

The Developing of a Web based 3D/VR Stretching Learning System for the Office Worker

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Abstract. The constantly evolving technology brings convenience and prosperity into people's life. Many intensive-labor jobs are replaced nowadays with the invention of machines. Although technology helped people in many aspects, it changes our working model to become more sedentary. Especially to those who work in front of the computer, occupational injuries due to long hours of sitting have endangered their health. The goal of this study is to develop a stretching learning system based on online 3D/VR technology. The author used the Vicon 624 Motion capture system to capture stretch motion data and designed the interactive program in Virtools educational software. The expert and user evaluation methods were used throughout the developmental stages of the system. The results indicated that the system have and practicability, and also being conducive to users in learning proper stretching exercises.

Keywords: 3D/VR, Stretching, E-Learning

1. Introduction

1.1. Background

The advance of technology has been changing people's working style, from laborious to sedentary. The strenuous works people are used to do are replaced with machines. Merely a call can bring foods, merely a click can send mail, and merely a drive can take people wherever they would like to be. But the price people pay for convenience is their health. According to the study done by Institute of Occupational Safety and Health (2005), those who belong to the sedentary working style are those who often suffer the muscular problems, such as neck pain, shoulder pain, or low back pain. Moreover, twenty-four percent of computer-related workers are often influenced by these muscular problems. To prevent workers from muscular injuries, in addition to periodically taking a break during their working, doing stretch exercise is very important as well.

With maturity and popularity of evolving technology, people gradually accept distance education as a channel of acquisition of knowledge. Chen (1999) indicates that the application of the internet and multimedia on teaching not only provides diverse learning materials, but also satisfies learners' personalized needs and promote their autonomic learning styles. In physical education, Chen (1994) points out that the advantages of using multimedia to teach motor learning include accurate demonstration, visual or verbal aids, and repetitive observation.

Many physical educators use movies as an instructional tool to demonstrate skills. Through slow motion or verbal and visual cueing, students can focus more on the target movement. Although the authenticity of movies is able to transmit the accurate content, lack of viewing perspectives prohibits learners from observing motions from different angles, which is an essential factor in acquisition of motor skills (Knudson & Morrison, 2002). Especially, vision is the most dominant sense while learning (Knudson & Morrison, 2002). Indeed, it is possible by offering movies from different angles, but providing movies which support diverse-angle may consume too much bandwidth of the internet. Thus, the best strategy is 3D/VR.

3D/VR (Three Dimension/ Virtual Reality) is real-time 3D animation. It not only emphasizes on the combination of images, movies, sounds, and animation, but also provides programming techniques, which allows the designer to build interactivity between users and content, such as walking around in the 3D environment and simulating the scenario when one opens the door or operate the machine. Compared with images-based learning context, 3D environment is more authentic and offers a more direct perception. In addition, 3D/VR can offer more interactivity, such as allowing users to navigate the 3D environment, or touching any objects as real as it occurs in the real life. Based on the advantages of 3D/VR and the emergent needs to solve office workers' occupational illness, the purpose of this study is to combine distance

education with 3D/VR technique for developing an online stretch learning system. Under the evaluation of specialists and users, the results can be used as the reference for future studies.

1.2. Limitation

The purpose of this study is to design an online stretch learning system for instructing office workers to perform stretch. Due to the uncertainty of learners' physical condition, the subjects are those who claim their healthy condition in good shape and without any serious disease. Most of them are working in the office, which belong to static working style. Moreover, stretch movements can be divided into two categories: dynamic and static. Numerous studies have done to prove that dynamic stretch is easy to cause injury. Concerning about this issue, the movements in this online stretch learning system are static.

2. Methodology

The researchers sent the hyperlink of the online 3D/VR stretch learning system to 150 potential subjects by e-mail, but only 55 people visited the website and finished the online survey. These subjects were 32 females and 23 males, including 4 fitness specialists, 4 physical therapists, 4 instructional designers, 42 sedentary workers who are the staff in the university, the elementary school, and a computer company. The survey consists of 37 questions using 5 points Likert scales, Very dissatisfied, dissatisfied, neutral, satisfied, and very satisfied. The last question in the survey is open-ended, allowing subjects to provide any suggestions to this system.

3. Results and Discussion

3.1. The outcome of system design

This online stretch learning system mainly consist of six options allowing user to choose while entering the main page of the system, including Introduction, Common muscular problems for office workers, Installation for safe working environment, Knowledge about stretch, 3D/VR stretch demonstration, and discussion board. These functions are further described as the following:

3.2.1 Introduction

This function is to notify users that this online stretch learning system is unable to serve as medication. What the requirement of hardware and software should be in order to run the system.

3.2.2 Common muscular problems for office workers

This section introduces for common muscular problems the office workers often have; there are low back pain, shoulder and neck pain symptom, and carpal tunnel syndrome, Tennis Elbow (Lateral Epicondylitis). User can click the hyperlinks provided and directly go to stretch demonstration.

3.2.3 Installation for safe working environment

Inappropriate posture and working environmental setting are one of reasons causing muscular pain. This section offers relevant information to instruct users how to improve their posture and setup a safe working environment.

3.2.4 Information about stretch

This section provides information about the function, category, and physiology of stretch for the users who would like to know more about stretch.

3.2.5 3D/VR stretch demonstration

- Interface: the layout of the interface can be seen below. (Fig. 1:)



Fig. 1: Interface

- Motion menu: Clicking of the menu button, the panel will pop out, allowing users to choose the motions they would like to perform.

- Perspective control: Clicking on the directional keys on the keyboard allows users to control the rotation of the viewpoint; clicking on the Page up and Page down button allows them to zoom in and zoom out.

3.2.7 Discussion board

The section allows users to post the feedback.

3.2. Discussion

The results of this study showed that 83% of subjects agreed that this system is able to arouse their learning interest. The advantages of 3D/VR, interactivity and authenticity, can arise learners' interest. The same results can also be found in the past studies. In the study of the impact of incorporating sports website into the physical education class in high school, Jung (2003) found that the female students' interest and motivation were improved after the integration of the sports website into the class. Ho (2000) showed that the application of multimedia was able to attract students' attention and interest while learning the overhand serve in volleyball. Thus, these literatures all indicated that the application of the multimedia can not only increase learners' motivation, but also diversify their learning experiences, which is compatible with the results of this study.

Seventy percents of the subjects showed satisfaction in using this system and they indicated that this system is able to help them learn stretch. The same results can be found in the past studies. Carr (2002) pointed out that the effectiveness of the group using 3D/VR was better than the traditional instruction group in the elementary physical education class. Chu (2001) emphasized that the application of 3D/VR was able to improve the students' learning in martial art. Chen (2003) stated that the integration of 3D/VR into the physical education had the positive effect on helping children acquire motor skills. The literature above all proves that the technique of 3D/VR is a potential tool on developing motor learning program for office workers.

The results of survey indicated that in the layout section 38% of subjects chose neutral or disagree to the question, "the text information is appropriate." In the stretch demonstration section, 36% of subjects chose neutral or disagree to the question, "The online stretch learning system offers thorough functions." In the interface section, 29% of subjects chose neutral or disagree to the question, "The design of the menu panel is convenient for users."

4. Conclusion

The purpose of this study is to adopt 3D/VR technique for developing an online stretch learning system. The results of the survey showing disagreement with the interface and content are due to two reasons. First, the system does not provide thorough information for users; under the limited timeframe, it is difficult for the researchers to design a complete system, even though the researchers have done the needs analysis and users and specialist evaluation.

Second, in order to run 3D/VR demonstration adequately, the standard of users' computers should at least meet the minimum of the requirement. But, the survey did not collect the information from the users; there is no way to know whether users are running the content properly, which may influence their satisfaction. In addition, users' experiences in using computers also have the impact (citation), but they were not collected as well.

The future studies can solve these problems by increasing subjects and interviewing more users and specialists to comprehend their needs. Besides, the application of database can be put into the consideration for the future studies. With database the researchers are able to track users' learning activity and develop a more customized system.

5. Reference

- [1] Carr, M. A. G. (2002). Computer-assisted instruction in elementary physical education. Unpublished doctoral dissertation, Middle Tennessee State University, Murfreesboro, Tennessee.
- [2] Chu, F. C. (2001). *The Study of a Web-Based Computer-Assisted 3D/VR Learning Material-for the Chinese Martial Art of Zhong Yi Quan*. Unpublished master's thesis, National College Of Physical Education And Sports Taiwan Republic Of China, Taoyuan, Taiwan.
- [3] Chen, W. C.(1994). The application of Multi-media technology in physical education teaching .National Sports

Quarterly, 23,103-109.

- [4] Chen, M. P. (1999). A study on computer-assisted programming learning through the Web. In Huang, S. Y. (Chair), *Toward new century of network*. TANET'99. National Sun Yat-sen University.
- [5] Chen, C. R. (2003). *The Development of a Web-Based 3D/VR Movement Learning System for Children*. Unpublished master's thesis, National College Of Physical Education And Sports Taiwan Republic Of China, Taoyuan, Taiwan.
- [6] Ho, J. L. (2000). *The Study of Multimedia CAI Volleyball Overhand Serve Teaching System*. Unpublished master's thesis, National College Of Physical Education And Sports Taiwan Republic Of China, Taoyuan, Taiwan.
- [7] Institute of Occupational Safety and Health. (2005). How can do computermans' shoulder neck pain? Retrieved February 10, 2006, from <http://www.iosh.gov.tw/data/f5/news941007.htm>
- [8] Jung, T. K. (2003). Effects of Exercise Homepage Intervention on the Physical Ftness and the Exercise Status of Female senior High School Students. Unpublished master's thesis, National Taiwan Normal University, Taipei, Taiwan.
- [9] Knudson, D. V., & Morrison, C. S. (2002). *Qualitative Analysis of Human Movement*. Human Kinetic: New York.