3D Course Teaching Based on Educational Game Development Theory – Case Study of Game Design Course

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Abstract—With the rapid development of information technology, 3D game technology also has developed gradually. Virtual reality technology is developing at a fast speed, too. At present, virtual teaching method of game design in software engineering major may be caught in the unfavorable situation where "teachers do not respect it and students' learning motivations differ a lot". Meanwhile, students may be easily influenced by nonintellectual factors such as emotion, hobby and will, and develop many harmful learning habits such as indifference to standards of game development procedure, which to certain degree influences teaching effect. On this basis, the teaching method of applying educational game development theory in game design course was proposed in this study. First of all, research status of domestic and overseas game design courses was analyzed. Starting from education and 3D software features, the content of Game Design in software engineering major was chosen for educational game design and development. Meanwhile, questionnaire survey and experiment were carried out to evaluate the application effect of the case. It was found that, educational game designed in this study was affirmed by students and teachers, and the case gained a favorable effect in the implementation process. Besides, game-based teaching method motivated students' learning interest. In conclusion, the teaching effect of educational game is better than traditional teaching effect.

Keywords—Educational game development theory; game design; 3D

1 Introduction

Educational game is a kind of serious games, which is developed especially for the specific education aim. With the features of education and entertainment, educational game takes the game as the educational means. During designing the game, mature educational theory is used as the theoretical support to achieve the balance of education and game. Then, educational process product achievement is completed through games. Educational game belongs to a branch of serious game. With further development of computer technology, scholars start to focus on the value of games in education. Educational game was first proposed by Woodrow Wilson International

Center for Scholars [1], called Educational Game or Edutainment (Educational + Entertainment). The concept definition of educational game is generally classified into two types. One view holds that educational game means the essence of computer games contains educational significance. The other view holds that, educational game means the relevant software used in teaching has the features of online game. Wangenheim et al. defined educational game as computer game software which can cultivate intelligence, knowledge, skills, emotion, attitude and values of game users and owns good educational significance [2]. Shang considered educational game is a computer program which is created by game design and production staff, has the purpose of education and entertainment and provides certain educational content for game users who can learn in games [3]. Although the definitions of educational game differ, but the connotation is consistent. It is generally believed educational game is a kind of computer software which takes computer game as the carrier and owns multimedia features. D in 3D technology is "Dimension". 3D is three-dimensional space which refers to the stereoscopic scheme with length, width and height. 3D technology is the technology which can present three-dimensional scene. To let people view 3D image, 3D technology utilizes visual deviation to generate distance deviation so that people fell being personally on the scene [4]. The rise of 3D technology provides a new path for educational game development and educational business. Simulation and tridimensional features of 3D technology not just meet needs of new course standards, but also adapt to students' thinking characteristic. Thus, 3D technology provides foundation for cultivating talents for the society. Once it appears, educational workers combine it with educational game in course education. 3D educational game is generally applied in such field as medicine, building and safety education. Besides, it is mostly applied in preschool, junior and senior high school education, such as mathematics, geography, physics and English. Researches show that 3D course educational game can obviously improve students' learning interest and attention, and promote teaching effect [5].

With rapid development of information technology, internet and digital game industry, online game has become an important part of adolescents' entertainment life. The demand for talents in relevant fields exceeds supply. Many universities have set up Game Design course in relevant majors to cultivate game design talents. National Outline for Medium and Long-term Education Reform and Development (2010-2020) explicitly indicates that the key to higher education talent training system reform is innovative talent training mode [6]. At present, virtual teaching method of game design in software engineering major may be caught in the unfavorable situation where "teachers do not respect it and students' learning motivations differ a lot" [7]. Meanwhile, students may be easily influenced by nonintellectual factors such as emotion, hobby and will, and develop many harmful learning habits such as indifference to standards of game development procedure, which to certain degree influences teaching effect. Under the general background of college education and online education, the educational game mode which combines games and education is increasingly favored by teachers and students in higher education classroom. With continuous development of digital game technology, the application of 3D technology in classroom also receives more and more attention of educational game teaching

practice. Game Design as a course highly related to game production requires learning of game-related network technology. 3D technology and educational game are combined ad applied in Game Design teaching practice, which are a teaching mode and also a teaching case. This teaching mode not just can significantly improve teaching quality and teaching effect and has important theory and practice value for Game Design education, but also can meet demand of game industry for professional talents and social innovation talents.

2 State of the Art

2.1 Researches about Game Design course

Foreign game talent training mode has been very mature. Many colleges have set up courses and majors about game design and development overseas, such as entertainment technology major, and game and interaction major. Some colleges even set up master degree's courses. Some colleges set up special game schools. In China, game design and development teaching is still in the preliminary exploration stage. From the 21st century, some universities started to set up the majors and courses related to game design and development, and some courses about game production are also added. But on the whole, game major development in China still has an obvious gap with foreign countries [8]. The differences between domestic and overseas teaching modes of game-related majors are shown in Table 1.

Table 1. Main differences between domestic and overseas teaching modes of game-related majors

	Overseas	Domestic
Theoretical basis	Multi-field, multi-perspective, value depth	Ignore theory and value technology
Teaching objective	To develop individuality, pay attention to research ability, critical ability and design practice ability, emphasize the effect of works in society and regard students as the subject	To balance development, lack peculiarity, pay attention to theoretical basis, professional skills and practical ability, control students' development direction and regard teachers as the subject
Teaching process	Emphasize flexibility, pay attention to teaching process and make real-time adjustments according to discipline features and teaching conditions	Emphasize integrity, lay emphasis on teaching results and focus on theoretical preciseness, beginning and end.
Teaching evaluation	Teaching tasks and teaching purposes of different teaching majors are different; evaluation standards and methods are diversified	Teaching tasks and teaching purposes are single; evaluation standards and methods are also single

The 41st Statistical Report on Internet Development in China issued by CNNIC in 2018 shows that, as of December 2017, the scale of online game users had reached 442 million, accounting for 57.2% of all netizens. Seeing from age structure, the proportion of 20-29 age group is highest, up to 30.0%, indicating college students are the main force of online games. The love and even addiction of contemporary college

students for online games have been beyond all doubt. College students often show high attention and desire for success for online games. Game industry has become a pillar industry of Chinese economy, and gains strong support of the government. Om January - November 2017, the income of online games reached 134.1 million. The talents in game industry are scarce [9]. Game Design course is very necessary for improving professional ability of students of relevant major and meeting social demand for talents, researchers indicate that [10] Game Design course can help students integrate knowledge of multiple courses, promote learning effect, motivate students' learning enthusiasm and motivation, enhance students' computing thinking and problem solving ability, and boost students' creativity and comprehensive quality. However, some researches indicate that, many problems exist in the course of Game Design, so teaching mode reform shall be enhanced. Li [11] considered that, some problems exist in game development course such as unreasonable teaching content, low learning enthusiasm, no attention to innovation ability training and unscientific evaluation system. Thus, teaching mode reform is urgently needed. How to carry out teaching mode reform and promote teaching quality of Game Design course? Most scholars think it is required to follow the times and introduce 3D technology in Game Design course. Meanwhile, educators found some problems in Game Design course, such as disconnection between teaching content and industry trend, lack of course practice, insufficient continuity and cooperation and poor occupational awareness [12]. The talents really conforming to the needs of game industry are very few. The root cause is that the knowledge is too old. It is required to combine 3D game development course to reform teaching mode of computer game major [13].

2.2 Advantages of application of educational game development theory in Game Design 3D course

Introduction of educational game development theory: Under the guidance of educational game development theory, educational game was introduced in Game Design course to reform teaching mode of Game Design, and to promote interestingness, creativity and scientificity of Game Design. The introduction of educational game development theory in Game Design has the following advantages. Firstly, educational games can transform abstract knowledge into concrete intention through pictures, sound and story plot to attract students and motivate their learning interest. Secondly, educational games generally involve some knowledge of history, geography and relevant fields through simulation and knowledge background introduction. Besides, the rules are set up according to physical and chemical principles, and the game levels are set up. Thus, students can consciously learn and enrich knowledge hierarchy during playing games. Thirdly, educational games are combined with game level mode. To pass the level, students must solve course-related problems in the playing process. To complete the game, students will actively learn relevant knowledge and actively solve problems. In addition, many scenes need to be completed by students through utilizing their imagination, creativity and cooperation with others. This can promote students' autonomous learning ability and problem solving ability and cultivate their cooperation awareness. Fourthly, the fresh

educational game teaching mode greatly shortens teaching time, promotes teaching efficiency and teaching quality and helps students grasp course knowledge faster in the process of boosting students' learning interest, transforming passive learners to active learners and solving problems actively.

Design of 3D packing game embedded with 3D desktop operating system: Since 3D design was developed, each relevant field has boomed. People's demand for virtual reality increases every day. To meet such demand, desktop 3D of 3D operating system was developed. However, game design in which such operating system is used is seen seldom. The researches on 3D course educational game design with such operating system and educational practice are still blank. The introduction of 3D packing game embedded in 3D desktop operating system in Game Design course can let students give full play to space imagination. The vivid scene can let students understand teaching contents more easily. The flexibility of 3D cursor control operation increase teaching interestingness and challenges. Students can understand what game design is and how to design games through personal practice. The combination of 3D cursor control operation with educational games can promote teaching quality of Game Design furthest and enhance game design and development accomplishment.

3 Theory Construction

3.1 Educational game development theory

Educational game development theory mainly includes constructivism theory, game-based learning theory and multiple intelligence theory. Constructivism theory emphasizes teaching situation design, pays attention to students' learning subjectivity and attaches importance to feedbacks of misconceptions to knowledge structure. Game-based learning theory aims to adopt game mode for learning and develop educational game software combining education with games to promote students' learning or let students learn educational knowledge attached to the game. Multiple intelligence theory indicates that individuals own multiple kinds of intelligence, including language, space, mathematical logic, music, body kinematics, introspection, interpersonal relationship, natural exploration and existence. Thus, to develop students' intelligence in a balanced way, multiple teaching methods should be used to give full play to all kinds of intelligence. In this study, multi-dimension teaching situation was created so that students could apply 3D for learning in the interesting environment through sound, image, music, video, space and movement, construct knowledge hierarchy, teach through lively activities, overall develop intelligence and improve learning effect. The structure of educational game development theory is shown in Fig.1.

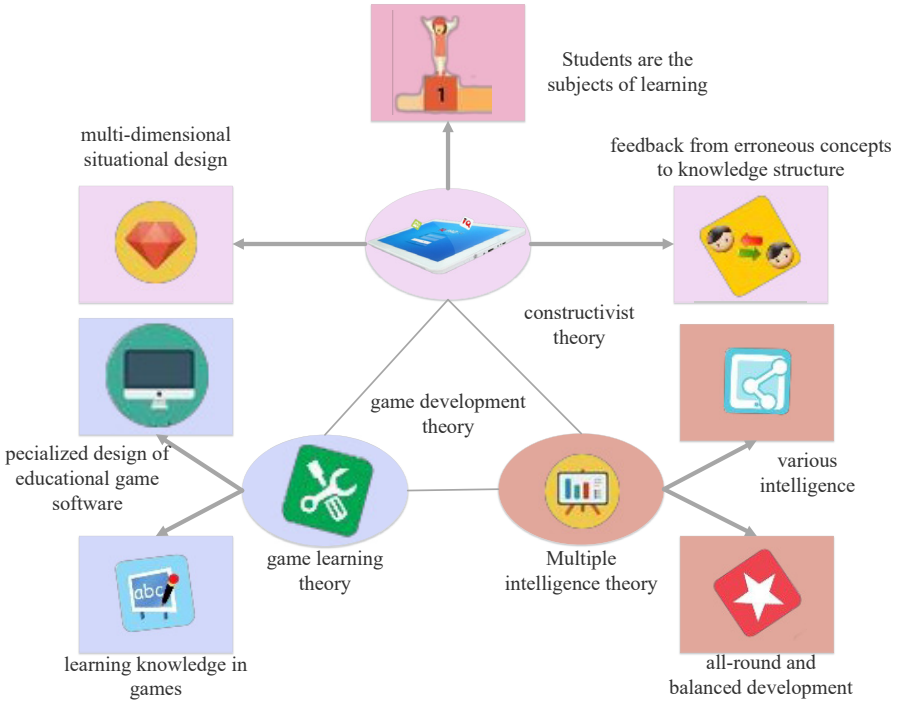

Fig. 1. Structure chart of educational game development theory

3.2 3D game design of 3D desktop operating system

The operating system of this game is 3D desktop operating system, and C++ and SDL+ OpenGL are the development tools. The main idea of the game is as follows: at first, automatically generate corresponding number of blocks according to user's level; then, horizontally move, rotate and collide blocks with 3D mouse under the observation from multiple perspectives, give play to creativity and space imagination, complete teaching tasks according to teaching requirements, and put the blocks to correct form mode until the game is over. This operating system is used to construct the scene, handle objects, render the situation, test collision and handle events for Game Design course. After students enter the game, they can choose game design knowledge points they want to understand and game design operation techniques they want to learn for analysis. Then, students can enter 3D scene for practical operation, and meanwhile solve problems in game design and development process according to the data collected and fed back. 3D game design platform of Game Design based on educational development theory is shown in Fig.2.

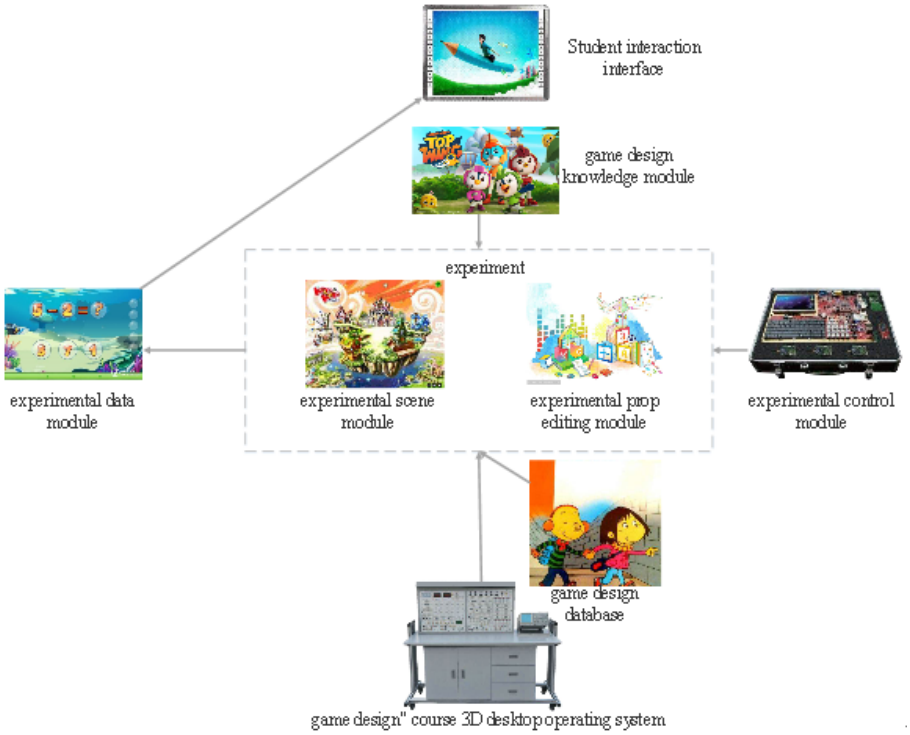

Fig. 2. 3D game design platform of Game Design based on educational development theory

The algorithms and formulas used in 3D educational game design for Game Design based on 3D desktop system mainly include the following:

Random cutting algorithm: The algorithm is used to cut blocks in game initialization. The big block is cut into small blocks. Each layer includes four blocks, and two layers are cut. The equation of tangent plane is AX+BY+CZ=0. A, B and C are normal vector of plane. Points are taken on the edge where original cut blocks and cutting surface. The plane equation formed by three points interacts with the fourth edge. If the point of intersection falls on the edge of original block, the first tangent plane forms. With the same method, the second tangent plane can be found out. The third tangent plane is cut with horizontal plane. The solving formula of plane equation is:

$$n = P_1P_2 \times P_1P_3 = \begin{pmatrix} i & j & k \\ x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \end{pmatrix} = (y_1 \times z_2 - y_2 \times z_1)i - (x_1 \times z_2 - x_2 \times z_1)j + (x_1 \times y_2 - x_2 \times y_1)k \tag{1}$$

$$dotn = P_1P_2 \times P_1P_3 = (P_2 \cdot x - P_1 \cdot x) \times (P_3 \cdot x - P_1 \cdot x) + (P_2 \cdot y - P_1 \cdot y) \times (P_3 \cdot y - P_1 \cdot y) + (P_2 \cdot z - P_1 \cdot z) \times (P_3 \cdot z - P_1 \cdot z) \tag{2}$$

$$|n| = \sqrt{(n \cdot x \times n \cdot x) + (n \cdot y \times n \cdot y) + (n \cdot z \times n \cdot z)} \tag{3}$$

The plane equation can be solved by combining Formula (1), Formula (2) and point normal vector equation:

$$\begin{aligned}&(x-x_1)(y_1-y_2)(z_1-z_3)+(x_1-x_2)(y_1-y_3)(z-z_1)+\\&(x_1-x_3)(y-y_1)(z_{1-}z_2)-(z-z_1)(y_1-y_2)(x_1-x_3)-\\&(z_1-z_2)(y_1-y_3)(x-x_1)-(z_1-z_3)(y-y_1)(x_1-x_2)=0\end{aligned} \tag{4}$$

The constant term and normal vector of plane can be solved according to Formula (4). $d=-(a\times x_1+b\times y_1+c\times z_1)$

Wherein, $a=(y_2-y_1)\times(z_3-z_1)-(z_2-z_1)\times(y_3-y_1)$

$b=(z_2-z_1)\times(x_3-x_1)-(x_2-x_1)\times(z_3-z_1)$

$c=(x_2-x_1)\times(y_3-y_1)-(y_2-y_1)\times(x_3-x_1)$

3D mouse: 3D mouse contains two parts: mouse appearance and hotspot M collected. Mouse appearance is mouse appearance, and it is used to let users know where the mouse is. The hotspot is used when the system is collecting. The class Mouse of cursor is as follows:

```
Class Mouse {
    void Draw( );// Render
        void DrawHotPoint( );// Render hotspot
       void Draw3DCursor( );// Render 3D cursor model
    public:
    void TranslateAlong(Matrix4x4 cord, Matrix4x4 T);//The function makes
    the cursor conducts T transform under the coordinate system cord;
    void TranslateAlongX(float dis);/* The function means the cursor
    horizontally shifts dis units*/ along X axis of camera under camera
    coordinate system
    ……}
```

To collect the direction of radial L during 3D mouse operation means to see the cursor direction from the perspective of camera. Longitudinal movement formula of 3D cursor is:

$$n=(pCamera.x-pMouse.x,pCamera.y-pMouse.y,pCamera.z-pMouse.z) \tag{5}$$

To judge front and rear movement of 3D cursor, such as moving pMouse2 to pMouse1, the formula is as follows:

$$v_1\cdot v_2=|v_1|\times|v_2|\times\cos(\theta) \tag{6}$$

Wherein, $v_1=pMouse1-pMouse2$; $v_2=n$

3D mouse collection utilizes OpenGL mechanism. glSelectBuffer is used to return the array of data selected. Buffer parameter is used to point to unsigned integer array to store returned data, including all objects that radial L passes through. The collection area S is positioned at cursor hotspot to make sure the cursor collects the object R. It is supposed that, the nearest point of R is p1, and the farthest point is p2. In 3D space, whether cursor hotspot M is in the collected object can be used to judge whether M is on the line P1P2. The formula is shown in (7). Wherein, buffer is depth value of M, and i is the index of object in buffer.

$$\left(buffer\left[i\times 4+1\right]\le buffer\left[1\right]\right)\&\&\left(buffer\left[1\right]\le buffer\left[i\times 4+2\right]\right) \tag{7}$$

Collision detection: Collision detection contains two parts: detect whether collision happens; calculate the position of collision. In the 3D game design, bounding box test (AABB) along coordinate axis was adopted. The bounding box can be gained through calculating the maximum and minimum of peaks of plane formed by x, y and z. Interaction test of AABB just needs to judge whether size maximums and minimums fall in x, y and z interval of another AABB. In addition, accurate detection method is used foe interaction test. First of all, it is suggested that a convex polyhedron just has N planes and the equation of each plane is:

$$Ax+By+Cz+D=0 \tag{8}$$

$$N\cdot p+D=0 \tag{9}$$

Wherein, P= (x, y, z) is a point in the plane, and N= (A, B, C) is normal vector of the plane. When Formula (9) ＞0, point P is in front of the plane and outside the object. On the contrary, point P is behind the plane. When point P is in the object, this means collision happens.

Collision treatment: If the object has collided, collision treatment is required. If peaks interact and collide, return to certain distance, and detect again; if collision still exists, return again. If the peaks do not interact and collide, detect direction vector, add one direction vector and then retreat; then, detect again until the distance reaches the set test value and there is no interaction again.

After the above operation is completed, the game designed is operated. The interface of primary game effect is shown in Fig.3.

Fig. 3. Screenshot of packing three blocks

4 Implementation of Game Design 3D Course based on Educational Game

4.1 3D teaching game mode of game design

In this study, teaching design was conducted on the basis of Game Design of software engineering major in University of Science and Technology Liaoning. Starting from educational game development theory, 3D desktop system was used as technical support to construct 3D educational game and inquiry-based learning mode for Game Design. The course content of each unit was divided into six parts: introduce multi-dimensional situation in course content, propose problems, arouse students to think, students cooperate and inquire for learning, share and exchange for in-depth understanding, experience game test effect, and freely review and consolidate after class. Firstly, the teacher used 3D educational game mode to set up multi-dimensional situations, and introduced students in teaching content of Game Design. Students prepared well for learning. Then, the teacher asked questions according to the situation, and aroused students to think. Students analyzed questions and put forward their ideas. Next, the teacher grouped students and guided them to gain answers through autonomous learning and cooperative inquiry. Later, the teacher guided students to discuss, exchange and share to deepen their understanding of questions. Then, students operated and tested 3D educational games in person. Finally, the teacher summarized and evaluated, while students reviewed and consolidated knowledge points. In the first four steps, 3D educational games as courseware resources provided corresponding situations and resources for students to help understanding. Step 5 is the main step, that is, students operate and verity learning effect. The details are shown in Fig.4.

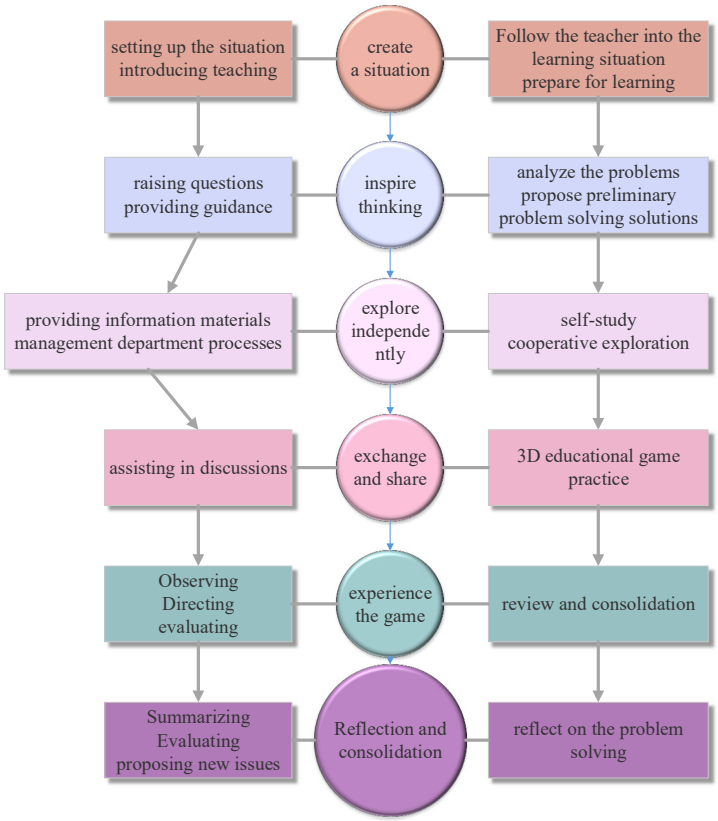

Fig. 4. Construction of 3D educational game teaching mode for Game Design

4.2 Teaching effect

In this study, two classes in the same grade were chosen for teaching experiment, and were classified into experimental class and control group. Each class had 35 students, and the teacher was same. Game design 3D teaching mode based on educational game development theory was applied for experimental class, while the previous teaching mode was used for the control group. One-semester teaching practice was conducted from March to July, 2018. Before and after the experiment, the attitude of experimental class to Game Design and test scores of experimental class and control group were investigated to analyze teaching effect of game design 3D course based on educational games development theory on Game Design course.

Questionnaire survey was conducted for experimental class and control class before and after the experiment. Frequency, percentage, mean and standard deviation were calculated for the data.

Students' attitude to Game Design course: After the experiment, the attitude of experimental class to Game Design course in which 3D educational game was introduced was investigated. The detailed results are shown in Table 2. 5-point

scoring method was applied for each question. 1 score: totally disagree; 2 scores: disagree; 3 scores: uncertain; 4 scores: agree; 5 scores: totally agree. 92.1% of students liked 3D educational games in the course. 82.5% of students would search and learn at once when encountering knowledge points they did not understand. 96.8% of students had confidence to pass all levels. 97.9% of students wanted to learn game design because of 3D educational games. Judging from the average score, the score of each item exceeded 4, and standard deviation exceeded 1, indicating the experimental class quite supported and liked 3D educational games in Game Design, with great enthusiasm.

Table 2. Attitude of experimental class to 3D educational game

Item	Proportion of agreement (%)					weighted mean	Standard deviation
	5	*4*	*3*	*2*	*1*		
I like the use of educational games in the course	68.9	23.2	7.9	0	0	4.43	0.56
Seek and learn in case of knowledge points they do not understand	22.1	60.4	6.6	10.9	0	4.01	0.67
I have confidence to pass all levels	90.5	6.3	3.2	0	0	4.69	0.44
Such mode makes me better learn game design	82.7	15.2	2.1	0	0	4.62	0.51
Average	66.1	26.3	5.0	2.7	0	4.39	0.57

Comparison of test scores before and after Game Design experiment: Before and after the experiment, score test of Game Design course was conducted for experimental class and control class. The results are shown in Table 3. Table 3 shows that, before the experiment, only 1 student in experimental class exceeded 90 scores, accounting for 2.9%. 7 students gained 80-90 scores, accounting for 20.0%. 9 students gained 70-80 scores, accounting for 25.7%. 15 students gained 60-70 scores, accounting for 42.9%. 3 students gained below 60 scores, accounting for 8.6%. In the control class, only 2 students exceeded 90 scores, accounting for 5.7%. 7 students gained 80-90 scores, accounting for 20.0%. 8 students gained 70-80 scores, accounting for 22.9%. 14 students gained 60-70 scores, accounting for 40.0%. 4 students gained below 60 scores, accounting for 11.4%. After the experiment, in the experimental class, 8 students exceeded 90 scores, accounting for 22.9%. 11 students gained 80-90 scores, accounting for 31.4%. 14 students gained 70-80 scores, accounting for 40.0%. 2 students gained 60-70 scores, accounting for 5.7%. No student gained below 60 scores. In the control class, 4 students exceeded 90 scores, accounting for 11.4%. 8 students gained 80-90 scores, accounting for 22.9%. 9 students gained 70-80 scores, accounting for 25.7%. 12 students gained 60-70 scores, accounting for 34.3%. 2 students gained below 60 scores, accounting for 5.7%. Before the experiment, the scores of experimental class and control class in Game Design course were close. But after the experiment, although the performance of both experimental class and control class rose, it was obvious that, the improvement range of experimental class was larger, far surpassing the control class.

Table 3. Comparison of Game Design results before and after the experiment

	Class	Statistical content	Above 90	80-90	70-80	60-70	Below 60
Before experiment	*Experimental class*	*No.*	1	7	9	15	3
		Percentage	2.9	20.0	25.7	42.9	8.6
	Control class	*No.*	2	7	8	4	4
		Percentage	5.7	20.0	22.9	40.0	11.4
After experiment	*Experimental class*	*No.*	8	11	14	2	0
		Percentage	22.9	31.4	40.0	5.7	0
	Control class	*No.*	4	8	9	12	2
		Percentage	11.4	22.9	25.7	34.3	5.7

5 Discussion and Conclusion

A micro-lesson is a mini-course in which learning activity support service is added on the basis of micro resources. It is a carrier of content, service, and interaction. Practice has proven that a micro-lesson teaching platform based on automatic recording technology exerts a remarkable effect on digital art teaching. The simplicity and high efficiency of micro-lessons greatly promote the development of multimedia teaching. From the technical aspect, a micro-lesson teaching platform can achieve fully automatic recording of micro-lesson videos, thus ensuring the quality of micro-lesson resources. From the theoretical aspect, a micro-lesson teaching platform achieves normative design of micro-lesson teaching. The application of micro-lesson teaching platforms in digital art teaching can facilitate the popularization of the micro-lesson teaching mode, and it plays a positive role in college teaching.

Through practice of 3D game design teaching mode based on educational game development theory in Game Design, learning state of experimental class and control class was observed in the experimental process. In combination of questionnaire survey results, it could be found that, the game suitable for Game Design course was designed by combining educational game theory and 3D desktop system, and introduced in teaching. The mode was obviously welcomed and favored by students, and could improve students' enthusiasm and learning interest of Game Design. Meanwhile, the performance of experimental class was obviously higher than that of control class. The number of excellent students in experimental class increased to 54.3% from 22.9%, and the pass rate rose to 100% from 91.4%. The number of excellent students in control class increased to 34.3% from 25.7%, and the pass rate rose to 94.3% from 88.6%. It also could be found from students' classroom state that, the enthusiasm and problem solving ability of experimental class were obviously higher than that of control class. They were more willing to preview before class and were more willing to review after class. Game design 3D course teaching mode based on educational game development theory can significantly have active influence on Game Design, promote their learning performance, enhance their game design and development attainment and facilitate cultivation of game talents meeting market demand.

Game design 3D course teaching mode based on educational game development theory integrates theory and practice, provides vivid scene, and teaches through lively activities. This mode not just can arouse students' interest, and let students experience learning joys in learning, but also can integrate knowledge learned in game design majors in Game Design through practical operation and transform textbook knowledge into students' knowledge structure. However, when this mode is used for teaching, some problems also exist. Firstly, many colleges lack teaching hardware environment. Due to the limit of educational funds, multimedia rooms of common colleges are restricted. The hardware environment required by 3D desktop system proposes a challenge to colleges. Secondly, there are short of games conforming to Game Design. The course teacher needs design according to textbooks, which invisibly increases workload and teaching difficulty for teachers. Moreover, almost no college introduces the mode in Game Design course. Thus, there is still a long way to improve this teaching mode. Meanwhile, game design and development are also conducted in Game Design course, amounting to implementation of game design in game design. Such complexity increases the difficulty of 3D educational game design. Thirdly, to introduce educational game in Game Design, teachers are required to control classroom under the teaching environment of gamification and avoid addiction to games and ignorance of learning. Meanwhile, the activity progress shall be based on students' level.

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