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Research Article

Research on the Relationship between Motion Performance and User Experience of Golf Virtual Simulation Putting Simulator

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This paper designs and develops a virtual golf simulation putting simulator based on the existing computer technology and conducts in-depth research and analysis on the relationship between its motion performance and user experience. The network architecture of the distributed virtual golf simulation system and the scene data management model are established, based on which the server-side system design and the client-side network communication module design of the distributed virtual golf simulation system are carried out. In the requirement analysis, the functional requirements such as building VR scenes, data communication and recognition models, and the non-functional requirements such as system security and ease of use are analyzed; in the outline design, the hardware equipment and logical architecture of the automatic user experience optimization system are described; in the detailed design, the functional modules of the system are designed in detail, including VR induction experience, physiological signal dataset user experience identification, data communication, optimization strategy, and so on, and important class diagrams and flowcharts are given. The intervention effects of positive thinking training on sports performance and improving athletes' attention and receptivity have been verified and recognized by coaches and athletes. The putting simulator in the experimental class had higher hole-in-hole parameters than the control class, a highly significant difference; the putting simulator in the experimental class had higher hole-in-hole parameters than the control class, with a highly significant difference. These 3D models may contain more detailed information. In a virtual scene, the more detailed information a model contains, the more polygons the model needs, so that the computer needs to draw many polygons per frame, which has a great impact on the real-time performance of scene drawing. The parameters of the 5-yard chip-and-shoot in the experimental class were higher than those in the control class, and there was a very significant difference between the parameters of the 15-yard chip-and-shoot in the experimental class and those in the control class. The experimental results show that the model optimization processing method and rendering acceleration technology proposed in this paper can largely improve the rendering efficiency of 3D virtual scenes.

1. Introduction

In today's high-speed economic development, people's demand for sports is getting higher and higher, and golf, which was once an aristocratic sport, is slowly appearing in the vision of popular sports, becoming one of the important sports for the public to participate in sports activities, thus enriching people's daily life. Because golf is the fourth most difficult sport in the world and belongs to the mental skill type of sports, to play golf well, you need to have more excellent golf-specific skills [1]. Golf technical movements are complex, especially the process of putting to hitting the ball, which seems simple but is complicated. To effectively master the basic techniques of this sport and accurately hit the ball to obtain the ideal sports performance, practitioners need to have good physical strength quality and effective movement control ability. Core strength training is especially important due to the technical force structure of golf. At present, most colleges and universities teach golf only in golf professional technical training and only pay attention to

the demonstration of movements, ignoring the fundamental reasons why students cannot complete standard movements due to lack of strength and unstable movements, resulting in the slow improvement of students' technical level. Therefore, the college golf course should focus on strengthening the core strength training of golf in addition to the professional training of students. After the golf-specific core strength training, the subjects have a better effect on the proficiency in golf sports skills; especially in the process of core power chain transmission, the control and performance of technical movements are improved more obviously, thus enhancing the stability of golf putting technology, improving the accuracy of hitting the ball, and improving the technical level of students [2]. The expert group has more obvious advantages and higher accuracy. Therefore, how to conduct effective core power training for golf students and how to select and evaluate the evaluation index of core power training in golf becomes the important and difficult point of this paper.

Putting is the most basic and important action in golf, and the special strength required is an important quality in the basic strength training of golfers. The accuracy of the putting stroke is very important in golf, and whether the putting stroke is standard or not is directly related to the distance and effect of the shot. The characteristics of putting action technology are mainly reflected in the high degree of coordination and unity of swing skill and individual swing skill.The entire process requires the organic cooperation of the overall rotation of the body and upper limb links [3]. Professional golfers are very concerned about their strength, balance, rhythm, and speed in the putting process, so the practice of putting action becomes the key to improving the level of golfers, and putting allows us to appreciate the leisure and relaxation of golf. Analyzing the players' putts only through their feelings or the coach's observation will cause many difficulties in golf training, and it is not easy to improve their putts [4].

Our golf trainer software combines laser infrared sensing technology, data acquisition technology, 3D image processing technology, and computer software technology and is used for golf putting and putting training, which can capture the angle of the stroke, the speed of the ball, and the rotation of the ball through laser infrared sensing. Players can adjust their next hitting force and angle of the ball in real time. The golf trainer software simulates the three-dimensional terrain of the golf course and processes the collected data to display the movement of the golf ball and the trajectory of the golf ball using three-dimensional technology and calculates the distance of the golf ball movement. It can visually display the player's ball striking index. To achieve a better training effect, the course should be as realistic as possible. The golf trainer software simulates a three-dimensional course so that the player can be integrated into the real golf course as much as possible.

2. Related Works

Positive thinking training combines Buddhist Zen thought with third-generation behaviorism as its basis. It advocates an appropriate understanding of current physical and mental conditions, acceptance of negative emotions, acceptance of such internal senses, and understanding of their meaning [5]. In the study of virtual simulation technology in physical education theory, Soltani and other scholars made a specific analysis of the feasibility of using virtual simulation technology in physical education based on a brief introduction of virtual reality technology [6]. It is proposed that the use of virtual reality systems in physical education can make up for the shortage of teaching venues, funds, and equipment (such as students' favorite shooting, rock climbing, diving, wilderness survival, trampoline, and so on), and students can practice in the virtual environment, and it is proposed that the technology can optimize the physical education process [7]. The experimental results show that golf experts can use their previous experience to adapt more quickly when facing different golf positions, to maintain good sports performance and higher putting accuracy. The conclusion that the technology can optimize the physical education process, improve the physical education environment, improve the level of teaching and training, and cultivate innovative talents has a far-reaching impact. Uhm believes that virtual physical education is an intelligent, distributed, interactive, and graphic teaching that is not limited by time and space and is completely different from traditional physical education methods [8]. González-Rodríguez et al. discussed the composition of the virtual system of sports scenes in exploring new methods and means of action technique analysis and sports training and were able to provide a flexible and safe environment for sports training [9].

The research on virtual golf simulation systems is mainly focused on data sensor technology and graphic simulation technology [10]. Data sensors are mainly used to collect accurate golf ball movement data or human hitting posture data in real time, and the main technologies used by foreign golf simulator manufacturers are radar sensor technology, infrared detection technology, and high-speed camera acquisition technology, among which 3D stereo high-speed camera acquisition technology is the most advanced [11]. Graphics simulation technology is mainly to simulate more realistic and natural golf natural scenes and more accurate golf physical movement effects, and there are many options for virtual golf simulation, such as the use of a self-developed graphics development engine or the use of a mature game engine [12].

The purpose of this paper is to study the implementation of a virtual golf course in which several different users located in different geographical locations can compete in the same virtual golf course through network interconnection. Since this paper must solve such problems as real-time interaction between different users, spatial and temporal consistency of virtual environment, management of massive scene data, network topology and network communication protocol of the system, simulation of virtual golf scene effects, optimization of large-scale virtual scene rendering, and so on, which are hotspots and difficulties of distributed virtual reality system, the research of this paper has important theoretical significance. At the same time, since the distributed golf simulation system overcomes the problem

that the stand-alone golf simulation system cannot be networked across regions for interaction, the distributed golf simulation system has higher use value and commercial value.

3. Golf Virtual Simulation Putting Simulator Design

Since the virtual golf simulation system is a realistic simulation of the golf ball flight scene, the golf simulation system should firstly have a highly realistic three-dimensional scenery simulation function; secondly, to truly display the golf player's shot level, the system needs to have the golf ball data collection function and the function to truly simulate the physical movement process of the golf ball in the virtual scene. In addition, to connect the virtual scene with the real interaction, the system must provide a friendly user interaction interface, and the data generated during the user interaction need to be saved and managed [13]. To enhance the user experience of the virtual golf simulation system, the system needs to add some additional functions, such as virtual 3D sound, multi-screen display, and other functions.

The data reception and parsing are mainly based on the API library of radar sensors provided by FlightScope. This part is mainly responsible for receiving and parsing the radar data and providing the initial data for the golf ball physical motion simulation module of the system.

The main function of the golf trainer software system is golf training, but of course, it can also play the role of entertainment. The system achieves training by establishing a driving range scene and a putting range scene. Putting data are collected in the practice range 3D scene through serial transmission, mainly including initial speed, angle, declination, and so on. Different changes can be made to the single-subject experiment to meet different experimental needs. A series of algorithms are used to simulate the putt data and display the trajectory of the ball after the putt. In this way, after each putt, the player can observe the distance of the ball to grasp the strength of his putt and the angle of the ball to grasp the standard of his putt. The putter data are collected through the serial port in the three-dimensional putting scene, mainly including putting speed, deflection angle, and so on.

Through the laser transmitter between the putter and the horizontal laser receiver tube, the receiver tube receives the data sent to the PC through the serial port, collects and processes the data and sends it to the golf instructor software for processing to calculate the ball index. The structure design of this system is shown in Figure 1. If the single-subject experimental method can be used reasonably, good research results can still be obtained after adaptive changes.

All the data collected by the laser receiver tube are transmitted to the PC through the serial port, and the software operation and use are realized on the PC [14]. Data acquisition is mainly using laser infrared technology, and there are three groups of laser transmitters and laser receiver tubes on the golf trainer: two groups located at the bottom of the golf trainer in the horizontal direction, and one group located in the vertical direction at an angle of 60° to the horizontal direction. In addition, this system leads to a sound acquisition controller, whose role is to collect the sound of hitting the ball. When the ball is hit, the two groups of lasers in the horizontal direction will collect the two groups of numbers and send them to the golf trainer software through the serial port for processing to calculate the speed and offset angle of the ball, while in the vertical direction, a group of numbers will be collected and sent to the golf trainer software through the serial port for processing to calculate the height of the ball. The data are processed and displayed in the 3D human-machine interface.

The end motion simulation platform is driven by three electric or hydraulic cylinders to simulate the position and attitude provided by the vision system, which can realize the lifting, pitching, tilting, acceleration and deceleration, bumps, and compound motion during the motion. The simulator consists of an end motion simulation platform, three electric cylinders, a base, three hooke hinges connecting the motion platform to the pushrod, and three Hooke hinges connecting the cylinders and the view system. By controlling the expansion and contraction of the three electric cylinders, the movement of the motion platform with three degrees of freedom of lift, pitch, and lateral tilt is realized. Combined with virtual reality technology and a somatosensory algorithm, various motion scenes are simulated to give the rider the feeling of being in the scene.

Unlike tandem robots, the end deformation of parallel robots not only comes from the deformation of its structure and the accumulation of deformation of other parts but also includes the displacement of the rigid body brought by the relative rotation or movement of the passive motion subassemblies [15]. The dangerous poses of the mechanism need to be determined, so the positions and poses of the mechanism need to be parameterized, as shown in Table 1.

As there are three different difficult holes on the general golf green, each hole is in a different position, some holes may belong to the green slope, and some holes may be in the depression of the green. When a golfer is not very far from the green, he may choose to hit the golf ball on the green in one shot, which can reduce the total number of golf shots. For the adjustment of golf ball speed, this system needs to simulate the real shot, so the flying speed of the golf ball should be as close to the reality as possible. In the virtual golf simulation system, it is difficult to perceive the elevation information of the green simply from the graphical point of view, so it is difficult to determine the ideal landing point of the golf ball when hitting the golf ball on the green from a long distance [16]. Therefore, this paper uses advanced coloring language technology to color the elevation of the golf course greens, aiming to provide users with sufficient information about the elevation of the green terrain.

The green topography elevation grid is designed to visualize the green elevation when a golf ball is dropped into the green. Each vertex of the green elevation grid has a roller ball, which can continuously roll from high to low according to the height of both vertices to visually represent the height information of the terrain, and the grid itself is also colored

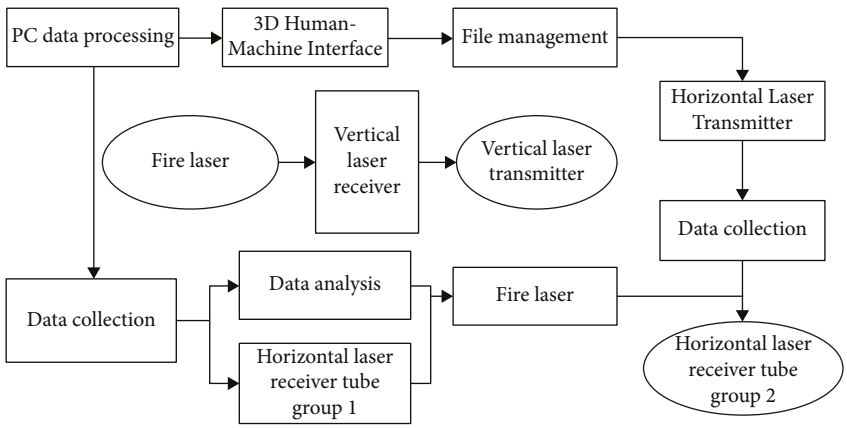

Figure 1: Golf trainer system putting training structure design.

Table 1: Position acquisition point settings.

X	Y	Z
0	0	0
1	2	−23
2	21	15
3	23	−17
4	5	−21
5	23	0
6	−20	9
7	6	−17

with red, green, and blue gradient according to the vertex height information.

In the virtual golf simulation system, the projection display of the 3D scene is a very important part. At present, the scene display mode of the virtual golf simulation system has three ways: single-screen display, three-screen display, and ring screen display. The scene display of the distributed virtual golf simulation system studied in this paper adopts the three-screen display mode, i.e., the rendered results are projected by three projectors onto three screens with different angles for the virtual scene display. The display system based on three projectors can give the user a 120° viewing angle, which largely enhances the immersion of the virtual reality environment.

The traditional multi-screen display technology adopts the C/S architecture, as shown in the figure below, i.e., one host is used as the server, the rest of the hosts are used as the clients to control one projector each, and the server sends information such as the scene perspective, upward vector, and projection matrix to each client to be displayed, and the client renders the scene output according to the received information and projects it through the projector. In this way, a wide-angle scene is formed on the screen, as shown in Figure 2.

However, for the display of three-dimensional scenes, the simple use of hardware to expand the scene screen is not enough to meet the requirements. Because the camera in the three-dimensional view system is mostly used in perspective projection, if the hardware is used to expand the scene screen to increase the width of the view, it will make both sides of the scene screen appears a large degree of stretch. Therefore, the cone projection matrix and viewpoint direction need to be calculated for different projection planes.

Through the observation of the actual flying speed of the golf ball, we have calculated a series of speed formulas and calculated different speed formulas at different stages. In virtual reality systems, to improve the realism of virtual scenes, it is often necessary to construct various complex 3D scene models, which may contain more detailed information [17]. The more detailed information the model contains in the virtual scene, the more polygons the model needs, thus making the computer draw many polygons per frame, which has a great impact on the real-time scene drawing. Therefore, how to achieve real-time drawing of large-scale scenes is an important research topic.

However, in many cases, for the same hardware level, the drawing efficiency of computer graphics seems to be inversely proportional to the picture quality of the final drawn scene. When pursuing graphics drawing efficiency, it may be necessary to reduce the complexity of the scene to be drawn, i.e., to reduce the detailed information of the scene to be expressed, which inevitably has a significant impact on the scene's picture quality.

4. Putting Simulator Motion Performance and User Experience Relationship Analysis

Golf putting requires a high standard of action, and whether the putting action is standard or not is directly related to the distance and effect of the stroke [18]. For the training of the standard of the putting action, we mainly analyze the angle of the ball to determine whether the putting action is standard. The next stroke is then modified according to the trajectory of the golf ball.

It was found that prior experience in motor skills can be of great help in motor skill operation. Therefore, this paper uses advanced coloring language technology to colorize the elevation of the greens of golf courses, aiming to provide users with enough information about the elevation of the greens. The experimental study found that the expert group of golfers and the novice group were more stable in putting at different distances, and the expert group was more

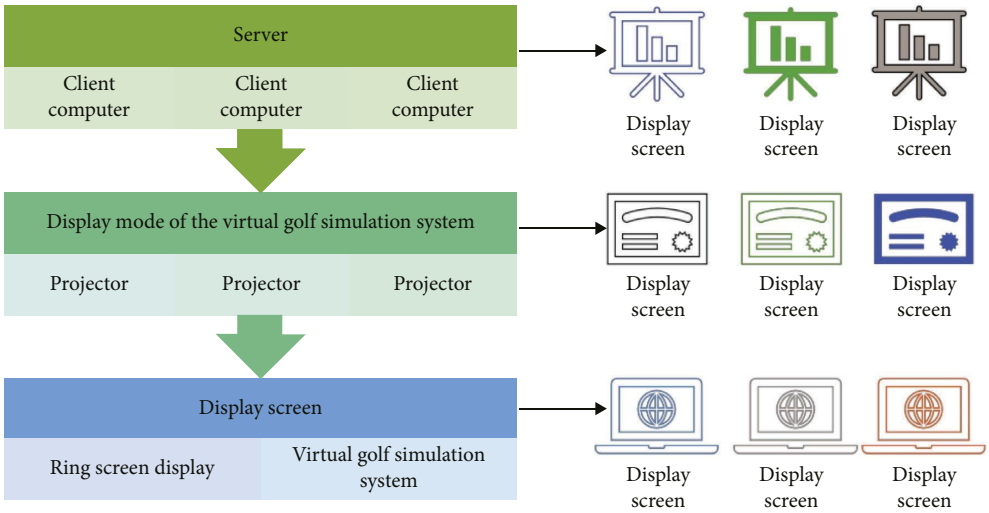

Figure 2: C/S mode three-screen display method.

accurate in putting with lower putter impact. There were also differences between the two groups when putting at different distances with differently weighted putters. The expert group used their existing experience to make faster and better judgments on the amplitude of the putting action, the ball position, and the speed of the putt, and the expert group had a more obvious advantage and a higher accuracy rate. The results of the experiment indicate that the golf expert team players can use their prior experience to make adaptive adjustments to different ball positions, thus maintaining good athletic performance and higher putting accuracy.

A-B design is the most basic experimental design for single-subject experiments, and the A-B form of single-subject experimental design has evolved to increase the validity of experimental effects and to adapt to different research needs. The reason for choosing the multi baseline level design is that the study believes that the multi baseline level tester in the single subject experiment can fully control the degree of independent variables, dependent variables, and irrelevant variables, and apply it to this study. In the A-B-A multiple baseline level design, in which the experiment is withdrawn in the study phase, no variables are used in the follow-up phase, and the behavior of the subjects and the collected data are observed to ensure the validity of the intervention experiment to eliminate irrelevant variables, and the data collection in the A2 follow-up phase is conducted and analyzed at the end of the intervention experiment to prove that the intervention experiment can affect the subjects to achieve the intervention effect [19].

At the end of the intervention, a follow-up test was conducted on the junior golfers, and the test was repeated using the Five-Factor Positive Thinking Inventory and the Brief Mood Inventory, and the data were collected seven times during the follow-up phase 2. After the data were obtained, we observed and analyzed whether the level of positive thinking and state of mind remained in a certain range or fluctuated and tested the sustainability of the positive thinking training effect. The specific time allocation of the data is shown in Table 2.

Single-subject experiments have been of great importance in the history of psychology. Single-subject experiments, also known as small-sample experimental designs, have a variety of designs and are flexible and highly operational, so that researchers can make different changes to single-subject experiments to suit different experimental needs and can still achieve good results after adaptive changes if the single-subject experimental method is used wisely. To effectively master the basic skills of this sport and accurately hit the ball to achieve ideal sports results, practitioners need to have good physical strength and effective movement control ability.

To ensure the objectivity and accuracy of the data collected from the experimental tests, statistical software such as Excel was used in this study to test whether there were significant differences between the data before and after the experiments to confirm the feasibility of the experimental protocol [20]. The data collected from the experiments were categorized and organized to produce views and tables of the relevant studies, which allowed for intuitive and clear analysis of the findings and visual interpretation of the data. Data visualization is often used in single-subject designs, which are characterized by the ability to make the most of experimental data and to analyze the effects of intervention data using visual graphics, which not only are easy to use but also make the results of the experiment clear briefly [21].

Any motor skill, although discussed in the context of sport, is, in general, a reaction to the habits of the individual. In golf putting instruction, it is also common to find that many golfers fail to devote all their energy to practicing what the instructor is teaching them, or their minds wander, or they chat about something else. By sorting out value-oriented habit styles, it helps individuals establish a motivational pattern of following a plan rather than an avoidance pattern. Make the event of the moment the goal of the action and focus on the task without distractions, as shown in Figure 3. To play golf well requires several good qualities such as strength, explosive power, endurance, flexibility, balance, and stability [22]. For a professional golfer, any one

Table 2: Time allocation for data collection.

Schedule	Frequency one	Frequency two	Time
Baseline period	7	9	6.14–7.13
Intervention expectations	8	7	7.14–8.13
Tracking period	9	8	8.14–9.13

of them is in a weak point, which will lead to a decrease in the quality of his or her swing and unstable shots, causing the performance to be negatively affected. Golf is different from other sports in that the most important thing is the stability and control of the golfer.

In the whole process of the golf swing, to ensure that the energy is not lost, the golfer needs to polish and improve the details of each technical action of the swing and the overall body movement chain is not able to have a large loss. The control and performance of technical movements are obviously improved, thereby enhancing the stability of golf putting technology, improving the accuracy of hitting the ball, and improving the technical level of students. In particular, the torso is the center of the whole body and the intersection of all the forces of the body, which plays an important role in the overall power transmission and integration [23]. If the stability of the torso is not sufficient, it will hinder the transmission of energy and cannot effectively control the force of all parts of the body, resulting in deformation of technical movements and deviation of the ball, which will hurt the sports performance.

5. Analysis of Results

5.1. Analysis of the Performance of the Virtual Simulation System. After each function of the system is realized, the system needs to be debugged to test whether each interface can be unified and whether each functional module meets the system requirements. System debugging is mainly divided into hardware debugging and software function debugging.

The software must have the corresponding hardware support, which is also a major highlight of the system design. Because the current domestic golf trainer is either only software or only hardware, rarely can the hardware and software be combined to develop. It can be difficult to determine where the golf ball will ideally land when hitting the green from a distance. The debugging of the swing training hardware is mainly the debugging of the laser transmitter and the laser receiver tube. Only the laser emitted from the laser transmitter hits the laser receiver tube to trigger the first, second, and third boards. For the first, second, and third boards, it must be triggered to collect data and realize the function of the data acquisition module. Whether the debugging is successful or not is reflected through the software interface.

The debugging of the swing training module in the driving range scene mainly includes debugging the received data and debugging the golf ball speed after the swing. The debugging of the received data is mainly through the serial debugging assistant to receive data and compare it with the received data of the system, if the result

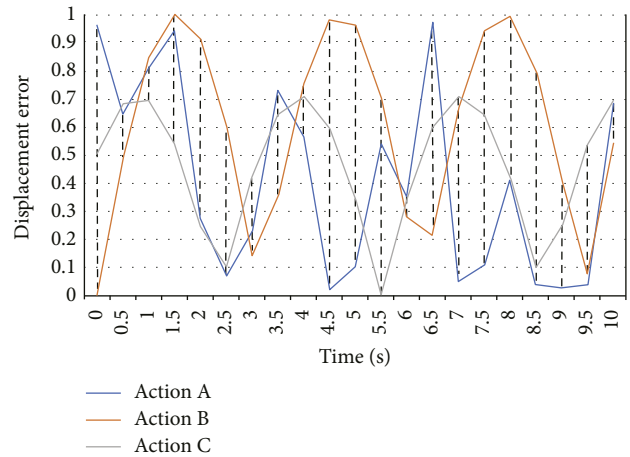

Figure 3: Control drive joint displacement error curve.

is consistent, it means that the received data are correct. For the debugging of golf ball speed, the system should simulate the real ball, so the speed of golf ball flight should be as close as possible to the actual. Through the observation of the actual ball flight speed, we counted a series of speed formulas, and different speed formulas were counted at different stages. After repeatedly debugging and modifying the parameters, the speed of the simulated high ball is made to match the actual high ball flight trajectory as much as possible. The same is true for the debugging of the putter training in the putting scenario. We connect the PC, monitor, and hardware for the overall debugging, as shown in Figure 4.

From the performance data shown in Figure 4, when the 1264 trees in the golf scene are not rendered, the frame rate of the scene is 35.23 fps, the number of private Vertices is (4431069), and the number of Primitives is (1477023). When the scene is rendered using the Instance technique, the data table shows that the number of private vertices and primitives in the scene is 218,412 and 72,804; however, the number of vertex instances and primitives is 0.0%. However, the number of vertex instances is 4431069 and the number of tuples is 1477023, the sharing rate of vertex instances is 95.07%, and tuple instances are 95.07%. This shows that Instance technology has a significant effect on the rendering performance improvement of the scene.

By observing the speed and distance of the golf ball in the practice scene, we can train the strength of our swing; by observing the trajectory and offset of the golf ball, we can train the standard of our swing. If the swing is not standard, the trajectory of the golf ball will be incorrect. We can switch the viewpoint in the scene to observe more intuitively, and there are three viewpoints set in the system. We can switch between them at will so that we can better observe the indicators of our swing, as shown in Table 3. In conclusion, Golf trainer has an important role in swing training. Through field debugging and a lot of experiments, this function meets the system requirements.

In the development process of the system 3D scene, there are still some problems in the articulation between various functional things, especially the articulation of

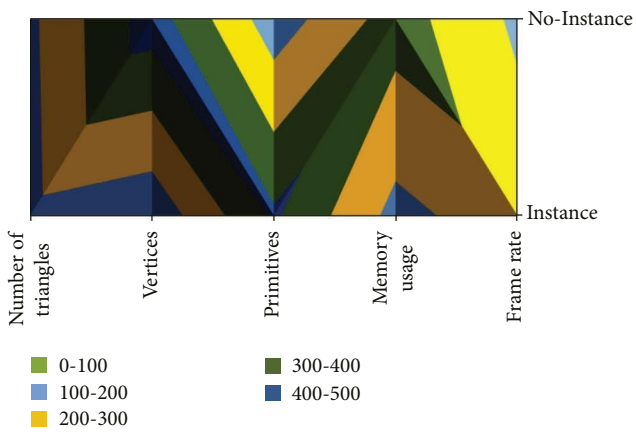

Figure 4: Rendering performance data.

the sky box still has defects. In the moment of hitting the ball, the scene sometimes flickers a bit. When the putter scene receives data to hit the ball, the putter scene will flicker a bit, which should be a problem when switching between data processing and scene rendering direct messages. Use three-dimensional technology to display the motion of the golf ball and the trajectory of the golf ball and calculate the distance of the golf ball. This is to be solved in future debugging. In the network online function module, the system can only support four players to join. This feature needs to be optimized and developed to allow a random number of players to train online. The implementation of this feature is subject to further development.

5.2. User Experience Relationship Results. When individuals face critical putting tasks, there is often an element of worry or fear at the root of anxiety in the mind, and training on breath awareness can help individuals identify feelings of safety and calmness. Second, the breath comes and goes freely, and attention to it can be achieved without undue distraction. That is, being aware of the breath allows one to observe one's thoughts more clearly when needed and to return one's attention calmly to the present moment, even during the briefest of breath meditations. Finally, the breath can be long or short, and can be adjusted whenever necessary, so that one can be aware of the state at this moment and obtain his own consciousness at this moment.

Clarity training focuses on improving the sharpness and vividness and realism of representations. It must be practiced by using all sensory experiences and performing the representation rehearsal as vividly and realistically as possible. It includes two elements: action recall training and scene recall training. For the action recall training, the putter is practiced before the exercise. Then, the subject is guided to close his eyes and imagine as much as possible the details of the movements of different parts of his body when he hits the ball. The tableau starts by seeing his ready position, the player looks at the hitting line with his eyes, sees and feels the action of his backswing to the apex, feels his body tense on his left and right legs, tilts his upper body slightly, swings the club like a pendulum, and sees the ball launched, far and straight, just landing in the middle of the fairway.

Table 3: The difference test of pre-test and post-test.

Name	Pre-test		Post-test	
	M	SD	M	SD
Acceptance of action	88.11	83.78	77.36	67.47
Fluency	82.46	85.45	77.86	90.8
Cognitive anxiety	61.46	60.65	99.46	65.89
Somatic anxiety	95.38	99.25	98.09	95.25
State of confidence	64.07	76.95	75.46	60.44
Putt hole (big hole)	61.24	89.08	96.08	82.12
Putt hole (small hole)	94.12	82.09	78.8	98.81

Scene recall training allows the subject to feel the change of mental state and feelings during the examination and competition situation. It includes imagining the game scene, standing on the tee, seeing the surrounding game scene, seeing the shape and color of the green, seeing the length and width of the course, the flatness of the turf, feeling the flow of the breeze and the sunshine, and making all kinds of feelings into their imagination; the more accurate and detailed the imagination, the better, as shown in Figure 5.

The positive thinking group scored significantly lower than the representational group in the acceptance action factor, indicating a significant reduction in behavioral avoidance, according to the statistical effect measure showing $r = 0.15$, and in this experiment, about 15% of the overall variance came from the larger effect of the experimental treatment.

The between-group difference in the post-test of positive thinking state between the phenotype group and the positive thinking group was 0.01, which was significantly less than 0.05, indicating that there was a significant difference in the post-test scores of positive thinking state between the two groups after removing the effect of the pre-test of positive thinking state. To improve the user experience of the virtual golf simulation system, the system needs to add some additional functions, such as virtual three-dimensional sound effects, multi-screen display, and other functions. The post-test scores of the total score of positive thinking in the phenom group were significantly lower than the post-test scores of the total score of positive thinking in the positive thinking group. According to the statistical effect measure showing $r = 0.40$, about 40% of the overall variance in this experiment came from the experimental treatment.

Traditional physical training is mainly for whole-body muscle development and has relatively little effect on core strength intervention. Core strength training is an effective training system for core muscle groups such as lumbar and abdominal muscle groups, back muscle groups, hip muscle groups, and so on. These muscle groups all belong to the mid-axis region of the body, and their main function is to maintain spinal curvature and stability, so that the generation, transmission, and control of force can be optimized. Therefore, the improvement of students' stability after core strength training is more obvious, which proves that core strength training is more targeted and effective for core

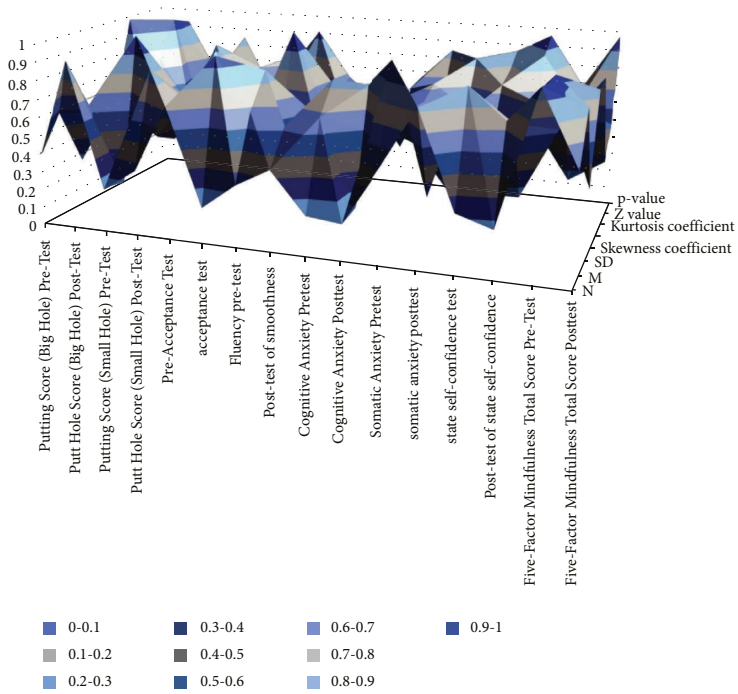

Figure 5: Normal distribution test chart of pre-test and post-test scores.

stability than traditional physical training, as shown in Table 4.

As shown in Table 4, after 18 weeks of training and golf instruction, both the experimental class and the control class improved their putting performance under the independent sample t-value test. The parameter (mean-$\pm$ standard deviation) of the big hole in the experimental class after the experiment was 7.75 ± 0.20, and the parameter of the control class was 6.30 ± 0.24, with a significant difference of P value <0.01. The mean value shows that the rate of large hole entry in the experimental class was 70% higher than 60% in the control class. The small hole is smaller in diameter than the big hole, so the accuracy of the putter is more demanding.

In conclusion, the effect of golf core strength training is higher than traditional physical training, putting plays a vital role in the golf game, and although the final game score is determined by the total number of strokes in 18 holes, putting accounts for more than 65% of the total number of strokes, and putting has a great influence on the player's performance in playing golf. Master the standard of your putter by observing the angle of the ball. Therefore, we should pay more attention to the training of putting technique. The golf putting technique is to lead, hit, and send the ball. The action is focused on the shoulder turn of the backswing, the release of the ball after a stable hit, and the body as the central axis of the shoulder turn to power the ball. Core strength training is a professional training aimed at fixing muscle groups. Its main function is to improve the core stability. The purpose is to control the posture and center of gravity of the body stably during the movement, so that the strength of the body and limbs can be transferred to the ends of the limbs with maximum efficiency. At the same time, it also has the power generation function. It can transfer the strength and control the center of gravity during the movement, so that the golfer can maintain body balance during high-speed movement.

Table 4: Comparison of putter accuracy parameters between the experimental class and the control class after the experiment.

Test items	Experimental class	Control class	T	P
Acceptance of action	83.6	73.63	90.67	71.87
Fluency	64.81	83.02	61.77	77.97
Cognitive anxiety	92.48	91.1	86.84	82.67
Somatic anxiety	69.81	74.58	70.08	64.19
State of confidence	97.95	71.22	80.55	71.97
Putt hole (big hole)	60.01	79.66	79.52	90.77
Putt hole (small hole)	97.16	88.61	92.18	62.14

6. Conclusion

The virtual golf grand simulation system is an application of virtual reality technology in sports training. It uses virtual reality technology to move the golf course indoors so that golf enthusiasts can break through the limitations of golf by space, time, and environment and get a realistic golf experience indoors. The design of the server-side system mainly includes the design of multi-threading, the design of data packets, the design of data protocols, and the distribution and management of interactive simulation data, while the design of the client-side network

communication module mainly includes the design of multi-threading, the coordination and management of local interactive simulation data, and the real-time sending and receiving of interactive simulation data. The functional requirements of the golf trainer software are completed. According to the system requirements, this thesis completes the training of golf swing function and golf putting function. Through the treatment of hitting speed, distance, hitting angle, and trajectory, the golf swing strength training and the standardization of swing action are completed. Through the processing of putt speed, distance, and putt angle, complete the golf putt strength and putt angle training. In the three-dimensional scene of the putter, the putter data are collected through the serial port, including the speed of the putter, the declination angle, and so on. After the overall debugging, analysis, and actual operating results of the system, the requirements of the system functions are met. It improves the level of the athlete's mind while improving the performance of sports behavior. When there is windy weather, athletes do not need to pay too much attention to the changes brought about by the weather, which affects the state of mind and affects sports performance, and athletes should always adjust their attention to the changes in the external environment so as not to judge or react, but to focus on the current putting behavior.

Data Availability

The dataset is available upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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