	ImmPF	ImmE	ImmP	ImmS	ImmF
AccPF					
Pearson's r	0.492**				
Sig (2-Tailed)	0.000				
N	388				
AccE					
Pearson's r		0.516			
Sig (2-Tailed)		0.000			
N		388			
AccP					
Pearson's r			0.479		
Sig (2-Tailed)			0.000		
N			388		
AccS					
Pearson's r				0.374	
Sig (2-Tailed)				0.000	
N				388	
AccF					
Pearson's r					0.524**
Sig (2-Tailed)					0.000
N					388

**Correlation significant at 0.01 level (two-tailed)

was considered to be a dependent variable, user age was considered to be a factor, and perceived achievement and perceived immersion were considered to be covariates. According to the model fit results, the level of significance (0.000) was less than 0.05, indicating that the model was suitable.

An analysis of the results revealed that the philanthropist player type was not associated with perceived achievement or perceived immersion. The achiever player type was positively associated with perceived immersion for the fictional dimension storyboard ($\beta = 1.352$).

The highest percentage of participants belonged to the socialiser player type, and therefore, the tendencies and experiences of players of this type were representative. The socialiser player type was negatively associated with perceived achievement for the performance-related dimension storyboard ($\beta = -1.204$) and with perceived immersion for the personal ($\beta = -1.426$) and social ($\beta = -1.319$) dimension storyboards. Additionally, it was positively associated with perceived immersion for the ecological ($\beta = 1.206$) and fictional ($\beta = 1.028$) dimension storyboards.

The free spirit type was negatively associated with perceived achievement for the performance dimension storyboard ($\beta = -1.387$) and positively associated with perceived immersion for the fictional dimension storyboard ($\beta = 1.368$). The results for the free spirit player type for the personal dimension storyboard differed considerably from those for the other player types. Two dimensions of the free spirit player type gamification experience existed simultaneously. One was negatively correlated with perceived immersion ($\beta = -1.547$), and the other was positively correlated with perceived achievement ($\beta = 1.679$).

The player player type was most strongly correlated with perceived achievement for the ecological dimension storyboard and with perceived immersion for the personal dimension storyboard. In addition, this player type was positively correlated with perceived achievement for the social dimension storyboard and with perceived immersion for the ecological and fictional dimension storyboards. All relationships are presented in Table 12.

Table 13 presents the mean valuefor preference and perceived achievement overall and stratified by sex. In terms of preference, the performance-dimension storyboard design was the most frequently selected. For perceived achievement, the social-dimension storyboard design was most frequently selected. The fictional-dimension storyboard had the lowest value for both preference and perceived achievement, indicating that such gamification designs are not preferred by users.

This study presented preference questions under each storyboard in the questionnaire to determine the players' preferences regarding the gamification elements in

Table 12 Results: associations between gamification design and player type

	β	*p* value	CI			β	*p* value	CI	
			2.5%	97.5%				2.5%	97.5%
SPFAcc → P	− 1.140	0.075	0.091	1.123	SPFImm → P	− 0.275	0.645	0.235	2.452
SPFAcc → S	− 1.204	**0.020**	0.109	0.824	SPFImm → S	− 0.361	0.385	0.309	1.572
SPFAcc → F	− 1.387	**0.016**	0.081	0.769	SPFImm → F	− 0.251	0.632	0.278	2.177
SPFAcc → A	− 0.575	0.251	0.211	1.502	SPFImm → A	− 0.769	0.076	0.198	1.082
SPFAcc → R	1.356	0.153	0.603	24.954	SPFImm → R	− 0.865	0.259	0.094	1.891
SPFAcc → D	–	–	–	–	SPFImm → D	–	–	–	–
SEAcc → P	− 0.321	0.644	0.186	2.831	SEImm → P	0.575	0.455	0.393	8.041
SEAcc → S	− 0.376	0.470	0.248	1.905	SEImm → S	1.206	**0.031**	1.116	9.990
SEAcc → F	− 0.674	0.279	0.150	1.728	SEImm → F	0.942	0.176	0.655	10.032
SEAcc → A	− 0.370	0.480	0.247	1.930	SEImm → A	0.542	0.337	0.569	5.198
SEAcc → R	− 1.864	**0.043**	0.025	0.944	SEImm → R	1.919	**0.031**	1.196	38.810
SEAcc → D	–	–	–	–	SEImm → D	–	–	–	–
SPAcc → P	0.644	0.428	0.387	9.371	SPImm → P	0.34	0.965	0.234	4.574
SPAcc → S	0.827	0.202	0.642	8.152	SPImm → S	− 1.426	**0.014**	0.077	0.754
SPAcc → F	1.679	**0.020**	1.304	22.013	SPImm → F	− 1.547	**0.047**	0.046	0.977
SPAcc → A	0.203	0.760	0.333	4.501	SPImm → A	− 0.207	0.717	0.266	2.488
SPAcc → R	0.291	0.781	0.173	10.359	SPImm → R	− 3.669	**0.002**	0.003	0.253
SPAcc → D	–	–	–	–	SPImm → D	–	–	–	–
SSAcc → P	− 0.242	0.807	0.113	5.439	SSImm → P	− 0.771	0.345	0.093	2.294
SSAcc → S	1.287	0.071	0.894	14.677	SSImm → S	− 1.319	**0.036**	0.078	0.917
SSAcc → F	− 0.160	0.835	0.190	3.825	SSImm → F	− 0.422	0.546	0.166	2.585
SSAcc → A	1.289	0.084	0.842	15.654	SSImm → A	− 1.226	0.053	0.085	1.018
SSAcc → R	2.491	**0.014**	1.667	87.486	SSImm → R	–0.017	0.986	0.157	6.144
SSAcc → D	–	–	–	–	SSImm → D	–	–	–	–
SFAcc → P	0.468	0.474	0.444	5.742	SFImm → P	0.345	0.589	0.404	4.949
SFAcc → S	− 0.191	0.699	0.313	2.176	SFImm → S	1.028	**0.040**	1.049	7.454
SFAcc → F	− 0.535	0.344	0.193	1.774	SFImm → F	1.368	**0.019**	1.249	12.359
SFAcc → A	− 0.0411	0.414	0.247	1.779	SFImm → A	1.352	**0.008**	1.428	10.463
SFAcc → R	− 1.279	0.085	0.065	1.191	SFImm → R	2.621	**0.000**	3.178	59.520
SFAcc → D	–	–	–	–	SFImm → D	–	–	–	–

Table 13 Mean values for preference and perceived achievement

Storyboard	Preference (%)	Accomplishment (%)	Female Acc (%)	Male Acc (%)
Performance	26.32	19.95	19.8	20.1
Ecological	18.42	20.02	19.42	20.62
Personal	21.05	20.00	20.14	19.98
Social	21.71	20.34	20.38	20.3
Fictional	12.50	19.63	19.91	19.35

Table 14 User preference summary

	Frame 1(%)	Frame 2 (%)	Frame 3 (%)	Frame 4 (%)	Frame 5 (%)
Performance	29.9	16.8	13.4	22.4	17.5
Ecological	14.9	18.3	16.8	21.4	28.6
Personal	17.5	21.1	30.7	16.0	14.7
Social	25.0	32.2	25.0	17.8	
Fictional	45.4	54.6			

each gamification dimension. The results revealed that for all users, the most preferred gamification element for the performance-related dimension was progress. The most preferred gamification element for the ecological dimension was economy. The most preferred gamification element for the personal dimension was puzzle. The most preferred gamification element for the social dimension was competition. Finally, the most preferred gamification element for the fictional dimension was narrative. These data are presented in Table 14.

Discussion

This study makes three main contributions. According to the literature, a 7-point Likert scale questionnaire design was used to establish a framework for determining the relevance of gamification dimensions for individual players by analysing the preferences and feelings of players of different types in terms of gamification dimension design. Storyboards were employed to study player behaviour and preferences regarding gamification designs, and this method was discovered to be both sensitive and reliable. The participants' perceived achievement and perceived immersion were compared across different dimensions of gamification to explore the basic components suitable for personalising gamification designs. The results revealed clear differences between player types and player motivations in the field of sports training that would lead to differing preferences and feelings toward training. The correlation between perceived achievement and perceived immersion was analysed, and significant positive correlations were discovered for all gamification dimensions.

The aim of this study was to investigate the associations of gamification with player motivation, player type (achiever, disruptor, free spirit, philanthropist, player, or socialiser), and gamification dimension categories (fictional, personal, performance, ecological, and social). The association between the players' perceived achievement and perceived immersion in gamification experiences in the context of gamified

sports training was also explored. Players with different sports motivations were discovered to have differing positive and negative associations with different forms of gamification training. Furthermore, the association between perceived achievement and perceived immersion was positive when players experienced different gamification training formats.

Socialiser and achiever the most common player types

The present results regarding player types differed from those of Marczewski and Tondello et al. In Tondello et al. (2016), the disruptor player type was the least common, whereas the philanthropist player type was the most common. In the present results, however, the socialiser and achiever player types were the most common, whereas the player player type was the least common. This difference in results may have been due to this study considering players' intrinsic motivations during its classification process. Furthermore, the study of Tondello et al. focused on a general educational setting, whereas the present study focused on a sports training setting. Although both are educational settings, sports training involves more factors that influence user autonomy and user motivation. Because of this, player motivation had to be accounted for in the design of the experiment (Oliveira et al., 2022).

The finding of a high number of players belonging to the socialiser player type (47.14%) was not surprising for the basketball training setting, and it demonstrates that the psychological and emotional needs of players were equally important during training. Furthermore, it indicated that one of the players' motivations for completing training was socialisation (Schüler et al., 2023). As Carolyn has researched (Savoy, 1993), the players wished to not only improve during basketball training but also to build relationships with other players. Of the six player types, that least frequently encountered in the present study was the player type (4.29%); only 2.17% of the female players belonged to the player player type. This may have been because the participants were teenagers or young adults (14–25 years) and had already begun to mentally mature, which may mean that they were less likely to complete basketball training simply because it was fun.

In Tondello et al. (2016), female players were typically more likely than male players to belong to the philanthropist, socialiser, free-spirited, and achiever player types. Although this study analysed the participants' player choices rather than scores, the results also indicated that female players were more likely to make choices indicative of a philanthropist, socialiser, or free-spirit player type than male players were. More male than female players made selections indicative of the achiever player type, although the difference between them was relatively small.

The tendencies of sports players of different player types with respect to gamification differ from those of general users of gamification in other educational areas (Schüler et al., 2023). This indicates that player types cannot be analysed solely by considering psychological motivations; they should be analysed comprehensively relative to individuals' physical behaviour. The findings of the current study may assist subsequent research in modelling player types and may provide some evidence to support future qualitative studies of player types.

Perceived achievement positively correlated with perceived immersion

According to Högberg et al. (2019), gamification experiences comprise seven dimensions. In the current study, the accomplishment and immersion dimensions were selected on the basis of the recommendations of Högberg et al. As presented in Fig. 8, a positive relationship was discovered between players' perceived achievement and perceived immersion under each dimension of gamification design. This indicated that when a player felt a significant sense of achievement when a particular gamification design was employed, the corresponding sense of immersion was also significant. The theoretical framework presented in Fig. 8 can enable future researchers and designers to save on costs when they are conducting research on gamification designs for sports training and can improve the ease with which researchers can determine whether gamification designs have a positive effect on players. By using this framework, researchers will not be required to test every dimension of the gamification experience to determine users' overall feelings. Of course, only knowing the positivity and negativity of the user feelings, although not very specific, would make the questionnaire much less difficult, which would help us to find more subjects for the experimental tests. Future research should investigate the other dimensions of the gamification experience to determine their associations with a sense of achievement.

Personalised preferences

The results of the current study revealed player's preferences regarding gamification elements in each gamification dimension, as shown in Table 15. Because the players' preferences for gamification elements were not analysed in conjunction with their perceived sense of achievement, several gamification elements could be identified as key for designing gamification elements from the perspective of general users.

According to Toda et al. (2019), the performance-related dimension includes point, progression, level, stats, and acknowledgement gamification elements, which provide

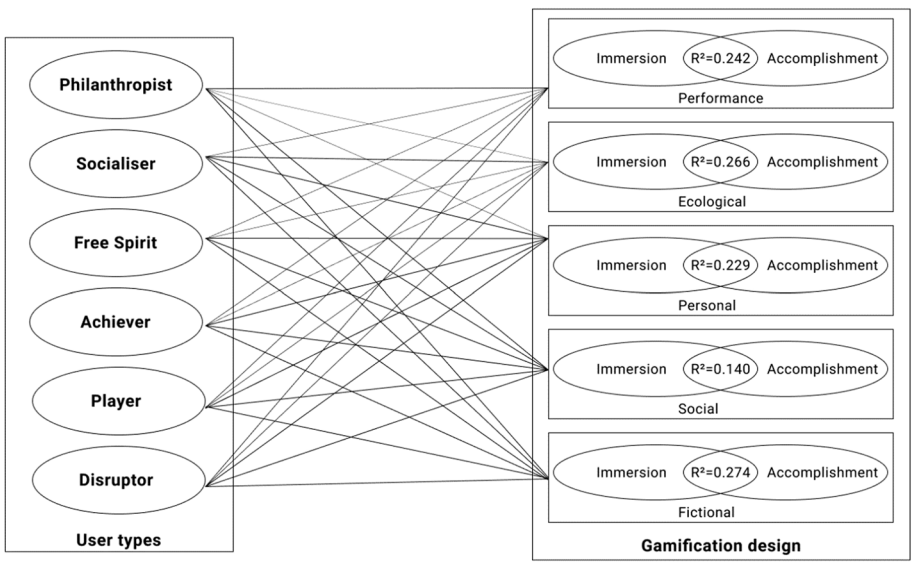

Fig. 8 Theoretical model

Table 15 Association of player preferences with gamification experiences

Preference	Sense of accomplishment	Sense of immersion
Philanthropist	− SPF and − SS	+ SP
Achiever	+ SP and + SS	− SPF and − SE
Player	− SPF and + SS	+ SS and + SF
Free spirit	− SS and − SF	− SP
Socializer	− SPF	− SP
Disruptor	–	–

SF: Perceived sense of accomplishment for fictional dimension storyboard; SP: perceived sense of accomplishment for personal dimension storyboard; SPF: perceived sense of accomplishment for performance dimension storyboard; SE: perceived sense of accomplishment for ecological dimension storyboard; SS: perceived sense of accomplishment for social dimension storyboard; PrE: preference ecological; PrF: preference fictional; PrPF: preference performance; PrP: preference personal; PrS: preference social

basic feedback to players on their behaviour and enable them to identify a direction for each stage of their sports training. These gamification elements are related to environmental responses, and they can have different effects on different players. The participants of the current study had a greater preference for progression elements, indicating that they valued the positive effects and progress they experienced from their sports training. In sports training, the progress of players often plateaus because of factors such as an innate physical ability or a lack of strategic understanding, which can be intimidating for developing players (Lampropoulos et al., 2021). Although coaching regarding how the player can adjust their strategy and efforts is often provided in real training, players require regular updates on their progress in certain areas to maintain their motivation during their next training session. When gamification of the performance dimension is being designed, a focus on progress can be employed to raise players' mental expectations and ensure they maintain a positive mind set in relation to their sports training. Such a focus would enable players to understand their stage of development.

The ecological dimension of gamification design concerns interaction with the user. For designs based on this gamification dimension, players feel that the training process is not monotonous, and this increases their motivation to train. For this dimension, economy is the most commonly selected gamification element. This element enables players to complete exchanges to gain a sense of self-worth. For example, their training scores and ratings can be used to purchase items that can improve their playing over time. The lure of the real world (or other forms of exchange) can lead players to have greater motivation to train for sports because they perceive the training to have value beyond itself.

The personal dimension is relevant to the players themselves. The gamification elements of this dimension include sensation, objective, puzzle, novelty, and renovation, and the presence of these elements can reduce player frustration by leading the player to focus more on their feelings. The results of the current study revealed that the most preferred gamification element of the personal dimension was puzzle. Therefore, designers can incorporate cognitive tasks related to sports training into their gamification designs for this dimension, which also reflects the difference between a sports training environment and a general educational environment. In a sports training environment, the presence of more challenges and self-conquest lead to more rapid skill acquisition. The challenges from sports training often have two sides to them. A successful challenge will give players more courage to explore advanced skills. Failing to face challenges is

also "positive feedback" for the player's sporting career. A player's failure in a sporting event is not an indicator of permanent failure in their sports career; it provides them with an opportunity to develop their technique. Challenges in a sports career can also lead a player to improve their psychological resilience and motor skills.

The present results indicate that in gamified sports training for basketball, preference, perceived achievement, and perceived immersion can be used to individualise gamification designs for each player on the basis of a player classification system involving the Hexad classification system for player type and the player's sport motivation. This framework can enable designers and researchers to shift their focus from universal to individualised gamification experiences to ensure gamified systems have an individualised motivational effect on their users. To design personalised sports training gamification environments that achieve a higher level of achievement and immersion, designers should focus particularly on their design's social components.

This study's main findings are (1) a correlation between perceived achievement and perceived immersion for various gamification designs for players of different types, (2) a tendency toward the socialiser and achiever player types in basketball players, indicating that most players play basketball to socialise and improve their skills, and (3) a preference for the performance aspect of gamification across player types, indicating that gamification elements under the performance dimension should be considered. On the basis of these findings and those of other studies, this study provided suggestions regarding gamification design research in the context of sports.

Limitations

Although the findings of this study were significant, the study has several limitations. First, although some correlations were identified between user preferences and perceived achievement and immersion, the player types were not robustly analysed. This study referred to the Hexad results of Tondello et al. (2016) regarding the determination of player type but did not fully adopt their measurement scale. When the study data were analysed, each player was roughly categorised into one of six player types rather than being considered to belong to one general category. This was performed because generalising the player type could have resulted in errors, suggesting that there are still other possibilities for results regarding the link of user type with preference and perceived achievement and immersion.

Conclusion

This study demonstrated associations of player type with five gamification designs in the context of basketball training. To avoid overgeneralising the gamification elements (e.g., points and leaderboards), this study referred to a validated gamification taxonomy. This gamification taxonomy classifies gamification elements into 21 elements under five dimensions. These dimensions were presented to the participants through a storyboard design to increase the likelihood that they would become immersed in the gamified sports training scenarios. In addition, the participants' preferences were correlated with their perceived achievement and perceived immersion (two dimensions of the gaming experience). The present results verify that immersion and achievement in gamification experiences lead players to feel the same feelings and that they are correlated. Therefore,

when considering gamification designs, only one of these feelings must be determined to understand the other. The present study's participants had the lowest preference for the gamification components of fictional (narrative and storytelling) gamification systems. A gamification design based on user preferences can enable designers to create more effective gamified training systems for sports players.

Recommendations

Future studies might present new research questions based on the present findings and limitations to further explore this field of inquiry. This study's findings are specific to the field of sports within the context of basketball training. However, the framework can be applied as a theoretical basis for designers of gamification in other sports. In addition, the framework can be applied in different areas of study involving gamification design in different contexts.

Almost all of the participants of the present study were older than 17 years; a few were between the ages of 14 and 16 years. This may prevent the findings from being generalizable to adolescents. Future research should focus on adolescents aged 14 years and younger and determine whether adolescents' preferences and perceptions and perceived immersion differ from those of the age group of the current study. This would expand the scope of the present findings and enable comparisons between age groups to be made. Most of the respondents reported being amateur basketball players (84.29%). Future research could investigate whether an individual's level of ability affects their preferences and perceived achievement and immersion with respect to gamification systems.

Two aspects of the gamification experience were measured in the present study (i.e. achievement and immersion); according to Högberg et al., these are the most crucial aspects of gamification design. The results indicate the existence of an inextricable relationship between the achievement and immersion dimensions. However, other dimensions of gamification experiences (e.g., challenge, competition, and gameplay) must also be assessed and analysed. Future researchers should investigate how other aspects of gamification experiences affect player preferences.

The results of the present study indicate the possibility of determining which gamification design components contribute most to users' feelings of immersion and accomplishment. This finding may be used to guide the development of gamification designs intended for sports enthusiasts. Future research could suggest reliable rating systems for designing gamification elements specific to each player type.

Abbreviations

TCA	Teacher-centred approach
SCA	Student-centred approach
GCAs	Game-centred approaches
AccE	Perceived sense of accomplishment for the ecological dimension storyboard
AccF	Perceived sense of accomplishment for the fictional dimension storyboard
AccPF	Perceived sense of accomplishment for the performance-related dimension storyboard
AccP	Perceived sense of accomplishment for the personal dimension storyboard
AccS	Perceived sense of accomplishment for the social dimension storyboard
ImmE	Perceived sense of immersion for the ecological dimension storyboard
ImmF	Perceived sense of immersion for the fictional dimension storyboard
ImmPF	Perceived sense of immersion for the performance-related dimension storyboard
ImmP	Perceived sense of immersion for the personal dimension storyboard
ImmS	Perceived sense of immersion for the social dimension storyboard
SF	Perceived sense of accomplishment for fictional dimension storyboard

SP	Perceived sense of accomplishment for personal dimension storyboard
SPF	Perceived sense of accomplishment for performance dimension storyboard
SE	Perceived sense of accomplishment for ecological dimension storyboard
SS	Perceived sense of accomplishment for social dimension storyboard
PrE	Preference ecological
PrF	Preference fictional
PrPF	Preference performance
PrP	Preference personal
PrS	Preference social

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Availability of data and materials
The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare that they have no competing interests.

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