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A Preliminary Study on the Learning Satisfaction and Effectiveness of VR Weight Training Assisting Learning System for Beginners

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ABSTRACT

In 2016, with the widespread use of the somatosensory technology, the improvement of virtual reality and the head-mounted monitors, a lot of research and innovation emerged. The VR head-mounted monitors aren't used at fixed places. Learning by using the First Person perspective to execute the games, learners can escape the limit of monitors. Beginners will reduce the willingness to learn due to incorrect movements, operating the devices without coaches, and unable to observe oneself simultaneously. This study is based on experiential VR device, using Virtual coach and expanding mirror for auxiliary teaching and observing self-training process. Experimental observation method and questionnaire survey are applied to test. The test subjects are 53 boys and girls aged 18 to 25 years old who haven't had contact with gym equipment. The study shows that 70 percent of the subjects hold a positive recognition towards the system operation and they can force on the correct position. The satisfaction is affected due to not being familiar with the way the game is operated for some learners. In the open questionnaire, learners mention that weight training materials provide them with the opportunity to view and correct their body movements and also raise learner's fitness will.

Keywords: weight training, virtual reality, experiential learning, somatosensory technology

INTRODUCTION

Due to the rise of computer animation and virtual reality, 3D movies and somatosensory games are gradually becoming universal. The intelligence of home technology became popular and virtual reality headset device allowed people to interact in 360 virtual spaces. Many companies have E-learning for related skills and training models that have also been launched.

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State of the literature

- Beginners will reduce the willingness to learn due to incorrect movements operating the devices without coaches, and unable to observe oneself simultaneously.
- Virtual reality combined with the movement can show good results and response.
- Learners can learn the concepts and methods of fitness through learning procedures. Through The actual experience to observe and imitate the fitness action to achieve learning outcomes.

Contribution of this paper to the literature

- The most concrete result of this study is to construct VR weight training assistant teaching system.
- The researcher found from the satisfaction questionnaire and semi-structured interview that the most of the learners are well reflected in the system.
- Technology blend into life has become a trend. We can use this way to break the space and time constraints, also get exercise effects and reduce sports injuries.

Because the western trend of fitness as well as the raise of awareness about health, weight training becomes one of the hottest selections of sports in recent years. Most beginners are afraid to ask the coach or they read the equipment icon to operate by themselves the first time. And then they manipulate the sports equipment incorrectly and receive sports injury and reduce their training will. This is one of the motives of my research.

According to what mentioned above, gyms still use traditional equipment to do the training nowadays. They rarely combine the application of technology. Besides, there are plenty of pictures, articles and films online. Beginners face the variety of information and without the guidance of professional coach; they take the risks of experiencing actions and accuracy. The development of the somatosensory technology, relevant sport games and auxiliary teaching system finally emerged. Experiencing and learning through virtual equipment, beginners can reduce unnecessary sports injuries as well as raise the will to exercise. Most important of all, they can become skilled by practicing continuously (Yun-Her Hong, Wu-Zhou Chen & Hsiang-Wei Hung, 2015). Thus this research hopes to construct Digital Assisted Instruction System by using VR equipment. Beginners can use this system to practice their actions and to modify their actions as an auxiliary device. The system will be used as one of the auxiliary tools for fitness coach. The following are the purpose of this research:

1. Analyze the feasibility and acceptance of VR glasses combined with weight training in interactive operation learning.
2. Explore satisfaction & effectiveness of beginners in the "VR weight training Assisting Learning System."
3. Provide beginners to correct the wrong posture and train the correct action, and explore the problems arising in the process.
4. Provide reference information for relating weight training and auxiliary teaching in the future

LITERATURE

Weight Training

Weight training is one of the physical training ways that can enhance muscle strength effectively. Muller and Hettinger, two German physiologists, conducted experiments about weight training principles in 1925, and they proved that the enhancement of muscle is proportional to the strength of stimulation, and it had nothing to do with the amount of exercise. According to Hettinger's research in 1961, if the muscle training is done by the max stimulation, the muscle effect will last for one week, and then it will decline to the original state in two weeks (Hettinger R, 1961). Though the short-term training effect is good, the gained effect will vanish fast once you stop

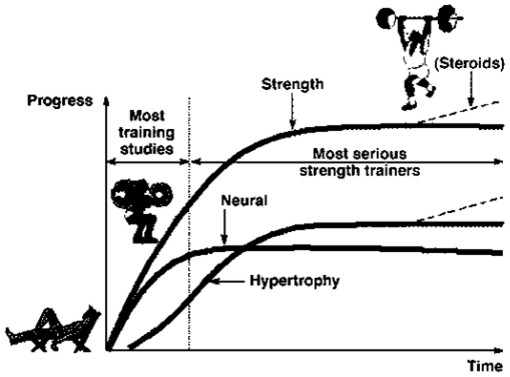

Figure 1. Weight training course frequency and length of time (From Weight training)

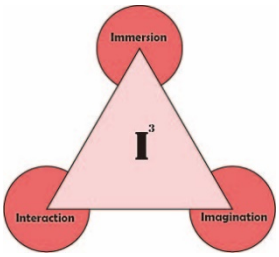

Figure 2. Three elements of virtual reality

training. So the regular habit of weight training can maintain a certain muscle mass and slow down the disappearance of muscle strength (**Figure 1**).

Virtual Reality and Related Research Applications

The application of Virtual Reality and relevant research Virtual Reality is also called VR. In 1935, Stanley G. Weinbaum, an American novelist, mentioned the glasses that can see the VR world in his novel. This is seen as the prototype of the VR development. The development of the relevant technology is also widely applied in academic research. In 1992, in the formal research papers "From Tool to amplify the mind" (Hamilton, J., Smith, E. T., McWilliams, G., Schwartz, E. I., & Carey, J., 1992), the initial research objective is set on medical engineering and educational engineering. In 1993, IEEE formally organized teams that research VR to seminar, extending VR technology to academic development. Thus, the connotation of VR includes three fields (**Figure 2**): Imagination Interaction and Immersion (Burdea G., 1993).

There are many examples applying VR technology to different fields domestic and abroad. In 2012, XBOX 360 released a video game-Nike+ Kinect Training, combining physical fitness and somatosensory. The game provides different training programs based on each player (**Figure 3**). In 2016, Yao-Hsien, Huang, an assistant professor at Department of Information Technology and Management in Shih Chien University, developed "VR Fitness Coach" that is based on somatosensory and immediate skeleton detection. It also combines ITRI's (Industrial Technology Research Institute) Foot Center of Gravity Pressure Sensor and develops the system. Players can experience the movements of squatting by VR equipment and modify the gestures as well as prevent sports injuries (**Figure 4**).

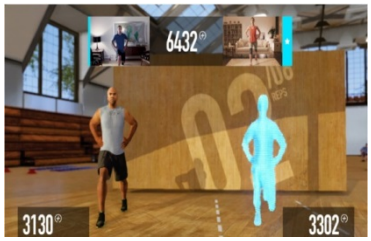

Figure 3. Nike+ Kinect Training (Retrieved from the X BOX360 sports game)

Figure 4. VR Virtual fitness coach (Retrieved from Apple Daily)

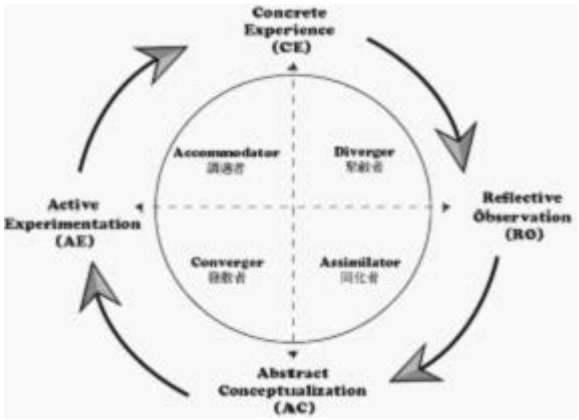

Figure 5. Kolb Experience Learning Cycle Diagram (Kolb, 1974)

Experiential Learning and Theory

Scholars from domestic and abroad mentioned the importance and continuity of the four stages of experiential learning cycle. The experience each stage will affect future experience activities. (**Figure 5**) Each stage is not a single cycle. It varies through the activities between people's interaction, including peers, learners themselves and instructors. Learners seek motivations from observation and imitation in the beginning. The clearer the goal is, the more the learning motivation can be enhanced. Hofer (2006) mentions that when the instructor provides an effective incentive strategy, positive learning affects learners' learning motivation. Learners will be more satisfied about course activity process, and thus learning outcomes will be improved.

In addition, experiential learning provides learners with related experiences. When entering the theme activity context, learning transfer is achieved by reflecting-what, generalizing and abstracting-so what. The goal is

achieved through the continuous learning cycle to develop. Experience transfer is the core of experiential learning. The goal can be achieved through learning procedures, learning roles, learning behavior and reflection feedback (Ving-Gi, He, 2001):

1. Learning procedures-- Understand the subject and purpose of the event. Through the activity process one can absorb knowledge theory, experience and practical implement of the technology.
2. Learning role-- Learning is achieved mainly by observation and imitation in the beginning, from which to find opportunities for participation and trigger learning motivation. After actually participating in the internship, one can design activities, and then go further for supervision and management and set the strategy to carry out activities.
3. Learning behavior-- By reading and doing field interviews, learning form class and discussion, engaging in the chosen work, and teaching others in cooperative learning.
4. Reflective feedback--Learners reflect on the way of the activity, groups and their own performance. The experience learned from the learning process, can be resolved with the rapid access to the situation for later similar related activities.

So this study uses this model and theory incorporated Into the VR fitness materials. Learners learn the concepts and methods of fitness through learning procedures. Through the actual experience learners observe and imitate fitness action, and then learn to operate the way to fitness simulation. And finally the action and reflection are tested through the break through experiencing the games. Experiences are accumulated to avoid sports injuries caused by operation of the actual equipment in the future. System teaching materials provide continuous training so learners can relearn until the action is correct.

METHODOLOGY

Once the concept of this study is formed and the topic is confirmed, relevant literature are collected for analysis. And then the structure is thus established. In addition, VR headset virtual reality fitness experience learning system content is built based on experiential learning theory. And then the questionnaires are written according to the purpose of this study and assumptions. Teddlie and Tashakkori (2009) think the mixed-methods research must have a complete process of problem formation, data collection, data analysis, and the interpretation of the results in the qualitative and quantitative orientation, and the results of the interpretation must link and discuss the relationship between qualitative and quantitative orientation. Sung, Chang, Lee & Yu (2008) mentions that both qualitative and quantitative approaches have their pros and cons. They can be adopted to make up for their shortcomings. The combination of the two can help to analyze and understand the overall situation. So, mixed-methods research was adopted in the embedded experimental design in this study, and then quasi-experimental design-based quantitative research with semi-structured interview was also adopted to understand the learning outcomes of beginners in the learning process.

This study focuses on modifying the action and learning of the college student beginners who use the VR headset device fitness experiential learning system. After the quasi-experimental study, the data collection and analysis are done based on users' system satisfaction questionnaire. The aim is to explore the VR headset fitness learning system combined with different experiential learning strategies and to know whether the beginners can correct the action and learn the correct concept of fitness effectively. And a qualitative interview with the users is conducted to understand the system more deeply for beginners learning the course of the impact (**Figure 6**).

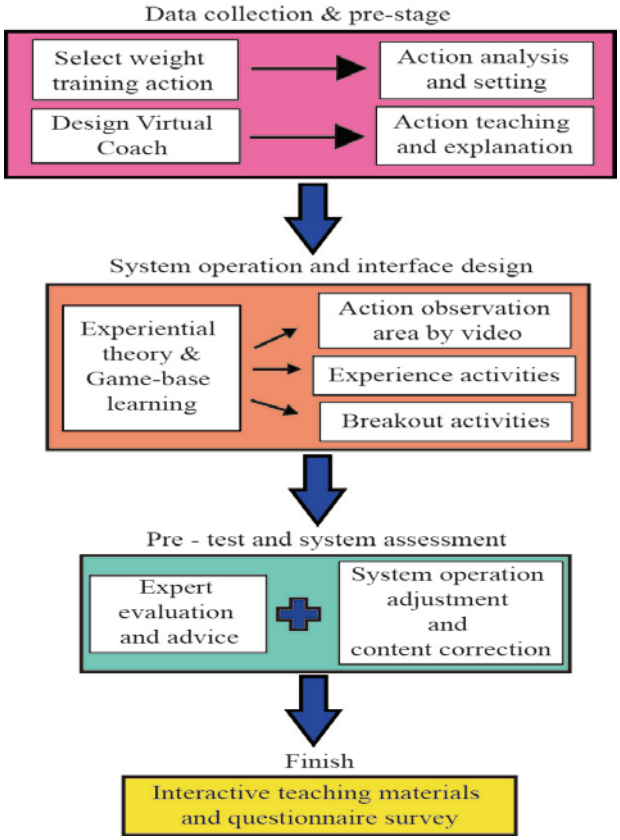

Figure 6. System content and evaluation flow chart (researcher design)

Research Objects

Alice Oglethorpe, the author of "Oprah.com", mentioned that a normal person body's muscle volume reduces year by year from the age of 30. When young people enter the adult stage, it is very helpful for the body aging to cultivate good and correct weight training habits and actions. (Alice Oglethorpe, 2016) So the subjects are 53 healthy college students (male 30, female 23) who are beginners on the weight training.

Experiment Process

To gain a better understanding of the practical operation and satisfaction and the effect after users experiencing "VR headset virtual reality fitness experiential learning system", the experimental process is divided into three parts, "Experimental activity process"," Scale assessment", and "User interview history." (**Table 1**) Most people are unfamiliar with VR headset, so the system operation instructions and practice will be provided before the experiment, so that users can be familiar with the overall operation of the system.

Table 1. Description of the experimental process

Experiment process	Time
A. Experimental activity process	
1) Description of experimental activities: Let the user understand the learning content, experimental goals and the overall activities.	5min
2) System operation and practice: Let the user understand the interface and the way and after the completion of the exercise.	15min
3) Formal experimental operation: The user conducts formal experience activities, and completes the learning content.	30min
B. Scale assessment The user performs a system satisfaction scale as a basis for further analysis.	10min
C. Individual interviews with users Through the one-on-one interview to understand the user's overall system of operation experience and learning experience to facilitate the relevant analysis.	10min

Study Tool

This study uses VR headset virtual reality learning system as an experimental tool for weight training, supplemented by expert interviews, beginner's personal information sheet, activity watch list, overall system assessment scale as a research help. They are described below.

1. Outline of the interview

   A semi-structured questionnaire interview has been conducted to this study after the experiment. The following is the outline of the interview.

   a. When it comes to dumbbells, push-up rack and elastic rope, how do you benefit from VR headset fitness experiential learning system?

   b. Can you link the real equipment and get inspiration through the system learning?

   c. Other ideas and suggestions?

2. Activity observation record method

   The experimental activity is conducted by direct observation method, supplemented by photography and video recording. The observer is assisting in completing the observation chart, recording the actual operation and helping users solve problems, and further analysis of its observations.

3. The scale of the system usage satisfaction

   This study mainly uses the scale of the system usage satisfaction to evaluate overall content, feature design, interface and visual design. Likert-scale Five-point scale is adopted. Totally agree—5 points, agree—4 points, common—3 points, disagree—2 points, totally disagree—1 point. The points are given to facilitate subsequent quantitative analysis.

4. VR headset virtual reality fitness experiential learning system

   This study uses the experiential learning theory and the digital learning system content design. And the head-mounted display is used as the study of hardware equipment. A virtual scene, objects and characters are constructed with 3D MAX and Unity 3D. The Interface design use Illustrator and Photoshop to match, and implemented in the VR headset device and Kinect Somatosensory sensor.

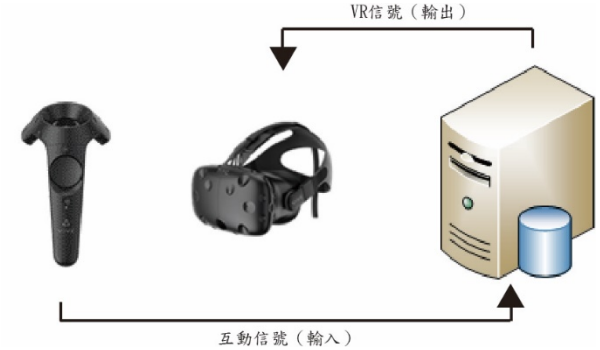

Figure 7. VR virtual reality weight training assistant teaching system data flow diagram

Data Processing

1. Statistical analysis of quantitative data

   In this study, SPSS22.0 statistical software was used for data processing. The main data source is from VR system usage satisfaction scale. Descriptive statistics and analysis of quantitative research methods of correlation analysis are also adopted.

2. Analysis of qualitative data

   User s' interview data are verbatim organized according to the outline of the semi-structured interview to ensure the correctness. The contents of the interview are sorted out and analyzed, and confirmed by interviewers as well. The code is compiled as S-1-1060315, S stands for student, No. 1 number, and the interview was conducted on March 15, 2017.

DESIGN THE SYSTEM FOR VR HEADSET VIRTUAL REALITY FITNESS OF EXPERIENCE LEARNING

This research is based on Microsoft Windows operating system and the Unity3D Game Engine is used as the main development platform while the HTC VIVE is used as the main interactive platform. This research system is User-oriented. The design of this system features in stability and structure. The purpose is to gain long term, Multi-frequency user Interactive detection. The system uses two signals' as the main I/O signal: VR signal and Interactive signal. The VR signal transmits to VR helmet through computing platform and then to the users 'eyes. The interactive signal is the opposite. Users use interactive handle to trigger interactive switch (Entity/VR).The interactive handle transmit the switch signal to the computer center to perform operations and the result is feedback to VR helmet to present entity (**Figure 7**).

This teaching system is composed of three parts: computing center, VR platform and users. The VR platform includes VR Display module and somatosensory interaction module (**Figure 8**). The main purpose of computing center is for computing tasks and storing initial teaching environment. VR platform is the main interface for users' interaction. Users gain interactive information Display module presented in visual form through VR display module. Using somatosensory interaction module and VR space to interact, the teaching objectives are reached and this is the important part of this system. It provides instant interactive message. It is the main motivation for the system's alteration as well as one of the important variables of the VR weight training teaching system.

THE DESIGN AND DEVELOPMENT OF SYSTEM CONTENT

This research Interactive design the scenes and objects by 3D MAX and Unity 3D (**Figure 9**), while the operation interface, System style and the Related Stickers are adjusted by Illustrator and Photoshop. Program language control, VR glasses and controller are used to integrate VR Somatosensory Teaching system in the end.

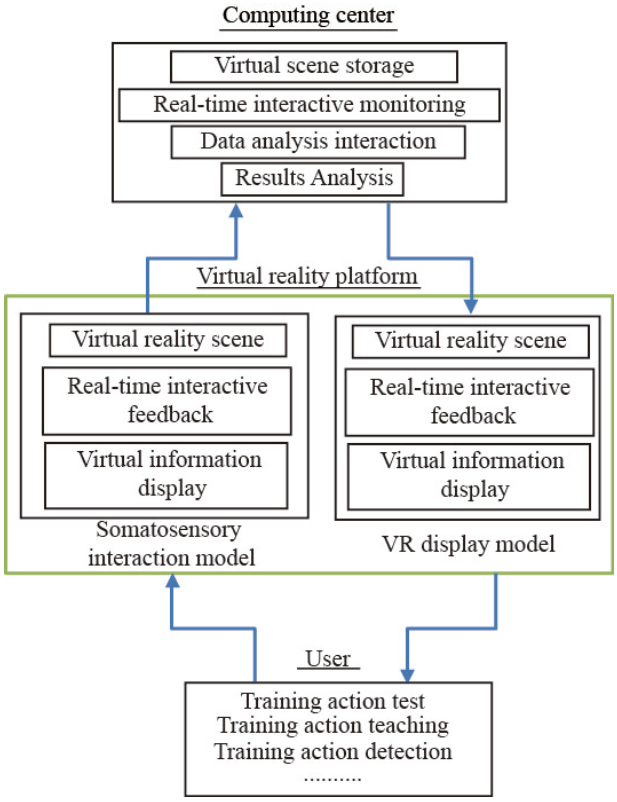

Figure 8. VR virtual reality weight training assistant teaching system architecture diagram (Researcher design)

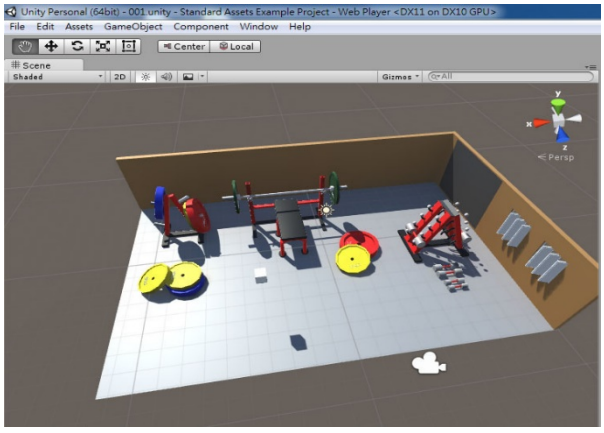

Figure 9. System scene design (researcher design)

System content and operation will be evaluated by three Digital media experts. Two professional fitness coaches will guide the system action. Questions and advice will be modified.

This Research teaching system is composed of four parts. 1. The description of the chest fitness concept. 2. Equipment instructions. (The explanation of the wrong actions) 3. Coach demonstration & practice. 4. Fitness game experience. Related content design is shown as **Table 2**.

Table 2. System Unit Description

Item	Content description
Fitness Concept Description	The first part provides the basic fitness concept description for beginners.
Equipment Instructions (Explain the Wrong Action)	Some common and easy to get Fitness Equipments are chosen by the designer. The training parts and gestures are incorporated in teaching system. The common seen wrong actions and the instructions will be provided.
Coach Demonstration & Practice	The Virtual coach demonstrates Fitness training. Learners practice and learn through VR.
Fitness game experience	The system designs four kinds of fitness equipments. Learners can choose equipment and experience the game.

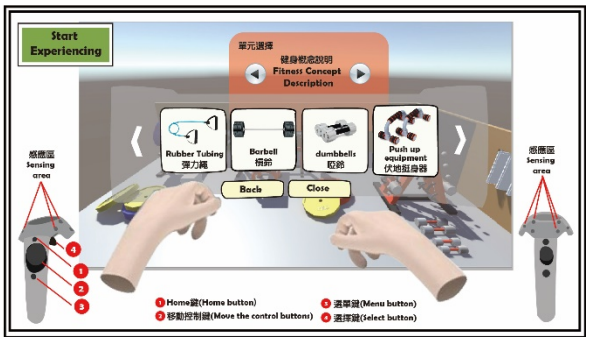

Figure 10. System operation interface (Researcher design)

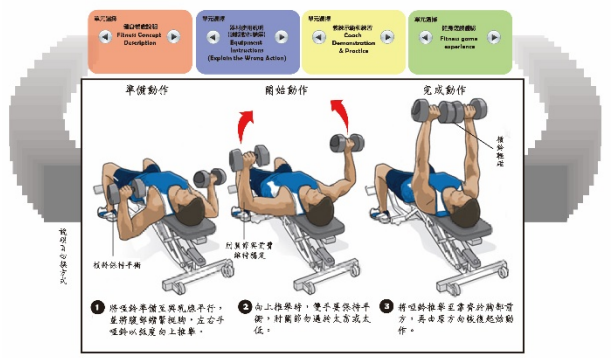

Figure 11. Fitness trainer demonstration (Researcher design)

The Design of the Operation Interface

Once you enter the system screen (**Figure 10**), prompt of the Virtual controller will show on the left and right sides. Four pieces of equipment are offered for learners to choose. After choosing the equipment, learners will choose the unit. The right and wrong actions will be explained as well as the demonstration and practice of the coach (**Figure 11**). Learners can go further to experience the games and upgrade the levels.

Tested by the Subject

Subject selected equipment and started the experience of practice. People Use Virtual Reality for do fitness. The action is divided into preparation action → start action → completed, the subjects can continue to repeat the operation (**Figure 12**, **Figure 13**, **Figure 14,** & **Figure 15**).

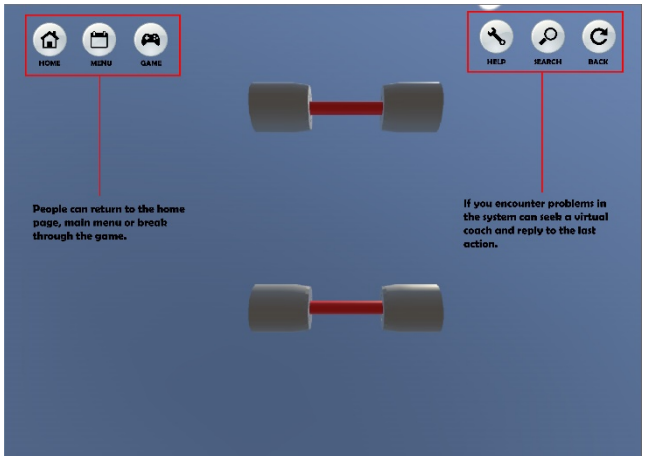

Figure 12. System operation screen (Researcher design)

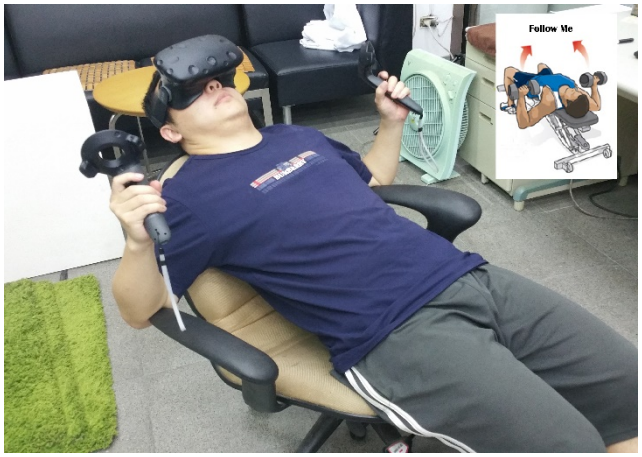

Figure 13. The subject starts the action (Researcher design)

Figure 14. The subject began to move (Researcher design)

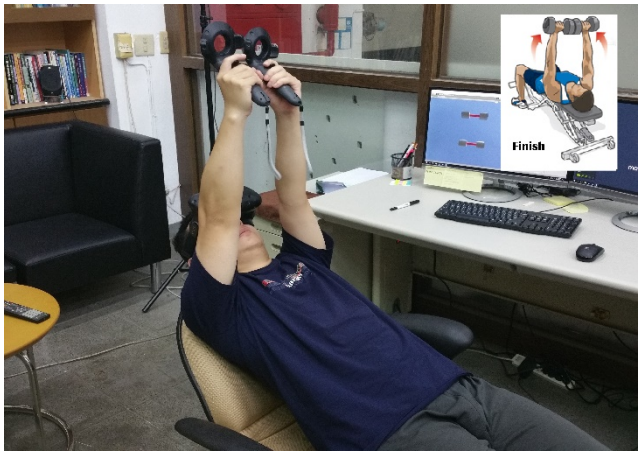

Figure 15. The subject completes the action (Researcher design)

Table 3. The credibility analysis of the scale of the system usage satisfaction

Evaluation content	Number of questions	Type	α value	Standardized item α value
The whole content design	11	Likert Five-Point Scale	0.886	0.904
feature design	6	Likert Five-Point Scale	0.898	0.901
Interface and visual design	11	Likert Five-Point Scale	0.793	0.812
The whole credibility			0.946	0.950

ANALYSIS OF RESULT

The major development of this research is the game system of VR Fitness experience learning. Operation interface, Operating fluency, and the rules are modified after pretesting the prototype and the evaluation of the experts. Likert-scale Five-point scale is adopted to the satisfaction scale of this system evaluation. Totally agree—5 points, agree—4 points, common—3 points, disagree—2 points, totally disagree—1 points. The result of the item is calculated based on the average and standard value.

As for the credibility of this research, the system is analyzed by SPSS 22.0. The Cronbach's value of the detection of System learning Content evaluation and usability about overall content design, feature design, and Interface visual design are 0.886, 0.898, 0.793. The whole α value is 0.946. The values of the evaluation items are all greater than 0.7. The Scale is among high credibility. In other words, the scale has a certain degree of credibility. (**Table 3**) The formal tests on 53 college students (59.3% of the Valid samples have experienced VR Wearable device, 40.7% haven't) to conduct the experiments. The following are the related experimental results and analysis.

Quantitative Data Collation Analysis

The overall content analysis of the user satisfaction scale

The average value of the overall content of VR Game system is 4.27, which shows that most of the subjects tend to agree with this system (**Table 4**). The recognition degree values of the game levels and VR coach experience learning are 4.55, 4.72, 3.38. Most subjects think VR coaches are helpful for the learners in the system. As for the rules to play the system, 70 percent of the subjects hold positive recognition about the system operation and they can all push on the correct position. The part about assisting learners in experiencing fitness movements, chest muscle groups are trained through prompt areas. As for assisting learners the status of fitness experiencing, chest

Table 4. The test results of the "Overall Content" of the VR fitness experience system

Questions	Evaluate score (percentage)					Average score	Standard deviation
	5	4	3	2	1		
Recognition degree about the game levels and virtual coach experience learning.							
1. Virtual coach teaching is very helpful to me.	74.5%	19.6%	5.9%	0%	0%	4.55	0.972
2. I can understand the equipment operating method by virtual coach's teaching and practice.	78.4%	17.6%	4%	0%	0%	4.72	0.841
3. I can challenge the suitable game level according to my skill level.	64.7%	25.5%	9.8%	0%	0%	3.38	0.686
Acceptance of the rules to play.							
4. I know how to push on the correct area of the equipment.	78.4%	13.7%	7.9%	0%	0%	4.66	0.706
5. I can handle the equipments provided by the system and experience the training parts.	76.5%	15.7%	5.9%	1.9%	0%	4.22	0.847
The status of assisting learners about experiencing fitness actions.							
6. I think it helps me realize related equipment training after experiencing VR fitness system.	78.4%	15.7%	5.9%	0%	0%	4.33	0.876
7. I will adjust to the standard action before starting training.	72.5%	19.6%	7.9%	0%	0%	4.49	0.869
Overall evaluation							
8. Through the VR fitness experience system I can clearly realize the fitness training actions.	78.4%	15.7%	2%	3.9%	0%	4.19	1.226
9 VR fitness game is helpful to me.	72.5%	17.6%	9.8%	0%	0%	4.49	0.869
10 I think I can operate real equipments after using VR fitness experience system.	66.7%	25.5%	3.9%	3.9%	0%	3.96	0.940
11 I can fully understand the concept conveyed in the VR fitness experience system.	68.6%	23.5%	5.9%	2%	0%	3.98	1.248
Average	73.6%	19.1%	6.3%	1%	0%	4.27	

muscle groups are trained through prompt areas. Learners have confidence before they face real equipments and are ready for training actions. As for the overall evaluation section, most people hold positive recognition about VR fitness game system for incorporating VR games in fitness system. The Standard deviation is less than 0.75 in questions 3 and 4.

Feature design analysis of user satisfaction scale

The test results in feature design, as **Table 5** shows, the body show blocks of prompt function and Game experiencing are 4.17 and 4.21. Most subjects agree that they can clearly understand the body training site while operating the system. The design of Restart and Life Value can make the subjects more concentrate on thinking about the correctness of the actions. Finally, in the whole question evaluation, more than 50 percent subjects totally agree that they can complete the game break through the target via designed system function. Up to 89.5% of the whole part of the questionnaire agrees the result presented in the feature design. (50.9% very much agree, 38.6% agree)

Table 5. The test results of the "Feature Design" of the VR fitness experience system

Questions	Evaluate score (percentage)					Average score	Standard deviation
	5	4	3	2	1		
System prompt function evaluation							
1. System prompt function evaluation	49.0%	37.3%	7.8%	3.9%	2.0%	4.17	1.076
2. The system's show blocks clearly tells me which body part to train.	47.0%	39.2%	11.8%	0%	2.0%	4.21	1.008
The feature design of the systems' Restart function and Game Life Value							
3. The Restart function lets me continue to practice, thus actions memory and correction are done.	51.0%	47.1	3.9%	2.0%	2.0%	4.32	0.911
4. The design of "Life Value" in the game lets me think more about the correctness of the actions while plying the game.	54.9%	39.2%	5.9%	0%	0%	4.41	0.933
Overall evaluation							
5. I can clearly understand the goal that I have to complete.	58.8%	27.5%	5.9%	3.9%	3.9%	3.91	0.925
6. The GOAL function lets me able to focus on the completion of fitness actions while playing the game.	51.0%	41.2%	3.9%	3.9%	0%	4.33	0.769
Average	50.9%	38.6%	6.5%	2.3%	1.7%	4.22	

Interface and visual design analysis of user satisfaction scale

The test results of the interface and visual design, shown as **Table 6**, the interface text arrangement design (4.13, 4.34, 4.53), the friendly design of interface (4.34, 4.58, 4.55), the visual design of the system and characters (4.40, 3.89), and the overall evaluation (4.26, 3.60, 3.91), the total average of the overall standard deviation is 4.23, which shows that most subjects tend to agree with this system's presented effect of Interface and Visual design. More than 70 percent of the subjects agree with the menu interface and the friendly of operation. Yet there is still room for improvements in edition of the text, equipment menu, and overall game interface.

Analysis of Qualitative Data

The interview data were summarized in this study, and how beginners can benefit from VR headset fitness experiential learning system when using dumbbells, push-up rack and elastic rope were sorted out. The following is an analysis of the interview data.

How do you benefit from VR headset fitness experiential learning system when using dumbbells, push-up rack and elastic rope?

1. The VR system allows beginners to have interest in fitness, understand and adjust training action.
   a. I have not been in contact with fitness before.

      Most relevant fitness information is collected on the Internet. I'm not sure whether my actions are correct. Sometimes I feel sore after the training. But through this experiential learning system, I can follow the virtual coach to do actions and adjust my training posture. When I go back I want to try again (S-24-1060318).

   b. I have played some VR games before. This time it's a new experience. I understand the dumbbells, push-up rack and elastic rope training methods through the experiential fitness learning system. It's very exciting and interesting (S-20-1060318).

Table 6. The test results of "Interface and Visual Design" of the VR fitness experience system

Questions	Evaluate score (percentage)					Average score	Standard deviation
	5	4	3	2	1		
The system and the Game interface text, icon, and the edition of button menu							
1. The text in the system and games is clear and appropriate.	47.1%	33.3%	15.7%	3.9%	0%	4.13	1.040
2. The edition of the icon in the system and games is clear.	53%	41.1%	0%	3.9%	2.0%	4.34	0.921
3. The buttons and menu in the system and games let me easy to choose.	74.5%	17.6%	3.9%	2.0%	2.0%	4.53	0.908
The friendly design of the interface operation							
4. The Interactive screen in the system and games let me easy to focus on.	56.8%	27.5%	15.7%	0%	0%	4.34	0.830
5. It's easy to operate the system and games, I can still remember how to operate it next time.	76.5%	19.6%	3.9%	0%	0%	4.58	0.824
6. The interface design in the system and games let me easy to operate it.	78.4%	15.7%	3.9%	2%	0%	4.55	1.022
The visual design of the system environment and virtual characters							
7. The design style of the game, System scene, and virtual coach attract my attention.	60.8%	33.3%	3.9%	2%	0%	4.40	0.975
8. The color of the game is in harmony with that in the system, which is easy to read and operate.	54.9%	29.4%	13.7%	2%	0%	3.89	1.064
Overall evaluation							
9. I can understand and correctly select the icon of Elastic rope, dumbbell, push-up rack and barbell.	47.1%	35.3%	17.6%	0%	0%	4.26	0.763
10. Overall, I think the game interface is well designed.	43.1%	39.2%	15.7%	2%	0%	3.60	0.776
11. The overall color of the system doesn't make my eyes uncomfortable.	56.8%	31.4%	11.8%	0%	0%	3.91	1.213
Average	59.0%	29.4%	9.6%	1.6%	0.4%	4.23	

c. I can know exactly which part of the body I'm training through the explanation, system diagram introduction, and the virtual coach assistance. And I can operate with the correct posture (S-8-1060315).

2. VR system can enhance learning interest, but it will cause trouble for those who have not operated VR before.
   a. The use of VR headset fitness experiential learning system can enhance learning interest. I used to go to the physical gym or spend money to ask the coach to get professional knowledge and posture. Through the game and VR experience I can adjust unfamiliar action and posture. It's very interesting(S-30-1060318).

   b. I have not played VR before. I don't get hang of operating the system and games. The technology is developing rapidly, and the operation mode is getting more diversified. Besides, many devices are a little expensive, I'm not used to such a mode of operation (S-47-1060320).

Can you link the real equipment and get inspiration through the system?

Professional fitness instructors mention that most of the training starts mechanically since the action is more consistent and fixed. But mechanical training must go to the physical gym to carry out. Many people are also curious about how to use the mechanical equipment of the gym. The equipment provided in this research system is commercially available. They are smaller and cheaper compared with mechanical equipment. From the questionnaire, we can understand that the subjects have a high degree of acceptance towards the easily accessed equipment. And the concept and action of fitness can be learned through the system and games. It's described below:

a. Although the operation of dumbbells, elastic rope and push-up rack in the system is very interesting, I also have elastic rope and push-up rack at home which can help me to learn the relevant fitness posture. But I have been to the school gym and there is quite a lot of mechanical equipments there. How do I train myself when facing mechanical equipment (S-51-1060320)?

b. I am petite. I wonder if the operation of physical dumbbell is the same as the system. When I go back I would like to give it a try(S-35-1060319).

Other ideas and suggestions

In the system, interface menu and resources are very rich. I hope that related topics of operation for different parts of the body can be designed in the future. But the text is a bit small in some places such as the part of the action diagram(S-1-1060315). The design of system icons is great. To me, it will be very boring if it only focuses on training. The system uses games and multimedia to increase learning content and fun. In addition to a wealth of illustrations, learning becomes a very interesting thing. It is so called learning by doing(S-40-1060319).

CONCLUSION AND SUGGESTIONS

The most concrete result of this study is to construct VR weight training assistant teaching system. In addition to the headset display device combined with somatosensory, the teaching models of experiential learning theory are also incorporated into the system content. In addition to the basic teaching and experience, activities are carried out in a game way. The evaluation and amendment of the system are done before and after the tests. Questionnaire and interviews are done after beginners use the system. Analysis of its relevance, satisfaction and effectiveness are made to provide future reference for new media technology integration research. The following will explain the features of the VR wear device in the fitness experience learning system:

Auxiliary Beginners Have a Sense of Immersion

From the interview and observation on the spot, researchers realize that most of the subjects are absorbed in the operating system. Operating the system is very similar to practical experience. They think they were really exercising in the actual gym. The study shows that the system through the VR technology can be effective for beginners to produce a sense of immersion, from which users can achieve the effect and fun.

VR Learning Process and Game Interaction

Fitness exercise emphasizes the actual feelings, so the actual learning experience is very important. The actual virtual space is simulated by the VR headset, which lets the subject (beginner) know the fitness actions and concepts in advance before they go to the gym. They can experience the relevant training methods, increase the willingness to go to the gym and to reduce the chance of injury.

FUTURE SYSTEM CONSTRUCTION AND RESEARCH PROPOSAL

Increased Selectivity of Equipment Operation

This study uses elastic rope, simple barbell, dumbbell and push-up rack, commonly seen on the market, as system fitness aids. The mechanical equipment in the gym is not designed in the system. More equipment can be designed in the system in the future. Not only for beginners, but the general public or the elderly can also carry out equipment experience and teaching.

Combined with Pressure Sensor for Measurement

The current game is built for the initial operation mode, so the system game operation is a little simple. Advanced training actions and the difficulty of breaking through will be added in the future to increase the richness of the system. In addition, the gym has a real bar or dumbbell weight. Related technology system of pressure sensor from Shih Chien University can be modeled to increase the effect of VR experience. More realistic simulation of the actual fitness of the telepresence can be made.

Increase the Network Platform Connection or Immediate Teaching

The current system only provides software on PC. Sports training with peer encouragement and help can improve the sporting effect. Training against each other, immediate professional coaching teaching, and online discussion for teaching and learning all can be done online in the future. So the fitness problems beginners encounter can be solved on the spot.

Add Sports Record

This study focuses on the VR fitness experience system on learning satisfaction and achievement, sports record function can be added in the future so that beginners can record their own state of motion at any time. (Such as: heartbeat, respiratory rate, training index and weight.) The coaches or trainers can understand their own situation to adjust and amend the next time they use the system. With professional records and learning, the sports effect can be enhanced and the sports injuries can be reduced.

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