Research on Educational Reform of Professional Courses in College Education Based on Practical Puzzle Games

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ABSTRACT: *With the development of educational ideas, practical puzzles emerged as a new cultural vehicle and mode of education in recent times. Game teaching itself is full of interest, interaction and collaboration, which greatly benefits the development of self-directed learning of student interests. At the same time, with the deepening of curriculum reform in colleges and universities, according to the "Science, Technology, Engineering, Art, Mathematics" (STEAM) concept, practical puzzle games including board games combined with professional basic courses will give them educational and social values which also leads to a concept of "teach through lively activities". From the perspective of teachers and students, the paper further improves the application of tabletop gaming education for the teaching of professional courses in colleges and universities. This improvement will be basically achieved by providing feedback on learning from three aspects: pre-class preview, in-class teaching, and after-class review.*

KEYWORDS: Curriculum reform, Board games, College teaching, Specialized courses, STEAM concept

INTRODUCTION

Board Games and Education

A board game is a recreational game played on a three-foot platform that dates back to ancient Egypt. The revival of the modern board game began in the early part of the last

century and had its roots in the Western middle class. This group is well educated and has plenty of spare time, and is financially well-off, thus becoming the main disseminators of board games [1]. The best-known of these is Monopoly, which has been played by more than 500 million people in the West. Since then, a variety of board games have emerged, like German board game "Catan Island" and so on.

Today, board games have become a form of entertainment that covers a wide range of fields, such as finance, history, literature, religion and more. As game mechanics and themes continue to evolve, board games have become a counterpoint to the information era. As a multiplayer interactive game, the social value of board games is highly evident. Of course, the value of board games is not limited to social aspects but the value is increasingly diversified as they continue to evolve. The most important is the educational value and ideology associated in board games, and properly guiding the development of board games is of great importance to education. In foreign countries, gamified thinking developed earlier, like the United States, Italy, Japan and other developed countries are top among the lists. In terms of the study of gamification in education, as early as the 1980s, Thomas proposed the idea of using gamification to stimulate internal motivation. In addition, MIT's "Games-to-Teach" research project [2] and Finnish researchers' experiential learning [3] have provided a theoretical basis for gamified teaching. Germany's practical experience in gaming education has become a global model. The widespread popularity of board games in Germany shows that their priority to children's game education. Germans believe that the board games are the best way to communicate with children, because board games not only have educational value, but also play an important role in improving children's logical thinking and social ability, which is no less than books [4].

TABLETOP GAME TEACHING DEVELOPMENT STATUS

Board games in foreign countries start very earlier. Its development is not confined to the realm of entertainment. Research and applications related to education have continued to emerge in recent years. In particular, the variety of board games based on scientific theory and expertise are more notable for their professional threshold and educational value. The popular phrase "quantum mechanics" comes from a book by Dr. Billis et al. called "Quantum Party!" Educational board game. The game takes the form of a board game and introduces the player to four classical quantum mechanics: the double slit experiment, black body radiation, the photoelectric effect, and the Rutherford scattering experiment. The game is interest-oriented, focusing on fostering

the interest and understanding of the scientific knowledge of quantum mechanics among the players, and contains rich educational value and learning implications. "Cell Factory" is a high-quality cell-themed board game recommended by the internationally renowned scientific journal "Cell Science Journal". The game primarily advances the game by simulating the process of material transformation, with a variety of alternative strategies and gameplay. The game itself is rigorous and fun, and the ability for players to learn a lot about high school biology while having fun is highly advantageous in educational perspective too. "Element Trajectory" is a popular science chemistry board game, using the basic principles of chemistry as the rules of the game, using the periodic nature of the elements to simulate chemical experiments. The game avoids the tedium of traditional teaching and gives players an almost authentic sense of experience and engagement. One of the representatives of the chemistry board game, it combines scientific principles with entertainment to make learning chemistry livelier and more interesting. "Photosynthesis" is a forest ecology themed board game, using the earth rotation principle and the big tree theory of the game rules. The rules of the game are easy to understand and are liked by the players. In the West, educational board games have come a long way and demonstrated the educational properties behind them. Educational board games are not only entertaining, but also effective in promoting the learning of knowledge and the cultivation of skills, which is important to guide the realization of the common values of education and entertainment.

The board game industry is still in its infancy in China, where supply and demand are currently imbalanced and the industry system is not standardized. Most of the domestic board games rely on foreign imports, but the high cost has led to an increasing piracy issues. At present, the more popular board games in China are mainly "three kingdoms kill", "werewolf kill" and other forms of single games. The main audience for this game is junior high school students. On the one hand, this phenomenon is related to the context of heavy student learning and limited electronics, and on the other hand, it reflects the changing entertainment needs of students, where board games have become an entertainment substitute for electronics. As an extension and extension of the game field, board games not only meet the needs of players for entertainment, but also promote the development of logical thinking and social skills. Its multiplayer features can effectively prevent addiction, and compared with electronic games, its low cost has become an ideal form of entertainment [1]. For college students, they have more abundant leisure time, a better system of knowledge, and frequent dormitory

communication, which makes them better suited for social activities such as board games. In fact, most of the college students have the basic ability to play board games, so educational board games with college students as audience are also viable options with promising implementation prospects. Moreover, board games have the advantage of being low-carbon and environmentally friendly compared to electronic games, and do not damage the eyesight of players, which is in line with the new-age concept of environmental protection and therefore deserves to be actively promoted.

At present, with the gradual saturation of the traditional online game market and the continuous popularity of board games in China [5], offline games such as board games and script killing are becoming increasingly popular. Some brick-and-mortar stores are starting to take root everywhere, and online board game sales continue to climb. The development of board games has shown a diversification trend and has penetrated into various fields. For example, "Corporate multiple DNA- the road to Listing" highly restores the real business operation, and expands business thinking with gamification thinking; At the same time, some board games such as "werewolf killing" and "Long vine Murder House" have also become popular topics in domestic variety shows. In addition, board games such as "Medical Pioneer" truly simulate the process of medical development and popularize medical knowledge to the public [1]. Domestic board games have spread across various fields and are deeply loved by the people.

According to a survey conducted by China Youth Daily online, about 73.9 percent of respondents believe that offline games, especially, board games have high social value. At the same time, 90.2% of respondents believe that board games are expected to become the new favorite in the social space, which vividly reflects the potential opportunities in the board games market [6]. So far, research into the integration of board games into educational curricula is still in its infancy, and trials have only been conducted on a small scale. According to Xu Shuyi [7], board games are crucial for children's comprehensive development. Specifically, board games help to promote children's social development, logical thinking and intellectual development, and emotional communication. However, the selection and use of board games for young children requires reasonable instruction and management. According to Wu Zhenxing's research [8], board game education has shown positive effects on learning motivation and attitude among the candidatesTaiwan, but its specific effects and mechanism still need to be further explored. Traditionally, board games are regarded as a form of

entertainment, and their educational value is often overlooked. In the traditional classroom, teachers often teach one-way through the way of explaining courseware, which makes the classroom monotonous. However, if board games are integrated into college classroom teaching as an experiential activity with many people participating, and the characteristics of strong interaction and low threshold can help the students to overcome their fear of learning and cultivate their interest in learning. In addition, by enhancing communication opportunities with the students, teachers transform the main object of the class so that students can participate more actively in the class.

THE DEVELOPMENT TRENDS OF TABLETOP GAMES AND EDUCATION

The three-dimensional development of board game courses should be based on different professional courses and gradually expand the expertise and skills of board games from appearance to connotation and from explicit to implicit. In this process, care should be taken to develop the thinking, logic, and exploration abilities of the students, and to gradually tap into hidden and deep expertise by exploring and mining explicit and superficial knowledge points.

The board game curriculum should achieve standardized and personalized development, which can be gradually improved and optimized on the basis of relevant courseware, and highlight its unique features in board game curriculum. In order to expand the educational value of games in general, board game courses should develop a common template that can be used in most courses, with a view to achieving broad application.

The interactive development of the board game curriculum emphasizes the student participation and interaction, and uses the interactive nature of board games to avoid the situation of one-way teaching by the teacher in the classroom. Students unconsciously absorb and apply knowledge in play, become the protagonists of the class, and truly realize the student-centered teaching model.

The socializing development of the board game curriculum emphasizes promoting the growth of the student's ideology. By guiding students and society towards a higher spiritual civilization, it promotes the rebirth of the curriculum in a modern information technology environment. This kind of education is extremely important in making the curriculum a guide to a more cultural social life.

COLLEGE BOARD GAME PARTICIPATION CURRICULUM EDUCATION CONCEPT

As education reform deepens, traditional classroom teaching in a single form is no longer able to meet practical teaching needs. As a new teaching method, board game course is based on its rich ideological attributes, highlighting the core concept of "edutainment". In combination with STEAM education concepts [9] (Science, Technology, Engineering, Art, Mathematics), emphasis is placed on students' subjective initiative. Based on this, we explore the construction of relevant professional college board game courses to achieve more professional and efficient teaching objectives.

SCIENTIFIC LITERACY GUIDANCE TO CONSTRUCT PROFESSIONAL

BASIC KNOWLEDGE BOARD GAME COURSE TEACHING

The background of board games is mainly based on the professional basic courses in college education, and adopts the principle of miniaturization to carry out teaching through a small range of professional knowledge points that are easy to understand, so as to facilitate students to gradually absorb knowledge and explore deeply. The teaching of the course adheres to the core concept of "edutainment", designs board games based on basic knowledge points, distributes the board games to students in advance, and explains the rules. In the process of learning the rules, invisibly exploring knowledge, allowing students to understand before the class, participate in class and give feedback after class, encouraging students to explore, design and discover, then sublimate and create board games to improve student scientific knowledge.

TECHNICAL LITERACY TO GUIDE THE CONSTRUCTION OF

PROFESSIONAL BASIC KNOWLEDGE BOARD GAME COURSE

TEACHING

At the heart of the board game curriculum lies the board game itself, which can be seen as both a technology and a medium. The integration of board games into the classroom has changed the presentation of traditional classrooms, exploring and innovating classroom forms and increasing interest and interaction. However, care must be taken to strictly control the time spent on board games, to avoid completely turning the lesson into a game, and to have a balance of relaxation, taking into account the pleasure and rigor of the lesson, so as to make the teaching more attractive. At the same time,

information technology can be further utilized, such as VR technology, 3D experiences, etc., to make board game lessons more personalized.

MATHEMATICAL LITERACY GUIDE DESIGN PROFESSIONAL BASIC KNOWLEDGE TABLE GAMES

Mathematical literacy in the board game curriculum consists of three main aspects: expression, manipulation, and checking computations. It is necessary to develop the mathematical logic skills of students through adequate communication and interaction. To this end, we need to refine the knowledge points in the professional foundation course, condense the core that involves mathematical operations or logical reasoning, and closely link board games to these knowledge points. Through board games, students can gain an in-depth understanding of the specific expressions of relevant knowledge points and achieve self-digestion and logical deduction. At the same time, strengthening the connection and progressive relationship between knowledge points, both from the table and from within, allows the student to gradually calculate the final tacit knowledge points from the explicit knowledge points, further expanding the thinking and logic capabilities. Feedback, evaluation, and summarization are provided in the game results, important links in the game are analyzed, and knowledge points related to the context of knowledge are consolidated.

ENGINEERING LITERACY GUIDE DESIGN PROFESSIONAL BASIC KNOWLEDGE BOARD GAME

At its core, engineering literacy is about developing students' ability to solve practical problems. Independent exploration, self-learning, analysis and problem solving are indispensable qualities for engineering students. Combining the knowledge points of the professional course with the engineering background closely, and reviving engineering cases and examples through the design of board game scenarios can effectively improve the knowledge and abilities of students. In addition, teachers can distribute board games to the students before class, so that the students can preview them through example board games, allowing students to more smoothly receive what is being taught in class and improving the students' independent learning ability. In a class, through communication and interaction, students will have a deep understanding of the operation mode of board games, optimize their learning of professional knowledge points, familiarize them with all important links of the basic theories of the major, and finally have a deeper understanding and mastery of the connotation of board

games which will help them to obtain better experience and knowledge advancement of board games.

ARTISTIC QUALITY GUIDES THE DESIGN OF BOARD GAMES

The essence of board game design is artistic representation. In addition to the core that appeals to the student, there are aspects of appearance, art, etc. which need to be appealing to the eye, and need to be the refinement of beauty. Designing a professional curriculum from the surface to the interior into a lively board game requires great expressive power and artistic accomplishment, and incorporating board games into the curriculum is an expansion and extension of the art. The integration of artistic and educational values can further promote the development of students' all-round abilities, which is not limited to the improvement of skills but is more focused on the cultivation of students' thinking and creativity.

TABLETOP GAMES ARE IMPLEMENTED TO ASSIST THE TEACHING OF PROFESSIONAL COURSES IN COLLEGES AND UNIVERSITIES

By combining the core idea of "teach through lively activities" with the concept of "STEAM", board games are incorporated into the teaching system of professional courses in colleges and universities, and thereby a systematic teaching method of "professional desk games" is developed. With board games as the core, lesson plans, courseware, curriculum, summaries, feedback and assessment as the process, this approach aims to build a teaching module that combines education with fun and teacher-student interaction to promote students' overall development and capacity improvement.

Many of the basic courses in each major have both fundamental theories and current hot-button issues. Appropriate sections of the professional curriculum are selected as a background to build new energy board games based on the expertise, which are then gradually expanded to establish and improve the corresponding board game teaching modules [10]. For example, solar photovoltaic power generation technology in new energy science and engineering, background theories are photovoltaic power generation principles, crystalline silicon cell production process, power generation efficiency; It

can be based on the integrated process from raw material for silicon battery production to power generation, combining the raw material acquisition, cost trading, battery line preparation, power plant construction, operation and power generation, integrating scientific theory and mathematical model, actuarial income design competition mechanism, but also can combine the current hot "double carbon" goal, adding environmental protection and other social benefits and other multiple victory conditions. Let the students learn from actual board games and the financial gain is not the only ultimate goal, but also intangible ideological and political education. The board game teaching module mainly uses board games as the carrier and "edutainment" as the core idea to set teaching tasks, enrich course teaching through detailed activities, add test questions guided by board game design, and properly deal with the relationship between the gamification characteristics of board game course modules and the rigor of college course teaching, so as to promote the two to complement each other. To enable students to actively engage in learning with an interest orientation. After the practice of board game course, the feedback evaluation of teachers and students is carried out as a guide, and then the overall design of board game and course modules is improved [11].
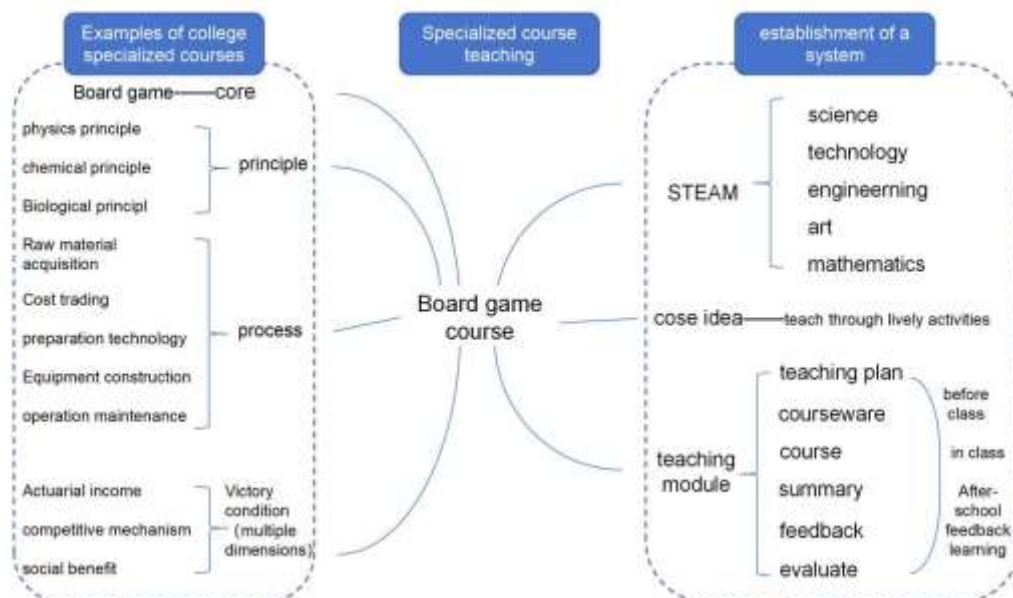

Figure 1. Schematic representation of college board game course construction.

The generalization of the teaching module of the board game course is based on the competitive nature of the board game itself, and uses the game as a medium to stimulate

active learning motivation in students, thus enhancing the appeal and effectiveness of the course teaching. As information technology continues to evolve, the introduction of VR and 3D technology brings more possibilities and changes to the teaching of board game courses. The integration of these scientific and technological elements with the teaching of board game courses can greatly enhance the student's sense of participation and experience, and thus optimize the teaching effectiveness. In a specific course, the teaching process can be divided into the following links: teacher's explanation of class process, determination of course topic, group board game, group class presentation, teacher and student evaluation and summary. As a multi-player competitive game, the inclusion of board games in classroom and group instruction facilitates competition and cooperation among students and promotes the development of students' ability to think logically, thus compensating for the training of skills and knowledge which are not available in traditional classes. Among them, the teacher's explanation mainly introduces the classroom process, implementation steps, summary mechanism, and principles. To determine the subject matter, teachers should rely on the context of the board game, the subject matter of the board game, and the content of the course to teach the relevant course. Board games are played in groups of five or six to ensure everyone's participation, integration into the classroom, and the development of students' social and self-presentation skills; The classroom presentation is a display and presentation of the group's combined expertise combined with each person's game earnings; Finally, the evaluation and summarization are designed to assess and improve the deficiencies of the curriculum and board games. In addition, since the basic theory and professional background of each course are different, the board game mechanism and auxiliary teaching module are designed according to the characteristics of each course, and then the comprehensive teaching auxiliary board game system of this major is set up from point to point, such as environmental protection and energy saving, electrical machinery, chemistry and chemical engineering, energy economy, etc., which makes the teaching of board game module more extensive and general. It can also change the context and the sense of substitution with the same mechanism, deepen the student's understanding of the same type of fundamental theory of knowledge, and reduce the burden on the teacher in designing the mathematical mechanism of the board game. The board game auxiliary teaching module is not intended to cover all the aspects, but has sufficient enough for both teachers and students in developing vital skills in an entertaining way [12].

Using board games as a teaching resource to assist in the teaching of specialized courses is a reasonable and innovative approach to teaching. Board games can not only become students' teachers and friends, but also innovate and improve traditional classrooms [13]. Among the other things, teachers should take an active role in guiding and encouraging students to actively participate in board game teaching, so that students can not only participate in classroom games, but also play independently after class to further understand and discuss what they have learned. In this way, the student's learning attitude will be interest-oriented, which will not only deepen their understanding of knowledge, but also form the ability to think on their feet and innovate, laying a solid foundation for future career development.

CONCLUSIONS

In this paper, we propose the construction of an auxiliary teaching module for board games based on the gamification thinking of the basic curriculum of each specialty. Integrate the core idea of "edu-play" into the concept of "STEAM"(science, technology, engineering, art and mathematics) and designing a board game mechanism based on the knowledge system, and establish a complete board game teaching module system from the perspectives of various stages (before, during and after class) which will help in promoting the application of board games in college teaching. The teaching module of the supplementary course has board games as the core, and the teaching plan, courseware, curriculum, summaries, feedback and evaluation as the process. The main significance of this study is to change the traditional classroom teaching mode, to enrich the form of university classroom teaching, and subtly deepen the understanding and application of theoretical knowledge by students.

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