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Application and exploration of game-based teaching in vocational education in port machinery courses

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ABSTRACT

Applying Ausubel's motivation theory for analyzing the student's learning drive in port machinery courses in the learning process. By analyzing their needs and external promotion, the game-based teaching is successfully applied in port machinery courses for using virtual simulation training platform game. Finally, the operability and usability of this new teaching methods is verified by comparing experiment and business research. This research starts the point from vocational educational reform in port industry, enters the point from cultivating modern port operation and maintenance talents and verifies the application of vocational game teaching model in port industry.

KEYWORDS

Game-based teaching; Vocational education; Motivation theory; Virtual reality; Port machinery.



INTRODUCTION

As a stronger developing industry with the economic globalization, port industry has become more and more influential to national economic development^[1]. At the same time, accelerating to cultivate high-qualified port shipping talents has been the key of our country's strategic development. In order to achieve these objectives, it is necessary to continuously improve the level of vocational education related to port area. The vocational education differs from the common education, the former focuses on cultivating the practical skills and working abilities^[2]. In order to adapt the different competitiveness of various occupations in society, the vocational-educates are supposed to do massive trainings to enhance the vocational abilities and skills, which can quickly satisfy the needs of occupations. In vocational education, because port machinery courses include complex theoretical knowledge about mechanical principles, mechanical structure and mechanics of materials, and need to use a variety of large-scale port machinery for training equipment, teachers are often difficult to guide students to participate in the class and interact with teachers or classmates^[3-5]. Meanwhile, it is also difficult to obtain real port machinery as training equipment. Therefore, it is necessary to find a teaching method and teaching tool to provide effective guidance for the courses about port machinery.

Randall Tania^[6] built a simulation environment for port security experimentation and training, the environment include operation center, boats, vessels and other equipment. Mendonça David^[7] designed gaming simulations for training new organizations, individuals, and public officials for responding to emergency and give some suggestions on how to improve the benefit of gaming simulations for training and operations. Jaligama Vikramaditya^[8] proposed a novel online virtual learning classroom environment focused for higher education. Students can submerge in virtual world and learn the course of 3D Graphics Programming. The research above is the application of virtual reality technology to simulate particular environment or emergency situations, but none mention its application on port machinery courses. Therefore, this article is intended to fill gaps in the field on the application.

REALIZATION OF GAME-BASED TEACHING ON PORT EQUIPMENT

In order to realize the goal of game teaching and introduce this teaching model to the real class, our university serve port electromechanical major as a pilot. Aiming to the vocational trends of port operations and repair and maintenance, the simulation training platform for port remote controls should be introduced.

This platform is based on virtual reality technology, most port equipment in the port areas integrated in different virtual port scenes. They could be chose flexibly according to the needs of teaching. Every movement of organization of different types of port equipment, organizations and other virtual objects (container, bulk load, freight car and so on) can be controlled according to actual situations. Supported by the powerful physical engine, all the movement are real interactively. Students can use the variety of interactive equipment provided by the platform to realize the communication with virtual port equipment.

Except for training students to remote control the port equipment, this platform can set the faults of virtual electro machines. Students can analyze comprehensively the displayed faults and are trained skills to repair and maintenance and fault removal. This platform follows the new tendency—gradually converts to remote control of equipment in the port industry in the future. It acquires great foresight and practical values.

As Figure 1 shows, while students drive container cranes on the bank, they operate inappropriately and overturn the containers. The figure illustrates that this simulation training platform for port remote controls is closed to the real situation. Its utility is valuable to spread widely.

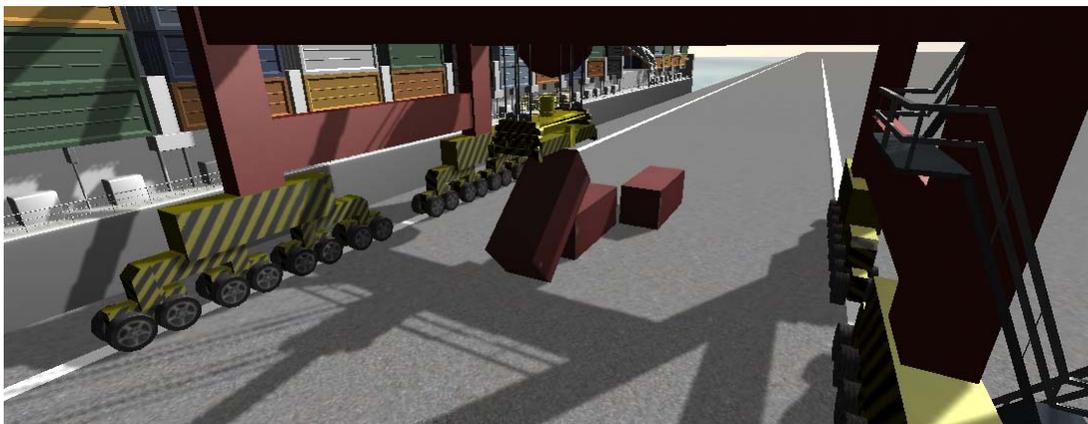


Figure 1 : The inappropriate operation led to containers overturn

THE APPLIED PRACTICE OF VOCATIONAL GAME-BASED TEACHING IN PORT INDUSTRY

Psychologist Ausubel proposed that in the learning process the driving factors of learners include cognitive drive, self-enhancement drive and affiliated drive^[9-11]. Cognitive drive is subjective need that the learner eager to acquire

knowledge and solve problem, and is learners' intrinsic motivation. This can be reflected teaching goals or teaching tasks in the game-based teaching of port machinery courses. According to the teacher's demonstration and guidance, the students acquire knowledge and skills positively. Self-enhancement drive is an external drive, and result from learners for obtaining rewards or self-esteem. Therefore, students can be teamed up to complete the task of teaching, feel their own value, get the glory and self-esteem. Meanwhile, after completing the task given successfully, they should be given certain incentives. Affiliated drive is to get praise and recognition, so in the Late stage of whole teaching process, all participants should have positive feedback for maximizing driving force. According to the standards of pre-service training by port industry companies, in combined with port equipment remote control platform, firstly improve the training course of port operation and maintenance by gaming methods.

According to Figure 2, the links of game teaching are divided into five stages, scene creation, scene roaming, game demonstration, personal/accompanied training task, task evaluation, award and punishment. Every stage has a related measure. Therefore, this research takes electromechanically major students who will soon graduate as the research object. After improving and applying for a long time the teaching theory, the companies which students working in were surveyed and the outcomes presented in the following histogram were obtained.

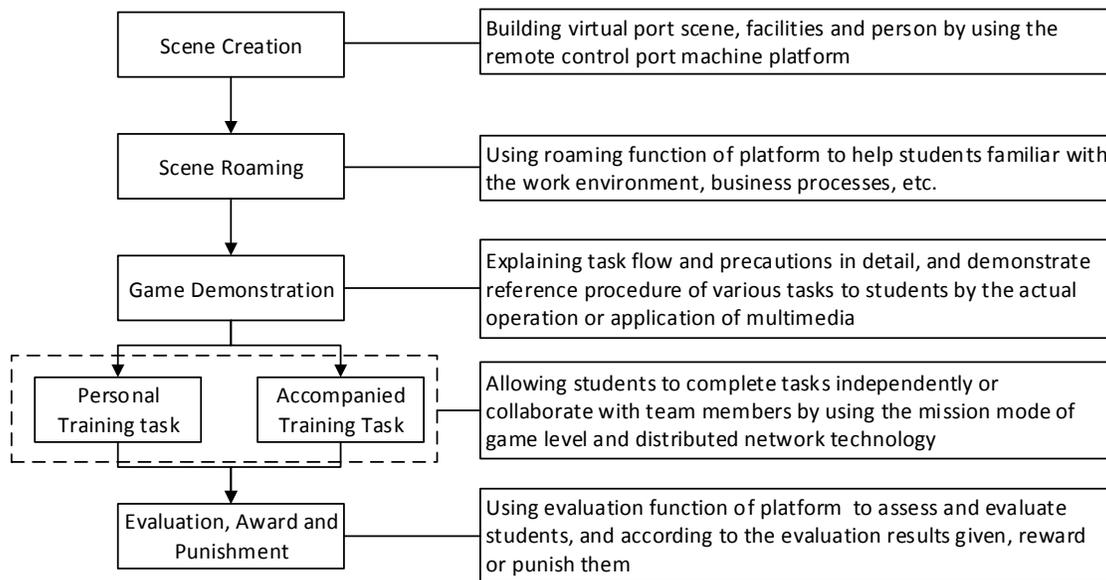


Figure 2 : The game-based teaching links of port operation and maintenance

The Figure 3 reflects the comparisons on total number of on-boarding training class hours (one class hour equals to 45 minutes) in four types of mainly vocational skills, between using traditional teaching and using game teaching students. The figure illustrates that the number of class hours using the traditional teaching methods on electromechanical major students reached 292. In contrast, after improving teaching methods, the number of class hours using game teaching on those students dropped by 194 in on-boarding training, an decrease of 98 class hours and 33.56 percent. It has dramatically shortened the time hours of on- boarding training. Students can enter the posts as soon as possible. The training cost of government will be saved. The efficiency of companies will be enhanced.

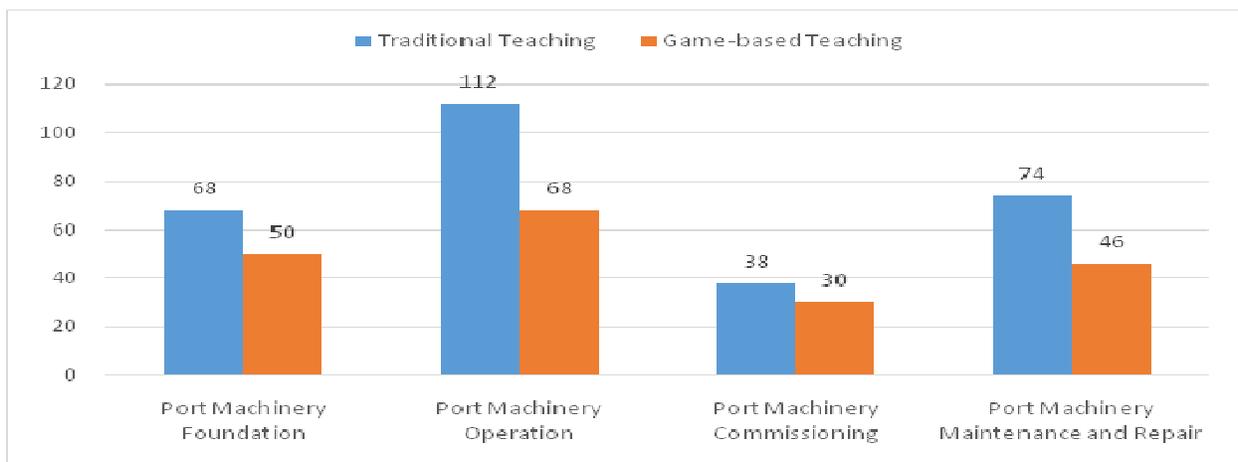


Figure 3 : Class hour statistics of on boarding training course of port machinery operation and maintenance

CONCLUSION

This article integrates Ausubel's motivation theory with the game-based teaching process of port machinery course. According to the application of virtual simulation platform, the process of game-based teaching service to the courses. In this teaching process, the self-awareness and competition consciousness of students have been fully reflected. Students can acquire the nearly real cognition and experience in virtual enterprising circumstances and vocational posts. They can also develop own creativity and imagination limitlessly to try all kinds of strategies to accomplish assigned tasks in cooperation with other team members. At the same time, due to the introduced game elements, the links of teaching have no longer been a repeated process and are becoming more interesting, which is the important educational development tendency as well.

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