

# Research on the Mode and Application of the Combination of Game-based Learning and Project-based Learning

Wen-Dan HUANG, Jun-Jie SHANG, Rong MIAO

*Lab of Learning Sciences, Graduate School of Education, Peking University, China*

\* jjshang@pku.edu.cn

## 1. Introduction

Both project-based learning and game-based learning are learner-centered learning modes. Buck Institute for Education (“BIE”) (2019) defined project-based learning, which took course learning as the core, as a systematic approach to teaching. Project-based learning involves the process of exploring complex and real problems, the careful design of project works and planning and implementation of project tasks. During the process, students acquire the required knowledge and skills. As to the definition of game-based learning, narrow sense of game-based learning refers to the application of games, especially video games, to learning, while the broad sense of game-based learning refers to the application of games or game elements, concepts or designs to learning.

During the process of implementing project-based learning, teachers and students will face some difficulties and obstacles. For instance, insufficient activity time, inexperienced teachers, too many students in class and students' lack of team experience and interest in subjects increase the difficulties in implementing project-based learning (Sumarni, 2015). Game-based learning has been proved by many scholars that it can improve students' learning motivation, learning participation, learning engagement, etc., and thus improve the learning effect. Based on this, this study tries to embed game-based learning into project-based learning and integrate it into a new learning mode to improve the effect of project-based learning (Shang et al., 2019).

At present, there are few researches on the combination of game-based learning and project-based learning. According to the literature research results in recent years, researches on the combination of game-based learning and project-based learning can be divided into four types. The first is the combination of project-based learning and educational games (Wang, 2020; Gabriele etc, 2017; Callaghan, 2016; Hewett et al, 2020; Ke et al, 2019). The second is the combination of project-based learning and game production (Gestwicki et al., 2016; Seralidou et al., 2021; Romero et al., 2019; Gaeta et al., 2019). The third is the combination of project-based learning with a single game element (Mantawy et al., 2019; Chua et al., 2017). The fourth is the combination of project-based learning and various game elements (Rajkovic et al., 2019; Atlanis et al., 2018). The research on the combination of game-based learning and project-based learning in countries around the world is still in the primary stage, such as the exploration of teaching mode, teaching design and the evaluation of teaching effect, and at the same time, there is a lack of exploration and explanation of the relative mechanism.

The theories of the combination of game-based learning and project-based learning are based on theories derived from game-based learning and project-based learning, including theory of pragmatism, theory of discovery learning, Jasper series, theory of multiple intelligences, theory of intrinsic motivation, Maslow's hierarchy of needs, flow theory and theory of online game motivation.

## 2. Preliminary Research Questions

What is the mode of the combination of game-based learning and project-based learning?

What are the design principles of the combination of game-based learning and project-based learning?

How effective is the combination of game-based learning and project-based learning?

### **3. Contribution of the Proposed Research**

In academic field, both project-based learning and game-based learning are current research focuses, but there are few in-depth studies on the modes, principles and practical effects of integrating the two. Therefore, this study is innovative to some extent. In addition, this study has reference significance for subsequent studies of other scholars.

As far as application is concerned, this study aims to provide certain operational guidelines, examples and tools for front-line teachers, so as to help them understand the operation process of the combination of project-based learning and game-based learning clearly.

### **4. Proposed Research Methodology**

Based on the research needs, the research methods used in this paper include investigation research method, literature research method, case analysis method, induction and experiment method, so as to make the research have theoretical and practical value.

#### *4.1 Investigation Research Method*

The investigation research method can be used to get a first-hand material of the real situation and can be used for classroom observation, mainly including in-class lectures and videos in some schools, as well as interviews with some teachers.

#### *4.2 Literature Research Method*

This study will use CNKI, Web of Science, Elsevier Science Direct Online and other databases, books and other methods to collect and refine the original materials related to the research. The literature materials that need to be collected for the research involves game-based learning, project-based learning and relevant papers and works of the combination of project-based learning and game-based learning. After that, through comparison, analysis, synthesis and other methods, the literature materials are concluded, classified and organized and the research results are summarized and refined, which help to find the deficiencies of existing research and will help broaden research thinking, establish research perspective, research direction and research thinking, and then make innovations.

#### *4.3 Case Analysis Method*

The case has three basic characteristics: typicality, research and inspiration. Case analysis method focuses on the analytical value of information. It is a research method for researchers to collect and extract information from the case materials. Case study is helpful to understand the truth, infer and discover the internal connection between things. This study gained experience through the help of concrete and vivid case analysis. Case analysis includes: analyzing the teaching design of the front-line class examples, students' homework, works and other texts; analyzing the class examples and classroom teaching fragments, and providing factual materials and design samples for the teaching strategy of the combination of game-based learning and project-based learning. Procedures include collecting cases, describing cases and evaluating cases.

#### *4.4 Induction*

By sorting out a large number of excellent experiences in the literature materials and practice, conclude its common elements, and then summarize, improve, systematize and finally form a model, and try to use it in the teaching practice and reflection summary of the experimental class.

#### 4.5 Experiment Method

Educational experiments are the foundation and source of the formation of new theories and new assumptions. The experiment method will use experimental classes and control classes to initially explore and verify some theoretical ideas of the combination of game-based learning and project-based learning. The findings of this study are intended to point the way for further research.

## References

- Altanis, I., Retalis, S., & Petropoulou, O. (2018). Systematic design and rapid development of motion-based touchless games for enhancing students' thinking skills. *Education Sciences*, 8(1), 18.
- Callaghan, N. (2016). Investigating the role of Minecraft in educational learning environments. *Educational Media International*, 53(4), 244-260.
- Chua, Y. L., & Koh, Y. Y. (2017). Internal competition in engineering education—a case study of project design competition in UNITEN. *Advanced Science Letters*, 23(2), 708-711.
- Gabriele, L., Marocco, D., Bertacchini, F., Pantano, P., & Bilotta, E. (2017). An Educational Robotics Lab to Investigate Cognitive Strategies and to Foster Learning in an Arts and Humanities Course Degree. *International Journal of Online Engineering*, 13(4).
- Gaeta, E., Beltrán-Jaunsaras, M. E., Cea, G., Spieler, B., Burton, A., García-Betances, R. I., ... & Arredondo Waldmeyer, M. T. (2019). Evaluation of the Create@ School game-based learning-teaching approach. *Sensors*, 19(15), 3251.
- Gestwicki, P., & McNely, B. (2016). Interdisciplinary projects in the academic studio. *ACM Transactions on Computing Education (TOCE)*, 16(2), 1-24.
- Hewett, K. J., Zeng, G., & Pletcher, B. C. (2020). The acquisition of 21st-century skills through video games: Minecraft design process models and their web of class roles. *Simulation & Gaming*, 51(3), 336-364.
- Institute of Buck (2007). *Project Based Learning Handbook-A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers (2nd Edition)*. Beijing, IN: Educational Science Publishing House.
- Ke, F., Clark, K. M., & Uysal, S. (2019). Architecture game-based mathematical learning by making. *International Journal of Science and Mathematics Education*, 17(1), 167-184.
- Mantawy, I. M., Rusch, C., Ghimire, S., Lantz, L., Dhamala, H., Shrestha, B., ... & Mabrich, A. (2019). Bridging the gap between academia and practice: Project-based class for prestressed concrete applications. *Education Sciences*, 9(3), 176.
- Rajkovic, A. I., Ruzic, M. S., & Ljubic, B. (2019). Board Games as Educational Media: Creating and Playing Board Games for Acquiring Knowledge of History. *IARTEM e-journal*, 11(2).
- Romero, M., Arnab, S., De Smet, C., Mohamad, F., Minoi, J. L., & Morini, L. (2019). Assessment of Co-Creativity in the Process of Game Design. *Electronic Journal of e-Learning*, 17(3), 199-206.
- Seralidou, E., & Douligeris, C. (2021). Learning programming by creating games through the use of structured activities in secondary education in Greece. *Education and Information Technologies*, 26(1), 859-898.
- Shang, J.J., Qu, X.M. et al. (2019). *Pedagogy of Game Based Learning*. Beijing: Higher Education Press.
- Sumarni, W. (2015). The Strengths and weaknesses of the implementation of project based learning: A Review. *International Journal of Science and Research* 4(3), 478-484.
- Wang, Y. H. (2020). Integrating Games, e-Books and AR Techniques to Support Project-based Science Learning. *Educational Technology & Society*, 23(3), 53-67.