Research on the Application of Intelligent Bionic Robot Horse in Juvenile Equestrian Teaching

Case Study: Beijing Chaoyang Park Youth Equestrian Center

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Abstract. Research purposes: in this study, the intelligent bionic robotic horse is introduced into the equestrian teaching for teenagers, compared with the traditional teaching mode of using real horses. This research aims to explore the effectiveness of using intelligent bionic robotic horse in equestrian teaching for teenagers, as well as to promote the further development of equestrian teaching for teenagers in China, and to promote the introduction of new technology into the equestrian teaching area in the age of internet.

Research methods: literature method was used; Mathematical statistics; Interviewing the equestrian coaches who participated in the experiment; Experimental method. The intelligent bionic robotic horse used in this research is the GETTAEN intelligent bionic robotic horse produced by Joy Game Technology Co., Ltd.

The bionic robotic horse is equipped with Internet technology, and the course is supervised and produced by senior coaches of China Equestrian Team. It also includes multiple operation modes. In this study, 40 amateur students in Beijing Chaoyang Park Youth Equestrian Center were selected as the experimental subjects. Students will spend 40 h to study how to ride a horse. 20 students in the experimental group, they are accommodated with 20 h of bionic robotic horse courses and 20 h of real horse course; 20 students in the control group were taught in the traditional teaching mode with 40 h of real horse courses.

Results: ① horseback physical fitness test, the average value of the control group was 101.9 s; 325.6 s in the experimental group. Independent sample T test $p < 0.05$ has significant difference, the experimental group horseback physical performance is better than the control group.

② horseback physical balance test, the average value of the control group was 3.75, and the average value of the experimental group was 7.1. Independent sample T test $p < 0.05$ has significant difference, the experimental group horseback physical balance test results have significant difference, and the experimental group is better than the control group.

③ The interview method was used to interview the equestrian coaches who participated in the experiment, coaches think that the bionic robotic horse can speed up the learning progress and has a strong technical consolidation, especially for teaching amateurs; But for the time being, it cannot meet the training and improvement target of the actual horse control ability and the ability to grasp the route, and such experience is not real and good enough for senior students.

J. Sun et al. (Eds.): SSESD 2022, ASSEHR 684, pp. 522–536, 2023.
https://doi.org/10.2991/978-2-494069-13-8_62

Conclusion: using real horse and intelligent bionic robotic horse combined, one can improve the teaching effectiveness and promote students' adaptation to horseback and technical mastery. But for the time being, it is only suitable for students with weak foundation or zero foundation. The capability of intelligent bionic robotic horse needs to be strengthened, and technological innovation is needed to adapt to all kinds of students.

Keywords: intelligent bionic machine · Equestrian teaching · teenagers

1 Introduction

Equestrian is one of the permanent events of the Olympic Games. For a long time in the past, it was used as a means of long-distance transportation for the rich. The cost of managing a horse is very expensive, and horses need a lot of professional cares [1]. Compared with people, horses are big and heavy, so riding a real horse is often accompanied by the risk of falling [1]. Therefore, it is dangerous to start riding without proper training. But there has been no standard equestrian teaching system to solve this problem. In order to solve these problems, the outstanding concept is horse riding simulator, which is much cheaper than real horse riding, and protects us from injury due to the controllability of its movement, and uses visual or auditory programs to guide us to learn horse riding.

GETTAEN intelligent bionic robot horse is produced by JOY GAMES Technology CO., Ltd.

In this study, GETTAEN intelligent bionic robot horse is applied to youth equestrian teaching. Beijing Chaoyang Park Youth Equestrian Center puts bionic horse in the teaching course, and combines real horse course and bionic horse course to jointly promote the mastery of equestrian skills to teenagers.

This study aims to explore the application effect of intelligent bionic robot horse in youth equestrian teaching, as well as to promote the further development of equestrian teaching in China. Promote the introduction of new technology into modern equestrian teaching and observe its feasibility.

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2 Research Method

2.1 The Literature Method

According to the needs of this study, through the search of China HowNet, Baidu Library and China excellent master's full-text database, with the keywords of "equestrian",

"Equestrian Training", more than 120 documents were found. Read in the reference room and electronic reading room of the library of Capital Institute of physical education, and refer to the work reports of Beijing Municipal Bureau of sports, equestrian association, and other relevant departments. And read professional equestrian magazines, collect relevant data and materials, and sort out valuable academic papers, master's papers and other relevant literature related to this study, as well as to provide theoretical basis for the research of this paper [2].

2.2 Experimental Method

2.2.1 Subjects

Students of the 2021 winter vacation class at Beijing Chaoyang Park Youth Equestrian Center. Class A1 and A2, each class 20 students, a total of 40 students. The number of boys and girls is the same, and they are all beginners in learning equestrian.

2.2.2 Experimental Instruments

Under the GETTEAN intelligent bionic robot horse professional course mode produced by Joy Game Technology Co., Ltd, students can independently complete the learning and practice of equestrian professional knowledge through the courses carried by the equipment. Each teaching content is equipped with well-made explanation recordings, demonstration videos and equipment simulation actions matching the video actions for students to learn and practice. For the knowledge points they have not mastered, students can also look back one by one, practice and review repeatedly and many times.

The course is supervised and produced by senior coaches of the Chinese Equestrian Team. The teaching content is rigorous, the teaching means is rich, and the teaching objectives are scientific (Figs. 1, 2 and 3).

2.2.2.1 Assisted Teaching Mode

In the assisted teaching mode, the coach can use the remote control to control the equipment to simulate the pace of horse movement, including walk, gallop, trot, running, left running, right running, etc. At the same time, in the running state, the action state of left running and right running can be realized through the rein sensor to simulate the real horse control environment.

Fig. 1. Course interface - Sitting posture

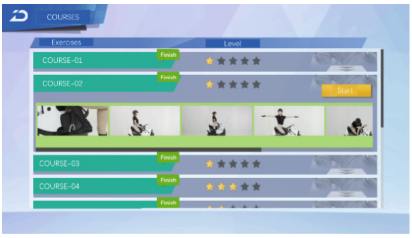

Fig. 2. Learning interface of the course

Fig. 3. Detailed explanation of action posture

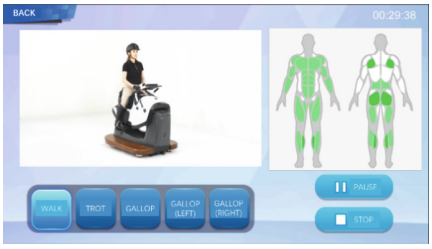

Fig. 4. Horse gait simulation

Coaches can use the remote control in their hands to start or pause the current practice at any time.

In the assisted teaching mode, coaches can scientifically train students' movement skills according to their proficiency in different movement essentials, so as to help students to correct wrong movements.

At the same time, students can also switch some actions in this mode by controlling the rein (Fig. 4).

2.2.2.2 Intensive Training Mode

This mode is specially designed for the physical fitness of athletes, aiming at enhancing the physical fitness of athletes through long time, high intensity and uninterrupted equipment exercise.

In intensive training mode, more horse gait simulation is available (Fig. 5 and Table 1):

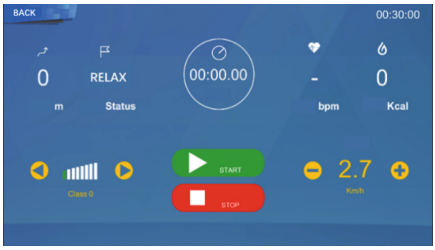

Fig. 5. Adjustment panel

Table 1. Gear speed correspondence

ID	Speed (km/h)	Intensity Level
0	2.7	Level 1
1	4.5	Level 2
2	6.5	Level 3
3	18	Level 4
4	19.5	Level 5
5	21	Level 6
6	30	Level 7
7	35	Level 8

2.2.2.3 Real Scene Experience Mode

The live experience mode can make the students feel the competition atmosphere at different levels in advance, enrich the teaching content, make the learning no longer boring, and increase the students' interest in continuing in-depth learning.

In this mode, the device will interact in real time with the competition video displayed on the screen. Students will feel immersive when riding on the device, as if they are galloping in the field of high-level events. Coaches can use this mode in different teaching stages according to the actual situation, so that students can understand and preview the next teaching content in advance, and stimulate students' interest in learning equestrian (Figs. 6 and 7).

2.2.3 Experimental Process

Group A: there are 20 people in the experimental group. The students in this group take the bionic horse and real horse courses with 40 saddles. The bionic horse and real horse take half of the time respectively. Before each technical study, they first practice the bionic horse and then go to the real horse (Fig. 8).

Group B: 20 people are the control group. The students in this group have all real horse courses at 40 saddles.

Fig. 6. Real operation mode

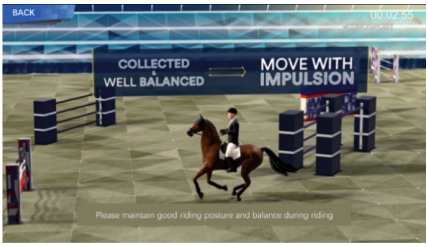

Fig. 7. Obstacle course demonstration

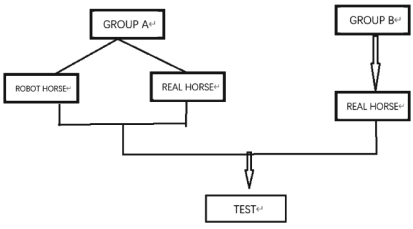

Fig. 8. Experimental flow chart

Examination content: the preliminary examination of Chaoyang Park Equestrian Club, including:

① Physical fitness test: Counter clockwise fast step up and sit in circles for sustainable time.

② Horseback balance test: The number of times that can be completed in one minute.

Action specification: after the body establishes the correct sitting posture, bend forward and extend the right hand to the front left of the horse. According to their own physical flexibility, touch the left foot as much as possible. After touching the left foot, get up and return to the correct sitting posture. Bend forward and extend the left hand to the front right of the horse. According to their own physical flexibility, touch the right foot as much as possible. In this cycle, each time you touch either side, it can be calculated as one time.

After collecting all the data of the above tests, analyze and summarize the data.

2.2.4 Test Time

September 1, 2020–March 1, 2021.

2.2.4.1 Enrolments Stage

From September 1 to January 31, 2020, they are zero basic teenagers among primary and secondary school students in Beijing.

2.2.4.2 Course Arrangement

January 31, 2021–March 1, 2021.

The training frequency of students is five days a week and two hours per class. A total of 20 days, 40 h. The preparation time for each class is 30 min, including putting on and taking off equestrian tools, preparing horses in the horse shed, etc., and 90 min is the net time for practice. When one saddle is every 45 min, the net time of each training is 2 saddle hours, a total of 40 saddle hours.

2.2.5 Time and Place

Beijing Chaoyang Park Youth Equestrian Club, gate 3, Chaoyang Park West, No. 1, Chaoyang Park South Road, Chaoyang District, Beijing.

2.3 Mathematical Statistics

The experimental group and the control group were tested after different teaching modes. The collected equestrian test data were processed by SPSS18.0 software. In the process of questionnaire data processing, the data in the paper literature should also be combed and integrated. On this basis, the data processing of this test should be cautious, which is valuable for the data obtained this time and can be used as a reference for future work.

2.4 Logical Analysis Method

This paper makes an in-depth theoretical exposition based on relevant research problems and relevant materials. As a system, according to the requirements of systematic research, this study makes a comprehensive research based on overall grasp of systematic, dynamic, relevant and orderly [2].

2.5 Interview Method

According to the purpose of this study, the relevant staff, equestrian coaches, riders and some equestrian club members of the experimental course of Chaoyang Park Youth equestrian club were interviewed to understand the subjective feelings of the staff in the learning and training of intelligent bionic robot horse, and whether the bionic horse is convenient to use? Whether it provides convenience for teaching and whether it can help promote the teaching progress.

3 Research Results and Analysis

3.1 Research Results and Analysis of Equestrian Teaching Experiment

See Tables 2 and 3.

Table 2. Post test results of control group (group A)

Group	Fitness time (s)	Balance time (times)
A1	3′ 37″	6
A2	2′ 29″	5
A3	59″	4
A4	1′ 03″	3
A5	2′ 24″	6
A6	1′ 59″	3
A7	48″	2
A8	26″	1
A9	2′ 17″	5
A10	1′ 22″	3
A11	1′ 07″	3
A12	56″	3
A13	2′ 01″	4
A14	2′ 26″	5
A15	3′ 02″	7
A16	1′ 01″	3
A17	1′ 23	2
A18	1′ 34″	4
A19	1′ 53″	2
A20	1′ 11″	4

Table 3. Post test results of control group (group B)

Group	Fitness time (s)	Balance time (times)
B1	5′ 37″	4
B2	6′ 12″	7
B3	7′ 11″	5

(*continued*)

Table 3. (*continued*)

Group	Fitness time (s)	Balance time (times)
B4	5′ 52″	4
B5	4′ 37″	4
B6	6′ 59″	8
B7	3′ 37″	4
B8	6′ 07″	3
B9	4′ 47″	8
B10	5′ 13″	7
B11	8′ 07″	13
B12	7′ 22″	10
B13	4′ 55″	7
B14	5′ 43″	5
B15	6′ 19″	7
B16	6′ 22″	8
B17	6′ 01	9
B18	7′ 22″	9
B19	7′ 32″	9
B20	8′ 00″	11

3.1.1 Physical Fitness Test Results

See Tables 4, 5 and 6.

3.1.2 SPSS Analysis of Physical Fitness Test Results

In the horseback physical fitness test after 40 saddle time learning, the average value of the control group (group A) was 101.9 s; The average value of the experimental group (group B) was 325.6 s. After the independent sample t-test conducted by sppss18.0, it is found that there is a significant difference between $P < 0.05$, then there is a significant difference in horseback physical fitness between the experimental group and the control group, and it can be seen from the experimental results that the performance of the experimental group is significantly better than that of the control group (Tables 7 and 8).

3.1.3 Horse Back Balance Test Results

See Table 9.

Table 4. Results of horseback physical fitness test in the control group

Group	Fitness test (s)
A1	217
A2	149
A3	59
A4	63
A5	144
A6	119
A7	48
A8	26
A9	137
A10	82
A11	67
A12	56
A13	121
A14	146
A15	182
A16	61
A17	83
A18	94
A19	113
A20	71

Table 5. Results of horseback physical fitness test of experimental group

Group	Fitness test (s)
B1	337
B2	192
B3	431
B4	352
B5	277
B6	419
B7	217
B8	367

(*continued*)

Table 5. (*continued*)

Group	Fitness test (s)
B9	287
B10	313
B11	482
B12	442
B13	295
B14	343
B15	379
B16	382
B17	361
B18	442
B19	452
B20	480

Table 6. Rest results of experimental group (group B)

Group	Fitness test (s)	Balance test (times)
B1	5′ 37″	4
B2	6′ 12″	7
B3	7′ 11″	5
B4	5′ 52″	4
B5	4′ 37″	4
B6	6′ 59″	8
B7	3′ 37″	4
B8	6′ 07″	3
B9	4′ 47″	8
B10	5′ 13″	7
B11	8′ 07″	13
B12	7′ 22″	10
B13	4′ 55″	7
B14	5′ 43″	5
B15	6′ 19″	7
B16	6′ 22″	8

(*continued*)

Table 6. (*continued*)

Group	Fitness test (s)	Balance test (times)
B17	6′ 01	9
B18	7′ 22″	9
B19	7′ 32″	9
B20	8′ 00″	11

Table 7. Statistics of physical fitness test group

Fitness test	Group	Number of cases	average	Standard deviation	Average value of standard error
	A	20	101.9000	49.41755	11.05010
	B	20	362.5000	82.30080	18.40302

Table 8. Independent sample t-test of physical fitness test

Fitness test		Levin variance test		Mean equivalence t-test	
		F	significance	t	Significance (2 tail)
	Assumed equal variance	3.873	.056	−12.140	.000
	Equal variance not assumed			−12.140	.000

Table 9. Post test results of control group (group A)

Group	Fitness test (s)	Balance test (times)
A1	3′ 37″	6
A2	2′ 29″	5
A3	59″	4
A4	1′ 03″	3
A5	2′ 24″	6
A6	1′ 59″	3
A7	48″	2
A8	26″	1
A9	2′ 17″	5

(*continued*)

Table 9. (*continued*)

Group	Fitness test (s)	Balance test (times)
A10	1′ 22″	3
A11	1′ 07″	3
A12	56″	3
A13	2′ 01″	4
A14	2′ 26″	5
A15	3′ 02″	7
A16	1′ 01″	3
A17	1′ 23	2
A18	1′ 34″	4
A19	1′ 53″	2
A20	1′ 11″	4

Table 10. Statistics of horseback balance test group

Balance test	Group	Cases number	average	Standard deviation	Average value of standard error
	A	20	3.75000	1.55174	.34698
	B	20	7.1000	2.67346	.59780

3.1.4 SPSS Analysis of Horseback Balance Test Results

In the horseback balance test after 40 saddle time learning, the average value of the control group was 3.75 times and that of the experimental group was 7.1 times. After the independent sample t-test conducted by sppss18.0, it is found that there is a significant difference ($P < 0.05$). Therefore, there is a significant difference between the experimental group and the control group. From the experimental results, it can be seen that the experimental group is better than the control group. That is, students with bionic robot horse learning have better performance in horseback balance test (Tables 10 and 11).

3.2 Interview Results and Analysis of Equestrian Coaches

Through interviews with 4 coaches and 2 participants participating in the teaching experiment, they all believe that the addition of bionic mechanical horse can greatly promote the effect and progress of equestrian teaching. At the same time, they have some ideas and suggestions:

Table 11. Independent sample t-test of horseback balance test

Balance test		Levin variance equivalence test		Mean equivalence t-test		
		F	significance	t	variance	Significance (2 tails)
	Assumed equal variance	4.588	.039	−12.140	38	.000
	Equal variance not assumed			−12.140	30.497	.000

① However, at present, the noise of the equipment is still large. When many people practice at the same time, it will inevitably interfere with the surrounding students. It is suggested to continuously improve the mechanical structure and reduce the noise.

② The current jumping action of the equipment intelligently simulates the obstacle height of 30 cm–50 cm, which is suitable for junior students with about 100 saddle hours. In the future, it is necessary to develop the jumping simulation function with higher height and longer distance, so that higher-level students can also practice with it.

It can be seen that the bionic robot horse is still a new thing and needs further scientific and technological development to make a breakthrough. Develop new machines with stronger and more complete functions.

4 Conclusion

Bionic robot horse is added to youth equestrian teaching, and the teaching effect is remarkable. The results of horseback physical fitness test and balance test between the experimental group and the control group after 40 saddle time learning show that there are significant differences between the experimental group and the control group, and it can be seen from the experimental results that the results of the experimental group are better than those of the control group.

Bionic horse can promote the learning of equestrian beginners. In the interview with coaches, they generally believe that bionic horses can speed up the teaching progress and have strong technical consolidation, especially for the teaching of zero foundation.

5 Recommendations

The intelligence of intelligent bionic robot horse needs to be strengthened, and technical innovation is needed to suit students in various situations. The current jumping action of the equipment intelligently simulates the obstacle height of 30 cm–50 cm, which is suitable for junior students with about 100 saddle hours. In the future, it is necessary to develop the jumping simulation function with higher height and longer distance, so that higher-level students can also practice with it.

At present, the noise of the equipment is still loud. When many people practice at the same time, it will inevitably interfere with the surrounding students. It is recommended to continuously improve the mechanical structure and reduce the noise. It can be seen that the bionic robot horse is still a new thing and needs further scientific and technological development to make a breakthrough. Develop new machines with stronger and more complete functions.

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