



SCIREA Journal of Education

<http://www.scirea.org/journal/Education>

October 29, 2023

Volume 8, Issue 5, October 2023

<https://doi.org/10.54647/education880488>

Exploring the Gamification Design of Physical Education Programs for Chinese Youths

Yulin Zhao¹, Ding-Bang Luh^{2*}

¹ Faculty of Innovation and Design, City University of Macau, Macau, China

² School of Art and Design, Guangdong University of Technology, Guangzhou, China

*Corresponding author: luhdingbang@126.com

Abstract

The physical health of young people due to insufficient physical activity has attracted the attention of all sectors of Chinese society, which has repeatedly emphasized that ensuring the participation of young people in extracurricular physical activities is the key to promoting their physical health development. In the further research, this study has noticed that the practice of designing physical education assignments still has problems such as insufficient feedback for evaluation, lack of guidance in the design process, and lack of appropriate assignment design concepts and skills. This study is based on the fact that gamification can be a useful tool for teaching and learning. Based on the understanding that gamification can introduce a better process tracking and feedback mechanism for teaching, this study explores the design mode of gamification of physical education assignments by combining the concepts of gamification design, and provides a detailed description and analysis of its construction principles, as well as specific steps and modes of construction, respectively.

Keywords: Physical education, Physical education assignments, Gamification design, Design patterns, Adolescents

1. Introduction

Along with the continuous development of China's society and economy, people's living standards are improving, and their lifestyles and habits have changed dramatically, the most obvious of which is the normalization of sedentary behaviors and the serious lack of physical activity. Under the habit of "more sedentary and less active", the physical health of young people is also facing a series of difficulties and challenges. However, in China, only about 20% of adolescents are physically active for more than one hour per day at moderate to vigorous intensity, and sedentary behavior increases dramatically on weekends [1][2]. And according to the analysis of the results of the 2005, 2010, and 2014 national students' physical health surveys released by the General Administration of Physical Education of China and the Ministry of Education of China, the lung capacity level of Chinese adolescent students is on a declining trend as a whole, and the detection rates of obesity, poor vision, and high blood pressure continue to increase, with a tendency of underageing [3][4]. Chronic non-communicable diseases, which are closely related to these monitoring indicators, are also gradually appearing in adolescents and increasing year by year, so the health problems of adolescents are becoming more and more prominent, and the health status of physical fitness is not optimistic.

The decline in the physical fitness of young people is a matter of great concern to all sectors of society, and in 2007 China issued the National Physical Fitness Standards for Students, which are intended to provide a set of standards for measuring the physical fitness of students and for evaluating the effectiveness of their exercise. It serves as a basic requirement for students of different age groups in terms of physical fitness, as well as an evaluation standard for comprehensively assessing the physical fitness level of students. China also promulgated the "Healthy China 2030" plan in 2016, which includes specific plans for youth sports skills and exercise time, and aims to guide all sectors of society to pay attention to and participate in the promotion of youth physical fitness and health.

Among the various opinions and approaches to promote the healthy development of young people's physical fitness in recent years, ensuring the time for physical activity for young students both inside and outside of school is a point that has been emphasized many times; in 2011, the Physical Education and Health Curriculum Standards were released, which clearly stipulated the number of hours of physical education classes for all grades; in 2016, the guiding opinion on strengthening health promotion and education, which was jointly released by ten national departments, mentioned that "Ensure that students have no less than one hour

of physical activity per day in school"; in 2019, the Ministry of Education once again made it clear that primary and secondary school students should have two hours of physical activity per day - one hour in school and one hour outside school. Extracurricular physical activity is an important expansion and supplement to physical education classes, assisting physical education classes to better realize the goals of physical education and physical fitness and health promotion.

In recent years many researchers have successively conducted corresponding surveys and studies on the status of physical education homework in primary and secondary schools in various regions of China. Zhou Gang et al. found that over 90% of physical education teachers had assigned physical education homework, but most of them only assigned it verbally in a survey on the current situation of physical education homework design for primary school students in Taiyuan City, Shanxi Province, in 2017 [5]. Cheng Guofeng in 2019 through visits and questionnaires in the form of 22 elementary school in Putian City, Fujian Province, physical education homework research, the data show that more than 80% of the schools can not be implemented in the implementation of "layout + implementation" [6]. Wang Heng in 2020 on the Beijing Haidian District junior high schools to carry out physical education homework research found that a total of 72 middle schools in the district, of which five middle schools have carried out physical education homework accounted for more than 70% [7]. The results of many related studies and actual surveys show that schools and teachers in many areas have already implemented the design and arrangement of physical education homework, and physical education homework is gradually becoming a part of physical education teaching. However, in the specific design, arrangement and acceptance of physical education homework, the results of a number of related studies reflect that there are still many problems in the design of physical education homework: for example, the lack of specific guidance and systematic methodology for homework design, insufficient enrichment of content forms, and difficulty in evaluating feedback and corresponding to the actual practice of the students, and so on. The synthesis of various research studies and the analysis of the current situation of physical education homework practice shows that there are still many problems in the design and practice of physical education homework that need to be improved.

The success of video games in the commercial and entertainment industries has galvanized interest in gaming over the past few decades. While digital gaming is a relatively new development, gaming has been more than just a pastime and entertainment for as long as

culture has been recorded. Games are both a spiritual and cultural activity born out of instinct in the course of human civilization, and exist as entertainment, connection building, training, and even as a survival tool [8], and profoundly affect our lives, learning, and work. More and more researchers have begun to focus on the principles behind the intoxication, pleasure, and concentration of games, and to extend their use to more fields, and in this context the concept of Gamification has emerged.

Among the conceptual definitions of gamification, Deterding's definition of gamification - "the application of game design elements to non-game situations" - is the basic definition of gamification that has been recognized and cited by many researchers [9]. Essentially gamification is a design idea, design method, and its related research focuses on how to play a role in behavior change, experience improvement, and goal achievement through the use of gamification design, rather than being limited to the design of a complete game. At present, there are more and more related researches on the application of gamification design in the field of teaching and education in China and abroad, and some researchers point out that the value of gamification in the field of education lies in the fact that gamification can introduce a better process tracking and feedback mechanism for teaching and learning and the key to the construction of students' competence lies in the reflection of the process of learning and practicing [10]. Although, in the practice of sports teaching, there are many researchers and teaching staff pay attention to the application of "games" in sports teaching and training, but most of the current research based on the application and practice of gamification in sports teaching still remains in the application of specific games to improve the teaching process, or the application of a number of fixed games to increase the interest and motivation of participation. However, most of the current research on the application and practice of gamification in physical education still remains in the application of specific games to improve teaching and learning, or the application of several fixed game components to increase the fun and enhance the motivation to participate, and some researchers have pointed out that the "game" is often used as a specific means of physical education, and there is a lack of corresponding model guidance [11].

To sum up, this study is expected to explore the improvement and supplementation of gamification in physical education teaching practice, especially in extracurricular physical training and physical education homework practice, which emphasizes the process of tracking and feedback, in further research. Based on the background and motivation of this study in the context of the aforementioned reality that the physical fitness and health status of adolescents

is not optimistic, as well as the generalization and analysis of the current status of research in the field of physical education homework and gamification design, this study expects to propose a design model of gamification for physical education homework, based on the theories related to physical development and health promotion of adolescents as well as theories related to the practice of physical education, and theories and frameworks related to the practice of physical education teaching and learning, and propose a design model for the practice of physical education homework. This study is expected to take the theory of physical education development and health promotion and the theory of physical education teaching practice as the theoretical basis, combine it with the theory and framework of gamification design, and propose a design model of gamification of physical education assignments, so as to build a specific and operable guidance for physical education teachers on the arrangement of physical education assignments.

2. Literature Review

2.1 Conceptualization of Physical Education Operations

The term "homework" is explained in the Dictionary: "Activities carried out to accomplish a set task in learning." In China's current research and definition of homework, it is generally agreed that "homework refers to learning activities closely related to teaching and learning for the purpose of achieving certain teaching objectives". In contemporary times, the definitions of homework in China's domestic and foreign educational fields are gradually converging, namely, homework is regarded as an important extension of teaching to make up for the limitations of classroom instruction in schools, and is an important and effective complementary means of educational and teaching activities. In terms of defining the characteristics of homework, in the domestic education field, the Dictionary of Education mainly divides homework into two categories: classroom homework and extracurricular homework. Based on the analysis of the meaning of homework mentioned above, the "homework" discussed in this study refers to the learning activities designed by teachers according to certain purposes and completed by students outside of non-teaching time according to the requirements. The basic connotations of homework are as follows: (1) it is only designed and assigned by teachers according to the needs and purposes of teaching and learning, and is completed by students; (2) there are various types of homework, including non-written activities; and (3) it is completed during non-teaching time, i.e., outside of the

classroom. The connotation of "homework" discussed in this study is the same as that of "homework" and "extracurricular work," so when citing existing studies in the subsequent articles of this study, we will ensure that the connotation and scope of the discussion are the same. Therefore, when citing and elaborating on the existing studies in the subsequent lines of this study, on the premise of consistency in the connotation and scope of the discussion, the term "homework" adopts the expression of "extracurricular homework" or "homework" in the original text, i.e., physical education homework is carried out by the physical education teachers according to the teaching content, teaching needs and students' needs. In other words, physical education homework is designed by physical education teachers based on the teaching content, teaching needs, and students' physical and mental development to develop extracurricular physical education activities with physical exercises and sports training as the main content.

In the review of relevant foreign studies, it is found that there is little definition of "physical education homework", but in many physical education-related studies, there are many references to "extracurricular physical exercise", "extracurricular activity mode However, in many studies on physical education, the concepts of "extracurricular physical exercise," "extracurricular activity model," and "extracurricular physical activity" are similar to the concept of physical education homework mentioned in this study. Therefore, we will refer to the relevant studies in the following part of the analysis of the current state of research.

2.2 Definition of the Gamification Concept

The concept of gamification was born when more and more fields started to focus on games and their extended application of design ideas and elements, and Kevin Werbach introduced the concept of gamification in 2003, defining it as Kevin Werbach introduced the concept of "gamification" in 2003, defining it as "the application of game or game elements, design and game concepts to non-game contexts" [12]. In the following decades, scholars have continued to propose definitions of gamification based on the extension of game-related content to specific research contexts in other fields, and in 2011, Deterding proposed a foundational, all-encompassing definition of gamification as "the application of game design elements to non-game contexts" [13]. In 2011, Deterding's basic, encompassing definition of gamification, "the application of game design elements to non-game contexts," has attracted much attention and has been cited by many researchers since then [13]. The core of many definitions of gamification is basically the same as this definition, but with qualifications or contextualization around this core, for example, Hamari et al. define gamification in the field

of service marketing as "the use of game design elements in any non-game system to help increase the internal and external motivation of users, helping them to process information, better achieve goals, or change behavior" [14].

This study will propose a more specific definition based on this definition to clarify the meaning of gamification and related research paths in the subsequent research process, so as to make the study easier to understand: gamification is a design idea that expects to change behavior, improve experience, and achieve goals through the application of game design elements in non-game contexts. Its basic connotation is as follows: (1) Gamification is not a specific game design process, but a design idea; (2) Gamification works in a non-game context, so the result does not necessarily have to be a specific game; (3) Gamification is a means to optimize behaviors, experiences, or procedures using game design elements to achieve a goal. The "game design elements" mentioned in this study's definition of gamification refer to the specific mechanics commonly found in specific game designs, and are defined as the components required for the implementation of the corresponding gameplay in specific games, taking into account the definitions of scholars such as Hunicke et al. and Sangkyun Kim et al. Mechanics. Mechanics often define a certain permissible player behavior and the corresponding rules of gameplay operation in a specific game [12][14].

2.3 A Study of Gamification in Physical Education

As more and more researchers pay attention to the application of gamification design in the field of teaching and education, in the practice of physical education, there are also researchers and teaching staff who gradually pay attention to the application of "games" in physical education and physical training. In some of these studies, although the word gamification is used, there is a clear difference between the definition of gamification in the actual research content and the scope of this study: the basic connotation of gamification in this study makes it clear that gamification is not the direct application of a specific game, but rather the application of the game design concept and design elements to optimize the activities and processes.

Li Guanhua's study explored the impact of basketball gamification instructional design in elementary school students' sports participation, and although the concept of gamification teaching was proposed in the study, the actual gamification process is still directly applying specific basketball games directly to teaching as gamification, rather than using game elements to analyze and adjust the process of teaching [15]. Li Cong's research on the new curriculum background of gamification teaching mode in elementary school physical

education teaching whether feasible, this study clearly mentioned that the current physical education teaching, only the game as a specific means to carry out, rather than a model, but the shortcomings of the study is that there is no clear operational steps for the construction of the teaching mode of gamification [16].

3. Design Pattern Construction

3.1 Principles of Building a Design Model for Gamification of PE Assignments

Based on the theoretical foundations organized in the previous section, the gamification design model for physical education homework constructed in this study follows the principles of usability, safety, and systematicity.

3.1.1 Usability Principle

As an important instructional tool for physical education teachers to plan and guide extracurricular physical education activities for young students, it is important to ensure the usability of the PE Gamification Design Model. Usability is mainly reflected in the fact that each method, process, and step proposed in the model is practical and easy to operate, learn, and memorize for the user. The usability of the model is also reflected in the fact that the content it is constructed from is valid - i.e., the physical education work produced by the model is learnable for the group of students who complete it.

3.1.2 Safety Principle

Physical education is essentially a physical exercise activity, and the development of physical exercise activities must be carried out with safety in mind. When constructing a model for physical education homework design, it is important to consider whether the physical education homework derived from the model, which is a physical exercise activity, fully complies with the guiding ideology of "health first" in physical education. The user is guided to consider the form, place, content, intensity, method and other aspects of the completion of the work, as well as the knowledge of the students' physical fitness and the loadable intensity of the exercise, in order to avoid the possibility of unsafe situations during the implementation of the work.

3.1.3 Systemic Principle

Physical education homework is an effective supplement to physical education teaching, and as one of the important components of physical education teaching, its objectives, contents,

evaluation methods and other components should be closely linked to physical education teaching and combined into an effective and complete system. The gamified physical education homework constructed under this model, its gamified part must also be composed with the homework into a complete and compact system. The implementation of the principle of systematicity means that the logical relationship between the components of the assignment itself must be dealt with, the relationship between the homework exercise and classroom teaching must be dealt with, and the relationship between pedagogical thinking and gamification design thinking must be dealt with. The application of the model, and the application of the products of the model should be dominated by the teaching system, and at the same time, the order of the students to carry out physical exercises and the development of physical fitness should be rationalized. The process of design, implementation, and acceptance should be sequential and orderly. Continuous attention and updating of the different levels of the system involved in the model is an important guarantee that this system will continue to operate coherently and continuously. Systemicity focuses on the need to understand that both the model itself and the product of the model (the operation) are systems that require their own internal logic, and that no part of the system should operate independently of the whole.

3.2 Model Construction

Based on the analysis of the theoretical foundations related to the promotion of physical fitness and health development of adolescents and sports training and physical education, this study will propose a design model for gamification of sports assignments based on the aforementioned theoretical foundations. And based on the relevant gamification design theories mentioned in the study, a specific and systematic design model for gamification of physical education assignments will be constructed. This design model contains five stages: analysis and preparation, prototype design, gamification design, adjustment of implementation form and implementation. Based on this design model, this study further constructs the design process of gamified sports homework, as shown in Figure 3-1.

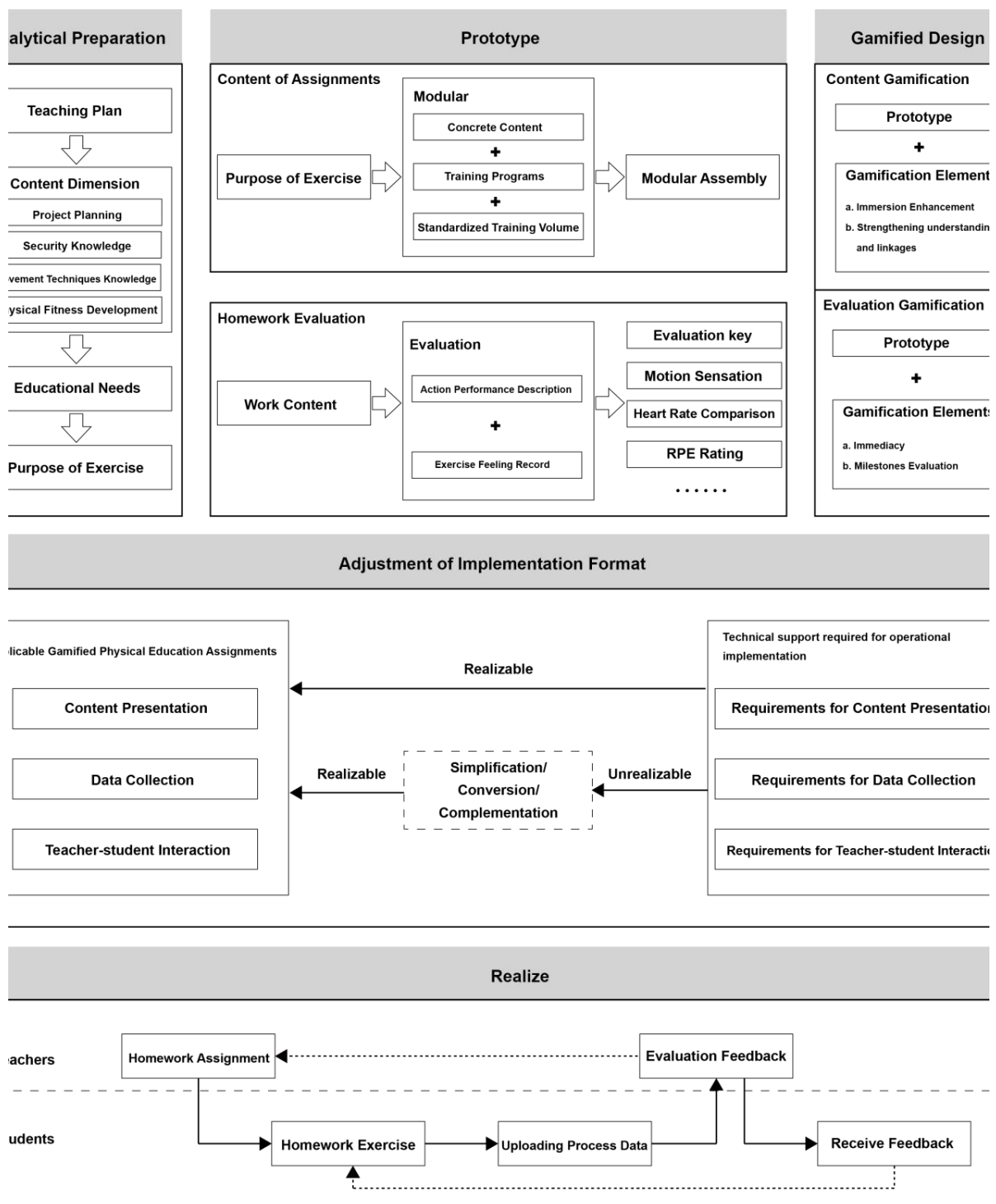


Fig. 3-1 Gamified PE Assignments Design Process

3.2.1 Analyze the Preparatory Phase

The first phase of the design model proposed in this study is the analysis and preparation phase. Physical education homework is an important part of physical education teaching, and

its fundamental purpose is to consolidate the knowledge learned in physical education class and supplement physical education teaching. Therefore, before designing the specific content of physical education homework, physical education teachers need to analyze the specific teaching plan and the corresponding class content in accordance with the "Standards" and the physical education teaching arrangement plan of each region and school, and combine with the students' learning of motor skills, to make clear what kind of supplementation is needed in the current teaching progress - that is, to achieve the teaching purpose, the students need to be taught in the physical education class.

The realization of the teaching purpose requires students to supplement their basic or specialized sports skills with corresponding exercises outside of school teaching in order to achieve better consolidation and improvement. In the corresponding process of analyzing teaching content and needs, this study refers to the teaching guidance recommendations of the Standards and combines them with the teaching references and actual teaching arrangements applied by physical education teachers in actual teaching, guiding physical education teachers to design specific assignments according to the "behavior" and "standards" parts of the specific teaching plans before designing specific assignments. Before designing specific assignments, physical education teachers are guided to analyze the content of the "behavioral" and "standard" parts of the teaching plan in further detail: what are the ongoing chapter modules, what are the specific sports being taught, what are the specific content points and their corresponding learning objectives, and what are the content dimensions corresponding to the above teaching content?

"The content dimensions are proposed to categorize the main contents of teaching exercises, which mainly contain the following four types of contents: (1) program rules, i.e., the specific rules, venue requirements, scoring standards, and foul behavior of each sport; (2) safety knowledge, i.e., self-protection knowledge, injury prevention knowledge, emergency treatment methods, and other knowledge content that the participants need to master in the process of sports training; (3) safety knowledge, i.e., self-protection knowledge, injury prevention knowledge, emergency treatment methods, and other knowledge content. (2) safety knowledge, i.e., knowledge of self-protection, injury prevention, emergency treatment, etc., that participants need to master in the process of sports training; (3) knowledge of movement techniques, i.e., the correct posture, joint positions and angles, key center of gravity positions, force generation sequence, etc., that need to be understood in the process of sports training; (4) physical fitness development, i.e., understanding of the level of fitness

quality required in the teaching, and carrying out the corresponding training on the basis of which the basic physical fitness quality is improved. This analysis framework aims to provide physical education teachers with content dimensions as indicators, and through the tendency to analyze specific teaching plans and contents in detail, it is convenient for teachers to have a clearer understanding of existing teaching plans, teaching content arrangements and the current teaching situation, in order to lay a good foundation for further clarification of the current homework practice needs and purposes, so that the subsequent design of physical education homework can be closely linked to the real teaching situation.

3.2.2 Prototyping Stage

After analyzing the current situation of teaching, teaching content, teaching needs and other information in the analysis preparation stage, and referring to the analysis to obtain the clear purpose and content dimension of physical education homework practice, the next step is to guide physical education teachers to enter the design of homework prototypes.

According to the determination and sorting out of the purpose of physical education practice in the analysis and preparation stage, teachers need to design the practice content module of physical education practice within a certain period of time - according to the clear purpose of practice, match the specific practice content for the purpose of practice, and set up appropriate training content according to the professional knowledge of athletic training and physical practice, and determine the appropriate training content for each item. The standard training volume for each program is determined, i.e., the number of sets, the number of movements per set, or the duration of the movements, and so on. The concept of standard training capacity is that the teacher who applies the model determines the amount of training that can be completed by the majority of students according to the average level of mastery of sports skills or physical fitness of the students in his/her class, grade, or even in his/her school or region. Each corresponding training program or several related training programs designed through the above process is regarded as a "module", and according to the purpose and content of the exercises corresponding to each module and its corresponding standard training volume, teachers can flexibly combine the modules in order to adjust the distribution of the overall content of the physical education homework with a view to achieving different practice effects, such as For example, in a certain week during the learning process of solid ball, the exercises assigned for Monday, Wednesday and Friday are mainly lower limb strength training programs and solid ball throwing movements, while the exercises for Tuesday and Thursday are mainly waist and abdominal strength training programs, together

with ball-carrying and ball-directing movements, and on weekends, ball throwing is practiced in a suitable field.

3.2.3 Gamification Design Stage

After designing the corresponding content module and evaluation module of the homework prototype, it is necessary to design the gamification of the modules of the homework prototype so that they can be organically integrated into a complete and specific sports homework gamification. In the gamification design stage, this model provides different gamification elements for teachers to further improve the design of the homework prototype. Teachers can optimize the whole system of physical education homework arrangement - implementation - acceptance through the use of gamification elements, so that students have a better chance to complete their physical education homework in the process. The teacher can optimize the whole system of assigning, implementing and accepting PE assignments through the use of gamification elements, so that the students can have better feedback and guidance in the process of completing PE assignments to achieve better practice results, and the PE teacher can also understand the practice status of the students through the PE assignment gamification. The whole model regards the prototype as the original "material", guides the teacher to choose the applicable "parts" of the gamification elements, and provides a variety of combinations of the material and parts for reference and selection, which finally constitutes a complete and diversified sports homework.

In the gamification of homework content, on the one hand, it is necessary to consider the gamification elements that can enhance the immersive experience of participants. Gamification elements under this consideration will help students to establish a deeper connection between concrete sports training, practice behaviors, and abstract goals such as competency development through narrative construction or fictional elements, in order to enhance the practice experience (the experience of completing the physical education assignments). The main gamification elements in this dimension are Storytelling and Narrative.

3.2.4 Forms of Implementation

After analyzing the ideas of matching and applying gamification elements, and proposing a framework for matching gamification elements with teaching needs, exercise purposes, and homework prototypes (content + evaluation), there is still one more critical step before the gamification of physical education homework can be fully formed and put into practice:

adjusting the form of the final implementation of gamification of physical education homework in the light of the actual teaching and learning situation.

The central question to be examined is whether or not the "hardware" required for gamification of physical education can be realized. The concept of hardware here does not refer to the general understanding of the concept of equipment, but refers to the carriers that need to be used for the implementation of the final sports work gamification, i.e., all the technical support needed for the successful completion of the process of setting up-implementation-acceptance of a sports assignment, including, but not limited to, collecting and recording the data information of the exercise process through smart devices, wearable devices, testing and measuring devices, or using corresponding APPs, software programs, etc. to realize the communication and interaction. APP, software programs, etc. to realize the process of communication and interactive display. Whether in the stage of prototyping or gamification design, the process of content presentation, data collection, and teacher-student interaction required for the implementation of the assignment is undoubtedly supported by the abovementioned "hardware" in order to make the whole implementation process more efficient.

3.2.5 Implementation Stage

After the teacher has analyzed and designed the sports training part of the gamified sports assignment and the application of gamification design in accordance with the guidelines through the operation of the aforementioned steps, and adjusted the implementation of the gamified sports assignment in the adjustment stage according to the actual teaching situation and available teaching resources, a relatively complete and applicable gamified sports assignment has been successfully designed. The next stage is the implementation stage, which is closely related to the subsequent redesign and adjustment of the PE assignment.

In this phase, there are two related subjects, one is the teacher and the other is the students. Teachers assign the gamified physical education homework in a certain form, and students receive the homework content, independently carry out the corresponding homework exercises and collect and record the data in the process of completing the homework according to the requirements. After completing the homework exercises, they submit the process data in the way specified by the teacher, so that the teacher can evaluate the feedback and acceptance. Teachers can give students appropriate evaluative feedback through direct observation of the relevant records, statistical comparison of data, or based on certain algorithmic rules, and make adjustments and redesign subsequent assignments through the

results obtained from the acceptance of assignments, and then continue to repeat the whole cycle. The students, on the other hand, practice, learn and strengthen according to the evaluation feedback received, and prepare to participate in new assignments. In such a cycle of interaction between the two sides, students through the continuous cycle of homework practice to make their own sports quality, physical fitness, physical health status can be enhanced or improved; teachers through the continuous cycle of implementation of physical education homework to obtain a more comprehensive reflection of the teaching situation, and to promote the design and optimization of the homework in order to achieve the objectives of the teaching to promote the development of physical fitness of adolescent students.

The smooth operation of the PE homework implementation model presented in this stage cannot be separated from the design of homework prototypes and the application of gamification elements in the pre-design stage. From the perspective of the overall sports homework gamification design model, the final implementation stage seems to be only an auxiliary start of the whole sports homework "design-layout-implementation-acceptance" system, but in the real teaching situation, it is also a key stage for monitoring and managing the dynamic balance of the whole gamification homework system. --Gamified PE homework is not a disposable product, and its operation, maintenance, updating and adjustment all require teachers' continuous attention and timely response during the implementation process.

4. Conclusion

This study combines the concept of gamification design to construct a design model for gamification of physical education homework, providing teachers with specific guidance for physical education homework design. In the follow-up study, this study considers that the application of gamification elements proposed in this study can be expanded and extended to more gamification elements, in order to construct a more solid model of gamification design, and guides teachers to carry out gamification design according to the model through the evaluation of physical education homework and the feedback method, in order to solve the problem that it is difficult to track the practice process, and to test and evaluate the usability and effectiveness of this model. Based on the model, teachers are guided to carry out gamification design through the evaluation and feedback of physical education assignments to solve the problem of difficulty in tracking the practice process of physical education assignments, and to test and evaluate the usability and effectiveness of this model. The

usability and effectiveness of the model is tested in a two-phase experimental validation based on remote user testing, questionnaire, interview, and observation to achieve better teaching results.

References

- [1] Okely, A. D. , Kontsevaya, A. , Ng, J. , & Abdeta, C. . (2021). 2020 who guidelines on physical activity and sedentary behavior. *Sports Medicine and Health Science*, 3(2), 115-118.
- [2] Yang, Liu, Yan, Tang, Zhen-Bo, & Cao, et al. (2018). Results from china's 2018 report card on physical activity for children and youth. *Journal of physical activity & health*.
- [3] Kong Lin, Wang Xiaozhan, Xu Qinqing, Yang Wenqiang, Wu Caiqian, & Zhou Bo, et al. (2020). Dilemmas and solutions to the development of Chinese children and youth sports in the context of sports-education integration. *China Sports Science and Technology*, 56(10), 7.
- [4] Ma Jun. (2017). Focus on adolescent health Implementing Healthy China 2030. *Capital Public Health*, 11(3), 2.
- [5] Zhou, G., Wu, C., & Riot, C. G.. (2017). An investigative study on the design of primary school students' physical education homework - A case study of Taiyuan City, Shanxi Province. *Sport* (16), 2.
- [6] Cheng, G. F.. (2019). Survey on the status quo of elementary school physical education homework and countermeasures exploration--Taking Putian City Primary School in Fujian Province as an example. *Youth Sports* (12), 3.
- [7] H.Wang. (2020). Research on the current situation of carrying out family physical education homework in junior high schools in Haidian District, Beijing (Master's thesis, Capital Institute of Physical Education).
- [8] Werbach, K. , & Hunter, D. . (2012). For the win: how game thinking can revolutionize your business. wharton digital press.
- [9] Toscano, S. . (2013). Collaboration patterns among commercial firms in community-based oss projects. department of computer & information science.

- [10] Zhang, Diem. (2017). Research on the application of gamified learning concept in flipped classroom. *Science and education literature* (19), 2.
- [11] Dicheva, D. , & Dichev, C. . (2015). Gamification in education: where are we in 2015? Simpson, P., & Jenkins, P. (2015). Gamification and Human Resources: an overview. Brighton: Brighton Business School, 1-6.
- [12] Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011, September). From game design elements to gamefulness: defining " gamification". In *Proceedings of the 15th international academic MindTrek conference: Envisioning future media environments* (pp. 9-15).
- [13] Hamari, J., Koivisto, J., & Sarsa, H. (2014, January). Does gamification work?--a literature review of empirical studies on gamification. In *2014 47th Hawaii international conference on system sciences* (pp. 3025-3034). Ieee.
- [14] Li, Guanhua. (2018). A study on the impact of basketball gamification instructional design on elementary school students' sports participation (Master's thesis, Yangzhou University).
- [15] Li, Cong. (2014). Feasibility study of using gamified physical education teaching mode in elementary school physical education and health class under the background of new curriculum standard (Master's thesis, Soochow University).