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Multi-modal Teaching Ecosystem Design for Computer Graphic Course

Xiaochun Zhang [1, *], Xiaopeng Xu [2]

[1] Department of Computer Science and Technology, Anhui University of Finance & Economics, Bengbu, Anhui 233000, China

[2] Department of Electronic Information, Anhui University of Finance & Economics, Bengbu, Anhui 233000, China

[*] **Corresponding author**: Xiaochun Zhang (Email: xiaochun.zhang@aufe.edu.cn)

Abstract: In the context of ecosystem sustainability and high-quality development of education, this paper explores a multi-model teaching ecosystem for the curriculum of Computer Graphics. In this study, the technological concepts of multi-model fusion, transfer learning are transferred to the design of computer graphics course. The proposed ecological course framework consisted of 1) multi-modal curricular practical training platforms; 2) multi-modal knowledge bases; 3) multi-modal hybrid teaching mode. Furthermore, the practical application cases of the industry are taken into account to solve the problems of disconnection between teaching and practice. The teaching effect shows that multi-model based teaching ecosystem have improved students' academic achievement and learning satisfaction.

Keywords: Multi-modal; Teaching Ecosystem; Multi-modal Hybrid Teaching Mode; Computer Graphics.

1. Introduction

Computer graphics is important professional course that studies how to use computer generation, processing, and display graphics principles and technologies. With the rapid development of computer technology, computer graphics is becoming more and more widely used in various fields. However, the traditional teaching methods of computer graphics have gradually exposed some problems, such as (1) the teaching content is too theoretical and lacks practical links, (2) the online and offline teaching resources and teaching practice platforms are many and scattered, and (3) the personalized development and expansion content of teaching materials is too little. Therefore, the teaching reform of computer graphics course has become an urgent problem to be solved in the development of engineering curriculum reform in our university, and this paper will discuss the teaching reform of computer graphics course, and put forward a multi-model teaching ecosystem for the curriculum of computer graphics.

New technologies such as transfer learning, big data, and multi modal are in a very important position in the current new economic environment. Intelligent technology plays an increasingly important role in the adjustment of the country's industrial structure and industrial upgrading, and we need to have high-end technical talents to fully enter the intelligent era. Cultivating students' patriotic feelings, innovative spirit, and practical ability, and teaching reform with the goal of serving the high-quality development of education are also the main contents of higher education curriculum research and reform.

In order to improve the programming practice ability of computer science students, many educators have proposed a step-by-step programming ability training model with different levels, and carried out a series of teaching method reforms with the goal of improving programming ability by constructing a curriculum system covering different ability levels[1,2]. Xiao Min et al. promoted the cultivation of students' programming ability by optimizing and improving the teaching hardware environment and classroom teaching mode [3]. S.T. Zhang et al. carried out the reform of teaching methods and teaching methods for the purpose of mobilizing students' enthusiasm and initiative in learning program design [4, 5]. Y.Q. Zhang proposed the necessity of teaching reform of C programming courses for non-computer majors [6]. Y.J.Yang et al. proposed a C language teaching reform with the goal of cultivating students' application and innovation ability, and achieved certain teaching results [7]. According to the needs of new engineering talents, X.W. Bi et al. carried out the teaching reform of programming language courses based on the characteristics of blended teaching [8].

According to the current teaching status of computer graphics courses, J.M. Liu et al. constructed a three-level blended teaching model based on knowledge, ability, and quality, as well as a diversified assessment mechanism that focuses on both knowledge and ability, and achieved good teaching results[9]. L. Wan et al. started with the application of industrial graphics, allowing students to describe phenomena, explain phenomena through learning theoretical knowledge, and then verify and gain experience in practice, and finally transform into knowledge, which stimulated students' interest in learning and cultivated students' practical ability and innovative spirit [10]. Y. Tang and other scholars have reformed the practical content of graphics, so that students' practical graphics ability can match the development of graphics technology in the industry [11]. J.Z. Xia et al. organically combined the cultivation of programming ability with the construction of computer graphics courses [12]. In [13], through the study of practical teaching and micro-courses, the teaching content of computer graphics was reconstructed, and the teaching mode of case plus micro-course was implemented, and good teaching results were obtained, and in [14-16], with the goal of cultivating students' computational thinking and innovative spirit, some teaching explorations were carried out on the computer graphics course, which effectively improved the teaching effect of the computer graphics course.

Based on the above literature review and analysis of the

current situation, it can be seen that many achievements have been made in the teaching research of computer science courses in colleges and universities, but these research results do not fully analyze the students' knowledge structure and learning data, and lack of teaching strategies based on students' individualization [17,18]. In the process of teaching and teaching material design, there are few elements of moral education [19, 20]

In order to respond to the high-quality development of education, adhere to the principle of cultivating people with virtue, and better promote the "new engineering" construction strategy of our university, it is necessary to carry out a comprehensive and systematic teaching reform of the existing computer graphics courses. Therefore, the research of this topic is not only of great practical significance for the improvement of students' practical ability of graphic programming, but also has important theoretical significance for the study of the realization of high-quality talent training in universities.

2. Multi-modal Teaching Ecosystem

Drawing on the latest research results of multi-modal technology in the field of artificial intelligence, this study takes the high-quality development of teaching as the guiding ideology, and builds a computer graphics course ecosystem composed of a multi-modal curricular practical training platform, a multi-modal knowledge base and a multi-modal teaching mode, as shown in Figure 1.

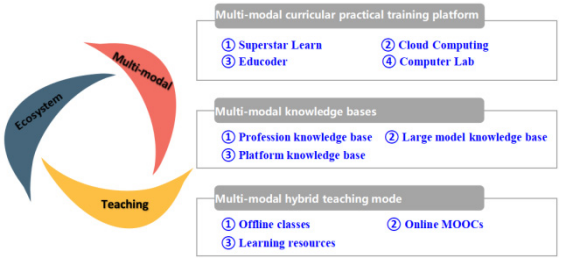

Figure 1. Multi-modal teaching ecosystem

2.1. Multi-modal curricular practical training platform

As shown in Figure 2, the proposed multi-modal curricular practical training platform provide four channels, includes Superstar Learn, Cloud Computing, Educoder and Computer Lab. Each of them is equipped with an experimental environment for implementing various computer graphics algorithms in OpenGL with C++.

Figure 2. Multi-modal curricular practical training platform

2.2. Multi-modal knowledge base

Multi-modal knowledge base in computer graphics course means various teaching concepts using multiple modes. In order to decreasing the amount of students' time spent searching for information about this course or any other related subject, a well-organized, multi model knowledge base were created, as shown in Figure 3.

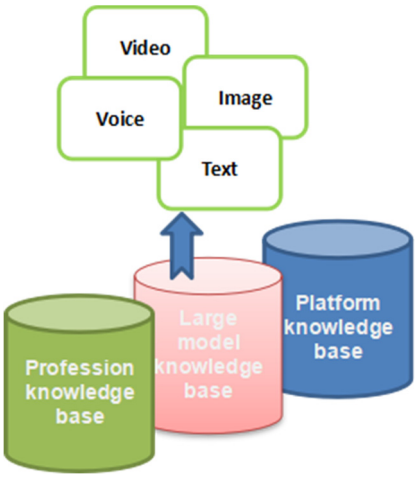

Figure 3. Multi-modal knowledge base

2.3. Multi-modal teaching mode

The proposed multi-modal teaching mode, as shown in Figure 4, combines pre-class self-study with in-class interactive discussions. Students outside the classroom learn new knowledge through video, text materials or other course resources, and collect study questions. Offline classroom teaching activities are transformed into teacher-student discussion of the problem.

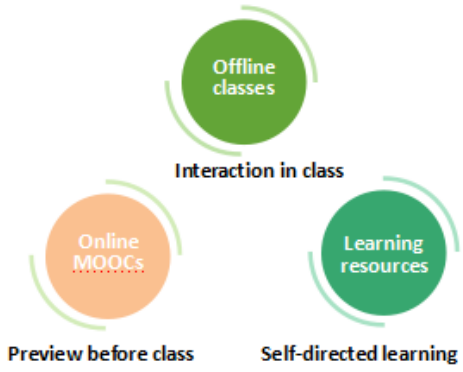

Figure 4. Multi-modal teaching mode

3. Conclusion

The human brain has the ability of multi-modal perception and information integration, and the teaching ecosystem of computer graphics course is divided into multi-modal practical training platforms, knowledge bases, and teaching modes, which can enhance the sensory impact, and help cultivate students' divergent thinking ability. In addition, the curriculum ecosystem helps students better understand and master the content of knowledge points and improve the learning effect.

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