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RESEARCH ARTICLE

An Experiment Of Using Virtual Technology In Basketball Drilling Skills Training

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ABSTRACT

This study evaluates the effectiveness and advantages of using Virtual Reality (VR) in basketball dribbling training. In the study, participants from Hulunbuir University were divided into three groups: a control group or a training group with special exercises, an experimental group and a training group using VR, and a comparison group or a traditional training group. Pre- and post-tests were conducted for all three groups. In the VR training of the experimental group, we observed basketball dribbling using a VR headset, HTC Vive, and engaged in specific VR exercises designed to improve dribbling skills. The results were analyzed using the ANOVA research method to study the performance of this group. The study results showed no significant difference in the basketball dribbling skills of the control training group and the comparison group. However, there was a substantial difference in the speed and time of basketball dribbling skills of the VR training group compared to the other two groups (traditional training and no training group), and the performance was significantly improved. This study is useful for increasing research to determine the effectiveness of modern technology in basketball dribbling skills training, making virtual reality technology one of the new practical learning methods.

INTRODUCTION

Nowadays, there is an increasing demand for the introduction of various new technologies to support the learning process, especially in the education sector. In this regard, to keep up with technological developments and not lag behind global developments, educational institutions and schools face a new challenge to equip their teachers, students, and staff with the skills to use VR technology and introduce it into their training.

The use of immersive and interactive technologies to adapt to various learning styles and teaching styles is essential in the education system (Abulrub, Abdul-Hadi G., Attridge, Alex and Williams, M. A, 2011). Virtual education is a modern revolution in educational methods and techniques using the latest technological achievements and discoveries in learning (Munawar Hussain, Zainab Mehmood Qureshi, Shazia Malik, 2024). Nowadays, the use of VR technology in training can have advantages in increasing students' activity and effort and attracting their interest and participation. The use of virtual technology in many fields, such as education, military and police organizations, and healthcare organizations, has increased dramatically. In addition, VR technology is used in various sports, including skiing and basketball (Cotterill, 2018). These modern technologies are becoming excellent tools for increasing the quality and speed of training and developing motor skills and training (Craig, 2013). A player spends a lot of time and effort mastering basketball skills and improving their performance, and the success of a team game largely depends on the player. In addition to traditional physical education methods, studying how to use virtual technology to teach some basketball skills

is very important for choosing innovative learning methods and interactive educational technology methods. Therefore, this study investigates the advantages and effects of using virtual technology in learning basketball dribbling skills.

METHODOLOGY

The research methodology employed a unique three-group experimental design, setting it apart from conventional studies in the field. This design included a control group undergoing intensive exercise training, an experimental group testing virtual technology in intensive exercise, and a comparison group receiving traditional training without any additional intervention. Pre- and post-tests were then conducted to compare the outcomes of these three groups.

A total of 30 volunteer students, who were the research sample, participated in the pilot study in the basketball hall of the school's physical education department. The 30 sophomore students from the physical education department were selected for the study, ensuring a diverse and representative sample. The participants were physically active and athletic second-year students of Hulunbuir University, with an average age of 19-20, an average weight of 62, and an average height of 170.

The study sample comprised 10 experimental group students exposed to a novel form of exercise training using virtual reality (VR) technology. These students were randomly selected from a pool of 30 volunteers from the physical training department. The participants, all second-year students of Hulunbuir University, were physically active and athletic, with an average age of 19-20, an average weight of 62, and an average height of 170.

The study sample consisted of 10 students in the virtual reality (VR) technology-assisted training group, 10 students in the control group using the intensive physical training method (verbal explanation - practical model - practical implementation in person), and 10 students who did not participate in the above two training methods participated in the comparison group.

- First group: The comparison group of 10 students who participated in traditional training. They did not join in either intensive physical exercise or VR training session
- Second group (Experimental group 1): 10 students from the control group who received intensive physical exercise training
- Third group: 10 students from the experimental group who received intensive physical exercise training with VR training

The study utilized a virtual reality headset (HTC Vive) to observe and test virtual reality in an educational environment, effectively combining active physical exercise with active physical exercise. The headset, equipped with a hand controller and a motion-tracking device, allowed participants to move in 3D space and interact with the environment, making it a suitable technology for gym measurements.

The experimental group with VR tested the hypothesis that performance was significantly faster than the control and comparative groups; their performance completion times were likely to differ between the control and comparative groups. The findings of this experiment, which were obtained through a rigorous methodology, including a one-way ANOVA to test the hypothesis and a paired t-test to compare the experimental groups, have practical implications for the design of exercise training programs. An exercise to assess basketball dribbling skills measured participants' speed, and each participant's completion time (in seconds) was recorded.

The pre-training and post-training performance of the dribbling skills were compared for the experimental group, the control group, and comparative group.

Right-handed fast-ball dribbling skills over a straight path at a distance of 1.15 m

ANOVA analysis of variance

A one-way ANOVA analysis of variance was performed to determine whether the differences in mean performance times between the groups were statistically significant.

Table 6. ANOVA analysis of variance

Data	SS	df	MS	F	p-утга
Between groups	1.925	2	0.9625	4.30	0.027
Within groups	6.045	27	0.224		
Total	7.970	29			

The F-statistic is 4.30 and the p-value is 0.027. Since the p-value is less than the 0.05 level, the null hypothesis (H_0) is rejected, and it is statistically significant, that the VR-based training experimental group has a faster and better performance difference in basketball dribbling performance than the other two groups.

T-test study

An independent sample t-test was used to examine the performance differences between the experimental groups. The null hypothesis (H_0) assumed that there was no significant difference between the two experimental groups, while the alternative hypothesis (H_1) showed that there was a difference.

Table 7. T-test study

Groups	Дундаж ялгаа	t-value	df	p-value	Conclusion
Control group	1.38	4.52	9	< 0.05	Significantly different (Null hypothesis H_0 rejected)
Experimental group	0.95	2.57	9	< 0.05	Significantly different (Null hypothesis H_0 rejected)
Comparison group	0.58	2.17	9	> 0.05	No significant difference (Null hypothesis H_0 failed to be rejected)

The results of the t-test confirmed that there was a statistically significant difference between the pre- and post-test performance of the three groups.

ANOVA analysis of variance

Pre-test left-hand straight		
comparison group	**control group**	**experimental group**
4.45	4.11	4.40
4.76	3.32	3.31
4.21	3.61	3.88
4.11	4.10	4.41
4.66	5.10	4.66
4.83	3.82	5.01
5.17	4.22	5.14
4.34	3.26	4.80
4.58	3.61	5.50
4.65	3.41	4.92

Post-test left-hand straight		
comparison group	**control group**	**experimental group**
4.28	3.46	4.0
4.60	3.09	3.0
4.10	3.10	3.2
3.99	3.66	3.3
4.55	3.75	4.2
4.65	2.25	3.6
4.84	3.18	3.4
4.16	2.86	4.0
4.23	3.45	4.3
4.18	3.14	3.4

A repeated measures ANOVA analysis of variance was used to compare the results before and after the left-hand rotation test between groups (comparison group, control group, and experimental group).

Group	**Mean Pre-test**	**Mean Post-test**	**Mean Difference**	**t-statistic**	**p-value**
Comparison	4.57	4.35	0.21	5.63	0.0021
Control	3.85	3.19	0.66	4.26	0.0003
Experimental	4.60	3.65	0.95	5.94	0.0002

RESULT

1. Comparison group:

The mean time before and after the test was 0.21 seconds, a slight difference, and a statistically significant difference (p = 0.0021).

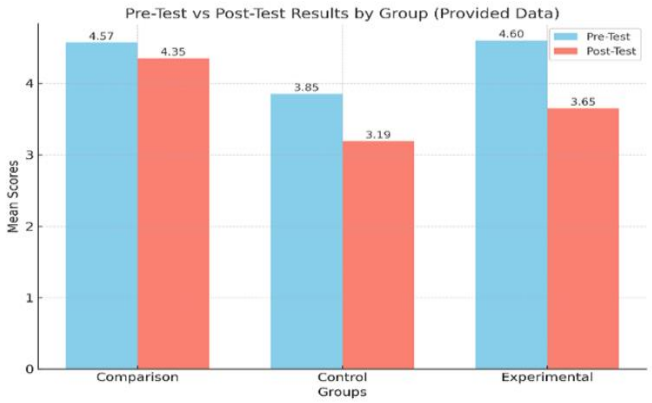
2. Control group:

The mean time before and after the test was 0.66 seconds, a statistically significant difference (p = 0.0003).

3. Experimental group:

The mean time before and after the test was 0.95 seconds, a statistically significant difference (p = 0.0002).

All groups had faster performance times than before in the pre-test and post-test comparisons, and statistically significant improvements were observed, with the control and experimental groups showing the greatest changes.



Pre-test right hand straight		
comparison group	**control group**	**experimental group**
4.07	3.55	4.00
4.25	4.00	3.91
4.89	3.58	3.73
4.05	4.11	4.31
5.50	5.03	4.50
5.31	5.23	4.80
5.32	5.40	4.41
5.15	5.33	5.23
5.04	5.24	5.60
5.24	5.50	5.05

Post-test right hand straight		
comparison group	**control group**	**experimental group**
3.98	3.30	3.73
3.99	2.99	3.30
4.79	2.30	3.40
3.97	3.91	4.22
3.95	4.89	4.30
3.23	3.60	4.40
2.91	3.91	4.00
3.09	2.99	4.80
3.18	3.06	3.20
3.16	2.96	4.80

Arepeated measures ANOVA analysis of variance was used to compare the pre-and post-test results of the right-hand fast straight test between groups (comparison, control, and experimental groups).

Group	**Mean Pre-Test**	**Mean Post-Test**	**Mean Difference**	**T-Statistic**	**P-Value**
Comparison	4.88	3.62	1.25	4.01	0.0031
Control	4.69	3.39	1.30	4.59	0.0013
Experimental	4.55	4.01	0.53	2.55	0.0314

RESULT

1. Comparison group:

The mean time difference between the pre-and post-test was 1.25 seconds, which was statistically significant ($p = 0.0031$).

2. Control group:

The study revealed a mean time difference of 1.30 seconds between the pre-and post-test, a statistically significant finding ($p = 0.0013$).

3. Experimental group:

The mean time difference between the pre-and post-test was 0.53 seconds, which was statistically significant ($p = 0.0314$).

However, for the experimental group with VR, there was no significant change in pre- and post-test performances for the right-hand straight dribbling speed.

experimental group).

Group	Mean Pre-test	Mean Post-test	Mean Difference	t-statistic	p-value
Comparison	4.57	4.35	0.21	5.63	0.0003
Control	3.85	3.19	0.66	4.26	0.0021
Experimental	4.60	3.65	0.95	5.94	0.0002

RESULT

1. Comparison group:

The mean time before and after the test was 0.21 seconds, a slight and statistically significant difference (p = 0.0003).

2. Control group:

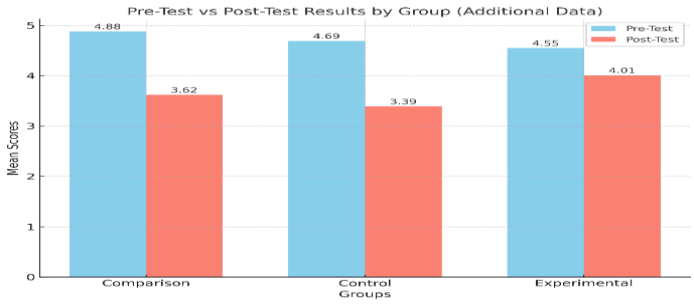
The mean time before and after the test was 0.66 seconds, a statistically significant difference (p = 0.0021).

3. Experimental group:

The mean time before and after the test was 0.95 seconds, a statistically significant difference (p = 0.0002).

All groups performed faster than before in the pre-test and post-test comparisons, and statistically significant improvements were observed. The comparison and experimental groups showed the greatest changes.

A repeated measures ANOVA analysis of variance was used to compare the pre- and post-test results of the right-hand-straight test between groups (comparison group, control group, and experimental group).



Group	Mean Pre-Test	Mean Post-Test	Mean Difference	T-Statistic	P-Value
Comparison	4.88	3.62	1.25	4.01	0.0031
Control	4.69	3.39	1.30	4.59	0.0013
Experimental	4.55	4.01	0.53	2.55	0.0314

RESULT

1. Comparison group:

The mean time difference between pre-test and post-test is 1.25 seconds, which is statistically significant (p = 0.0031).

2. Control group:

The mean time difference between pre-test and post-test is 1.30 seconds, which is statistically significant (p = 0.0013).

3. Experimental group:

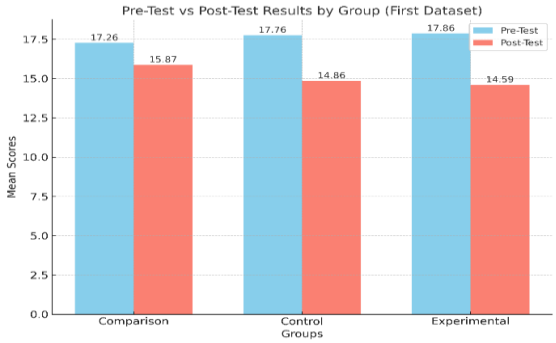
The mean time difference between pre-test and post-test is 0.53 seconds, which is statistically insignificant (p = 0.0314).

3. Performance of right-handed hurdling dribbling passing over a hurdle at a distance of 15 m

The pre-test and post-test results were compared between groups (comparison group, control group, experimental group) using repeated measures ANOVA analysis of variance.

Group	**Mean Pre-Test**	**Mean Post-Test**	**Mean Difference**	**T-Statistic**	**P-Value**
Comparison	17.25	15.87	1.38	6.06	0.000187
Control	17.76	14.85	2.90	4.65	0.001201
Experimental	17.86	14.59	3.26	11.89	0.000000083

Ability to dribble a ball with the right hand hurdling at a speed of 15 m over a hurdle



RESULT

1. Comparison group:

The difference in mean time between pre-test and post-test was 1.38 seconds, statistically significant (t=6.062, p<0.001).

2. Control group:

The difference in mean time between pre-test and post-test was 2.9 seconds, statistically significant (t=4.651, p<0.01).

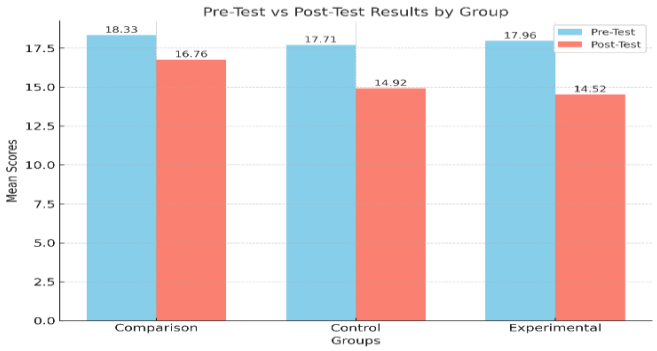
3. Experimental group:

The difference in mean time between pre-test and post-test was 3.2 seconds, statistically significant (t=11.897, p<0.001).

Ability to dribble a ball with the left hand hurdling at a speed of 15 m over a hurdle:

A repeated measures ANOVA was used to compare the pre-test and post-test results between groups (comparison group, control group, experimental group).

Group	**Mean Pre-Test**	**Mean Post-Test**	**Mean Difference**	**T-Statistic**	**P-Value**
Comparison	18.33	16.76	1.57	9.46	0.000006
Control	17.71	14.91	2.79	3.86	0.003850
Experimental	17.95	14.52	3.43	6.14	0.000170



RESULT:

1. Comparison group:

The difference in mean time between pre-test and post-test was 1.57 seconds, statistically significant ($t=9.460$, $p<0.001$).

2. Control group:

The difference in mean time between pre-test and post-test was 2.79 seconds, statistically significant ($t=3.860$, $p<0.01$).

3. Experimental group:

The difference in mean time between pre-test and post-test was 3.43 seconds, statistically significant ($t=6.143$, $p<0.001$).

CONCLUSION

1. The study of the theoretical and practical basis for using virtual reality technology in training has led to a reassuring conclusion: it has a positive impact on basketball dribbling performance, enhancing the skills of the players.
2. As can be seen from previous studies, students' right-handed dribbling is higher than their left-handed dribbling, and this study confirmed that left-handed dribbling skills can be improved using virtual reality technology to bring them to the same level as right-handed dribbling skills.The students' symmetrical dribbling technique can be improved by watching and reflecting on virtual reality technology and practicing repeatedly. This not only leads to significant improvements but also opens up a world of potential for further improvement and development of passing and dribbling skills.
3. The student's interest gave rise to the hope that VR technology can provide an opportunity for easy self-expression in learning, increase self-confidence, and strengthen theoretical knowledge and practical skills quickly. This study answered two questions: "How can VR technology be used as a learning tool?" and "Will the use of VR technology in training improve student performance?"
4. The use of VR technology in basketball dribbling training not only enhanced learning outcomes but also significantly boosted student motivation, leading to substantial performance improvements.
5. The methodological research on the improvement of dribbling skills was carried out in cold weather, and there was a problem with heating the experimental gym. The low indoor temperature of the gym caused the students to move slowly and uninterestedly. Therefore, if the indoor temperature of the classroom where the lessons were held affected the students' activity, these factors did not affect the experiment using VR.

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