

The Implementation and Evaluation of a Friendly PC Game Development Tool

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Abstract

The production of the game is a combination of professional skills such as planning, art and programming. If the game designer has a basic understanding of the art and program parts, the game will have better design and team integration. The professional game engine are used in PC game production like Unity. For design students, there are difficulties in understanding the program and its logic. If the program is written as an easy-to-use interface design, the designer can focus on the design work for game design and increase the effectiveness of learning. From this idea, this study develops a friendly PC game development tool on the professional game engine Unity and evaluates the teaching effect on the students. By comparing the questionnaire survey before and after using this tool to understand the impact of this tool on students, we can see from the questionnaire analysis that no matter in professionalism, teaching methods, teaching content and teaching effectiveness all have obvious progress.

Key words: Game Design, Game making learning, Cross-domain learning

Introduction

The game development must combine a variety of professional. A game development team includes game planning, program development, art creation and game testing, etc., requires a variety of different professional skills. Game planners, also known as game designers, are responsible for the design of the game's content and game fun and form the basis for the project's book for team members to do their job. Programs and art designers produce actual games, each requiring background expertise in the fields of engineering science and humanities. Game testing is to help game debugging, and provide the development team for game fine-tuning.

Game designers need to ensure the communication of team members to promote the production of the game. Designers usually need to have the basic concepts of technology and art to facilitate the design of games and team communication. Game designers in the game development team responsible for planning, designing, and even making, is a core member of the game development team. If there is a problem with the game planning, the program and the art work will be affected; causing problems such as duplication of work, and the game may fail.

Game designers must have a basic concept of programming. Programming requires more complex concepts of abstract logic, which is not easy for design students who are familiar with image concepts to learn programs directly from the ground up. The basic concepts of programming required for game design

do not necessarily require programming skills such as informational student. Therefore, it is possible to create a conceptual basis for programming through more practical game-making learning and also to reduce the difficulty of learning by reducing abstraction to arouse students' interest in learning and to learn how to combine design, art and programming, and also understand the game production process and skills.

In order to enable students to learn with the industry, the game engine used in this study is the Unity engine commonly used in the industry. However, the use of professional game engines requires writing programs. This is a challenge for design students. Therefore, the study will use the improved version of the game development tools developed in previous studies [16] on this game engine for teaching purposes, which makes students easy to use. Since it is Self-developed tools also have a pedagogical purpose to build the student's foundation program concept.

Literature review

A. Scaffolding

Scaffolding theory is to provide a learning framework to help students learn when students begin to learn new knowledge. Teachers should play the role of supporters, just like the role of scaffolding when building a house. As the ability of students gradually increases, support is gradually reduced. And gradually shift the responsibility of learning to the students themselves. The purpose of the scaffolding theory is to train students to solve problems independently.

The concept of scaffolding theory, proposed by Wood, Bruner and Ross in 1976[1], describes the learning process by providing temporary support from teachers to help students develop initial learning skills and then gradually reduce the support as students improve on their own.. This concept is based on the learning theory of Vygotsky[2], who argues that the concept of the zone of proximal development (ZPD) exists in the ability of learners to solve problems alone and to solve problems under assistance or guidance. Temporary support (eg, scaffolding) can occur in the form of instructional strategies or tools to enable the learning process to evolve from interactive to student-owned knowledge construction in ZPD. While using computer learning environments to provide "temporary support," Kintsch[3] emphasizes that it is important to help learners complete tasks beyond their capabilities, rather than simply providing intelligence to guide or monitor learning progress.

In this study, the modular program provides students with learning support to enhance students' learning ability in game production and programming. This system is a modular program that helps students to design games with creativity.

And when the scaffolding is taken away, students can begin to develop independent learning strategies through collaborative learning.

B. Game making in teaching

The use of game making in teaching to observe the impact on learners, there are some literature in the relevant research. An [4] used qualitative analysis to study the game design of 12th grade 7 students using Gamestar Mechanic. The results show that this course aroused students' willingness to learn more about game design and programming. Baytak et al. [5] used Scratch to design educational games in the environmental science unit. Fifth-grade students designed games to teach second-year students. Students improved their game design by constantly testing and modifying their games and knowledge of science and programming. In a study by Hayes et al. [6] investigating a variety of software for game-making learning. It shows that it has positive effect for learner's computational thinking. In Robertson et al. [7], 10-year-old learners were learning how to make a game. The results showed that the game making aroused the interest of young learners in writing programs and allowed the learners to develop high-level thinking on computational thinking. The above studies were based on integrating game-making into the curricula of students, and have positive impacts on learning interest.

Simplifying game development and programming learning helps to improve game design and increase game development efficiency, both of which have been proposed by some. In order to simplify the way of game development, Kahn [8] proposed more advanced dynamic programming than visual programming in 1996, but so far it has been based on visual programming. Javier et al. [9] proposed a low-cost game development program that can develop games without high-tech skills, but not for game engines. Some studies [10] provide game developers with api or monitor programs for strategy games to help game development and learning, which enhances students' motivation to write programs. In programming learning, there are development tools to help learners to learn C programming language, object-oriented programming and algorithms, with good results [11, 12]. The above development tools are lack of teaching game design tools suitable for commercial game engine.

This study uses the improved version of the development platform designed for essay [13] in the course of game design. This platform is suitable for students to learn how to make first person game and third person game. Independent design of the system modules and components, allows game designers to flexibly use creative ingenuity. This system is used in the teaching of the course, and is assessed by questionnaire survey at the end of each course. In the study, we will compare the teaching effectiveness of using this game development system based on the results of the questionnaire survey between the system was not used and the system was used.

System structure

Simple to use and flexible to operate are the key concepts in designing this system. The system uses a simple interface design, can reduce the learning threshold of primary game design students. Modular design of the program makes the

system flexible to use, reducing the limitations of the students' creativity. At the same time, we also pay attention to the simplification of the program during system development, making it easy for the advanced game design students to understand and learn the program. After the game system of paper [13] has been improved in use, this game development system includes the following modules:

- (1) Player Life module
- (2) Player capabilities module
- (3) Weapons module
- (4) Reward module
- (5) NPC control module

Player Life module

Games can be divided into two types of games, those with characters and those without characters. In games that have characters, there are two ways to show them: a) the characters are invisible (such as the first person games) and b) the characters are visible (such as the third person games, God's perspective, etc.). In first person games, the camera is placed on the characters, thus making them invisible. Game designers don't need to design the character's appearances and movements while creating this kind of game. Relatively, while creating third person games, the designer will not only need to create the character's appearances, but also its animations, motions and camera control programs to adjust and control this type of game. Therefore, these programs will provide the parameters needed to allow game designers to adjust their programs according to their game needs.

Characters in the game will encounter various challenges and affect their life and the game's progress, the role of life control contains three ways to control the role of life: time, targets, and blood. When the character finishes his life, the result is a text screen, a picture screen, a movie, jump off or send to a specific location.

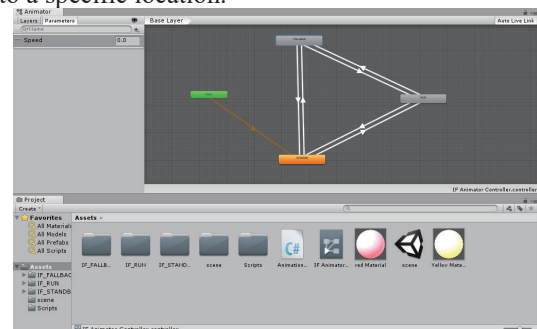


Fig. 1 The Control of Character animation

Player capabilities module

When the character encounters different conditions during the game, the game may react differently to make the game appear pleasantly surprised or challenged. The characters in the game encounter different situations and may touch the visible or invisible objects to represent the situation they encounter. The ability of the character designed in this module to touch the object can cause the object to roll, translate, rotate, hide or appear the object, and the new object appears in three modes: the absolute position appears, the relative position appears and the random position appears. In the course of the game, it is

possible to switch the lens in different positions, so a program is also provided in this system to switch the lens when the character touches a specific object.

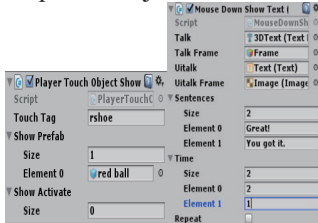


Fig. 2 The modular program of Player capabilities module

Weapons module

Combat system is to provide players and the computer or game player and other players against each other between the game behavior, the general combat system includes combat control, character manipulation, character combat action management, NPC artificial intelligence and combat special effects. Combat effects include weapon effects, sound effects, moves and magic effects, wounded effects, death effects and victories effects, etc., which can be produced by game engine or animation software effects system. In the game the effects can be issued by the program to show the game object, so this module is designed combat system mainly in the action control and weapons management part.

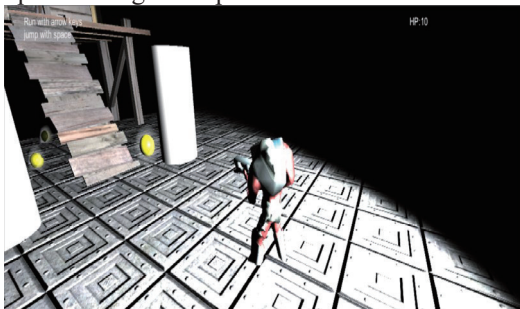


Fig. 3 The example of Weapons module

Reward module

Too easy to get rewarded will diminish its effect, so design treasure collection system will get rewards items after the player has collected enough treasure items, in addition to items, it can also be a weapon or bullet to increase the role of the attack. Reward Items can be accompanied by other functions such as programs or special effects to enhance the fun of the game. The program also provides the function of activating rewards items so that program features of the rewarded items are not limited. The system is divided into two types of treasure collection by the character touch the treasure and the mouse click to collect treasure.

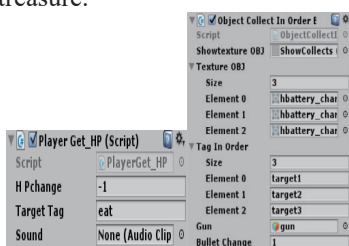


Fig. 4 The modular program of Reward module

NPC control module

Non-Player Character (NPC) refers to the non-player-controlled character in the game but controlled by the computer. How to make the NPC behave as a human being is the study of Game AI technology. Game AI technologies currently used in video games include: Group Steering, Goal-based Planning, Path Finding, Finite State Machine, and so on. The use of anthropomorphic artificial intelligence technology makes the system more complex, so the module controls the behavior of NPCs in a simple way and the program is simple and easy to learn. NPC control functions in this system include: the control of NPC random time and place appear, and control the movement of the NPC there is a straight line and curve movement, patrol, tracking the protagonist and dialogue with the protagonist, NPC weapons control and injury settings, etc. . . .



Fig. 5 The example of NPC control module

Results and conclusions

Through the study and application of the game development tool, students in the Design Department can use this system to learn game production. Students can use this system to learn the game design and production by using the prepared artwork, pictures and other related artwork. They can use their creative ideas to combine different modules to create games. The completed games include first person shooter, role playing game, word adventure game, action adventure game and platform game. The game style is composed of students' game world view and gameplay combined with their artwork.

In the course, the students learn the functions and programming of all the modules to increase the ability of making game. And the students are divided into several teams (4-6 students each team) to think about the appropriate game world view and complete game planning, then make their own games. This process allows students to understand game planning, art and program integration to enhance students' understanding and interest in game design.



Fig. 6 Student work



Fig. 7 Student work



Fig. 8 Student work

To understand the learning interest of students in game design using this system, a comparative analysis of the teaching evaluation questionnaire between traditional textbook and this system to understand the impact of using the system on teaching. The total 9 classes before using the system be lectured with textbook were compared with the total 11 classes taught by this system. Each course will carry on the teaching appraisal questionnaire survey to the class student at the end of the semester. The questionnaire consists of 15 questions divided into five parts: dedication (3 questions), teaching methods (4 questions), teaching content (3 questions), grade evaluation (3 questions) and teaching effect (2 questions), each question adopts Likert five point scale (1 point: strong disagreement; 2 points: disagreement; 3 points: no comment; 4 points: agreement; 5 points: strong agreement) to assess students' subjective knowledge of the curriculum. The questionnaire results and analysis are shown in Table 1 below.

TABLE 1
 Statistical analysis results of the Questionnaire Survey Responses

	Textbook(n=9)		This tool(n=11)		t
	Average	SD	Average	SD	
Dedication	3.84	0.19	4.02	0.16	2.34
Teaching Method	3.81	0.17	3.99	0.15	2.44
Teaching Content	3.78	0.16	4.04	0.15	3.71
Teaching Effect	3.77	0.16	4.09	0.17	4.31
Overall	3.80	0.16	4.04	0.15	3.31
df=18 p<0.05					

This questionnaire is designed to understand the effectiveness of teaching. From the overall results of the questionnaire assessment, it can be shown that this teaching material has a significant effect on arousing students' interest in learning. The results of the questionnaire assessment that taught by textbook (average = 3.80, standard deviation = 0.165) and the scores taught by using this tool (average = 4.04, standard deviation = 0.150) were compared and the t test value was 3.31, we can see that the progress of the assessment score

has reached a significant level.

If we look at the sub-items of the questionnaire, we can see that the progress of the appraisal results has reached a significant level, regardless of the dedication of teachers, the teaching methods of teachers, the content of teaching materials, the way of assessing performance and the teaching effect of courses. The progress rate of the evaluation items (teaching contents, teaching effects) related to teaching materials shows obvious effects. In terms of professional dedication and teaching methods, although the teaching is conducted by the same teacher, the improvement rate is lower.

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