Development of 3D Digital Animation-Based Basketball Shooting Training for Amateur Athletes

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Abstrak

Proses pembentukan bakat yang dimiliki oleh seorang atlet, perlu untuk dilakukan sejak usia dini. Sehingga para pelatih diharuskan mampu merancang berbagai media modifikasi latihan sesuai dengan klasifikasi umur. Salah satunya yaitu memanfaatkan media teknologi berbasis video 3D digital animasi. Penelitian ini bertujuan untuk mengetahui nilai validitas dan reliabilitas pada media latihan serta efektivitas pada media program latihan *animals name* berbasis berbasis *3D digital animation* untuk meningkatkan *shooting free throw* pada atlet kelas amatir. Populasi dalam penelitian ini berjumlah 40 atlet amatir yang dimana dasar pengambilan sampel menggunakan *Total Sampling* sehingga sampel dalam penelitian ini berjumlah 40 atlet. Selain itu, penelitian ini melibatkan 7 validator dari disiplin ilmu yang mendukung penlitian ini. Sebelum data dianalisis dilakukan terlebih dahulu uji persyaratan analisis, yakni uji normalitas dan uji homogenitas. Analisis data dilakukan dengan uji-t untuk perbandingan data berpasangan menggunakan SPSS versi 26. Hasil dalam penelitian ini menunjukkan bahwa nilai validitas sebesar 0,864 dan reliabilitas sebesar 0,980 > 0.05. Sehingga hal ini menunjukkan bahwa produk media latihan *animals name* berbasis 3D digital animasi valid dan reliabel. Selain itu, hasil produk tersebut efektif setelah diimplementasikan kepada para atlet kelas amatir, yang dimana pada hasil uji efektivitas menggunakan uji *Paired Sample T-Test* mendapati nilai Sig. (2-tailed) sebesar 0,000. Berdasarkan dari hasil penelitian tersebut dapat disimpulkan bahwasannya produk media latihan berbasis 3D digital animasi mendapati hasil yang positif, valid, dan reliabel. Sehingga produk ini menjadi solusi bagi para pelatih dalam memberikan pelatihan khususnya para atlet amatir dalam melakukan gerakan teknik *shooting Free Throw* permainan bola basket.

Kata Kunci: Media; 3D Digital Animasi; Shooting; Bola Basket; Atlet.

Abstract

The process of developing the talent of an athlete needs to be carried out from an early age. Therefore, coaches are required to design various training modification media according to age classification. One of them is to utilize technology media based on 3D digital animation

video. This research aims to determine the validity and reliability values of the training media and the effectiveness of the training program media named animals, based on 3D digital animation, to improve free throw shooting in amateur class athletes. The population in this study consists of 40 amateur athletes, and the sampling method used is Total Sampling, resulting in a sample size of 40 athletes. In addition, this study involved 7 validators from disciplines that support this research. Before the data was analyzed, preliminary tests were conducted for analysis requirements, namely normality tests and homogeneity tests. Data analysis was performed using t-tests for paired data comparisons using SPSS version 26. The results of this study show that the validity value is 0.864 and the reliability is 0.980 > 0.05. This indicates that the media product for practicing animal names based on 3D digital animation is valid and reliable. In addition, the product's results are effective after being implemented to amateur class athletes, where the effectiveness test using the Paired Sample T-Test found a Sig. (2-tailed) value of 0.000. Based on these research results, it can be concluded that the 3D digital animation-based training media product shows positive, valid, and reliable results. Therefore, this product becomes a solution for coaches in providing training, especially for amateur athletes in executing Free Throw shooting techniques in basketball.

Keywords*: Media, 3D Digital Animation, Shooting, Basketball, Athlete.*

Introduction

The process of talent development possessed by an athlete needs to be carried out from an early age (Yang et al., 2022). Therefore, coaches are required to be able to design various training media modifications according to age classification (Hassan et al., 2023). One of them is to utilize technology-based media such as video animation (Allahabadi et al., 2024). Over time, technology continues to evolve; however, in using technology as training media, there are several factors that need to be considered such as the characteristics of the athlete, the surrounding environment, and the type of training media used (Martínez et al., 2022). This modification becomes a very important element during the training process (Lin et al., 2023). The use of appropriate training media can help improve the quality of athletes and assist them in gaining broader insights (Osken & Onay, 2022).

3D Digital Animation-based video training media can make the training process more interactive and inspiring,

thus encouraging athletes to actively participate in the training process and develop their creativity through role-playing modifications (Di Mattia & Krumer, 2023). Role-playing can foster character traits in amateur class athletes (Griffin et al., 2022), one of which involves using animal names such as frogs, kangaroos, and giraffes. These three animals represent the implementation of basic movement techniques in shooting free throws in basketball. A person's skills serve as a benchmark in carrying out various activities, both professionally and amateurishly, as a player will perform many technical and tactical movements and actions while on the field or in the competition arena (Fazel et al., 2022). Many findings and researchers agree and prove that an athlete's skills will facilitate the execution of various activities, for example, engaging in sufficient physical activity to provide beneficial effects for a person's body/health (Patrick et al., 2023).

This research aims to contribute to the training process on the basic shooting free throw techniques in basketball

performed by athletes using video modifications of Animals Name by acting as animals based on Digital Animation to examine the effectiveness and feasibility of the model. The researcher then defines several questions, namely: What is the design of the animals name development model based on digital animation to improve the shooting free throw among amateur athletes? Furthermore, how feasible is the animals name development model based on digital animation to enhance shooting free throw performance in amateur athletes? And how effective is the animals name development model based on digital animation to improve shooting free throw among amateur athletes? Researchers hypothesize that there are positive results in terms of design, feasibility, and effectiveness that are very significant in improving free throw shooting skills for amateur athletes themselves. The findings of this study serve as the basis for focusing on the context of sports innovation and health based on science and technology, particularly in the basketball sport towards achieving gold performance. The specification of this research is in the field of research focus on innovation & steam development. The ultimate goal of this activity is to reduce the level of knowledge of athletes that is still not optimal, because this activity will facilitate athletes in the training process and optimize athletes in achieving performance.

This modification becomes a very important element during the training process (Jildeh et al., 2021). The use of appropriate training media can help improve the quality of athletes and assist them in exploring broader insights (Hasan et al., 2023). In addition, video-based training media using 3D Digital Animation can make the training process more interactive and inspiring, encouraging athletes to participate more actively in the

training process and to develop their creativity through role-playing modifications. Role-playing can instill characteristic traits in amateur athletes (Nakase et al., 2020), one of which involves taking on the roles of animals such as frogs, kangaroos, and giraffes. The outcomes associated with these three animals represent the implementation of fundamental movement techniques for shooting free throws in basketball, and the Wall Pass training represents the implementation of basic movement techniques for passing.

It is a great task for coaches to provide training treatments that are suitable for the needs of the athletes. In addition, in the implementation of efforts to enhance these skills, there is a need for training programs that align with the characteristics of athletes based on the age classification required. The implementation of programs should consider the principles of training (Zhang & Mao, 2022). Before the age of 10, efforts should be directed towards improving neuromuscular coordination systems and gradual light enhancement of aerobic and anaerobic skills (Tummala et al., 2022). At the ages of 12-14, endurance components can be added (Siu et al., 2020). The statement is reinforced by Bompa & Haff (2015: 42) who state that the training process should require and pay attention to the basic concepts and components of training. Thus, in the concept of overload, the researcher applies a training program for ages 12-14 years using a frequency of 3 times a week with a total of 10 repetitions for 3 sets and a recovery time of 3 minutes. This program can be performed repeatedly over 16 sessions, applying the training concepts proposed by Bompa & Haff (2015: 42), where the training process continues to be repeated while paying attention to the frequency, repetitions, and

recovery in order to achieve more optimal skill movement.

Practically, physical training media actually already exists and has been widely applied in training centers, such as regional and national training centers. However, based on the needs analysis through interviews and questionnaire distribution, there are still problems such as a lack of facilities and infrastructure, and a relatively monotonous training process. Therefore, this urgency is very important for

Method

In this research, the researcher uses the Research and Development methodology. This type of research is developmental research using the ADDIE method.

The research method used in this study is expert validation involving 7 validators from disciplines that support this research, in addition to 40 samples to determine the effectiveness of the product to be developed. The data collection techniques used in this study include three techniques, namely: observation techniques, literature study,

conducting a more in-depth study to solve these problems. Additionally, the novelty of this research is related to the design of training media based on science and technology. In this case, the researcher utilizes technology that is increasingly developing over time. By providing training with modified 3D Digital Animation videos, the researcher hypothesizes that there will be a significant improvement from both motoric and psychological perspectives of the athletes. and questionnaires. The instruments used employ a 1-4 Likert scale method with indicators of Content Quality, Video Appearance, Color Harmony, and Media Usage. Before the data is analyzed, prerequisite tests for analysis are first conducted, namely normality test and homogeneity test. Data analysis is performed using the t-test for paired data using SPSS version 26.

Results and Discussion

Result

The results of the tests from this research will be presented through the description below.

1. Validity Test

   a. Material Expert

Table. 1. Expert Material Validation Test

Bullet Item	R_{table}	R_{count}	Sig. R 5%	Sig. Result	Information
1	0,754	0,844	0,05	0,017	Valid
2		0,844		0,017	Valid
3		0,938		0,002	Valid
4		0,912		0,004	Valid
5		0,880		0,009	Valid
6		0,826		0,022	Valid
7		0,826		0,022	Valid

8	0,938	0,002	Valid
9	0,926	0,003	Valid
10	0,869	0,011	Valid
11	0,916	0,004	Valid
12	0,912	0,004	Valid
13	0,836	0,019	Valid
14	0,808	0,028	Valid
15	0,912	0,004	Valid

From the table above, it is known that overall the value of $R_{count} > R_{table}$, and the significance value overall < 0.05, it can be concluded that the questionnaire for material experts to be used in the research is valid.

b. Media Expert

Table 2. Expert Media Validity Test

Bullet Item	R_{table}	R_{count}	Sig. R 5%	Sig. Result	Information
1		0,918		0,004	Valid
2		0,799		0,031	Valid
3		0,861		0,013	Valid
4		0,879		0,009	Valid
5		0,828		0,021	Valid
6		0,770		0,043	Valid
7		0,906		0,005	Valid
8	0,754	0,945	0,05	0,001	Valid
9		0,828		0,021	Valid
10		0,918		0,004	Valid
11		0,828		0,021	Valid
12		0,773		0,042	Valid
13		0,879		0,009	Valid
14		0,865		0,012	Valid

15	0,937	0,002	Valid
16	0,918	0,004	Valid
17	0,916	0,004	Valid
18	0,867	0,012	Valid
19	0,797	0,032	Valid

From the table above, it is known that overall the value of $R_{count} > R_{table}$, and the significance value overall < 0.05, it can be concluded that the questionnaire for media experts to be used in the research is valid.

2. Reliability Test

a. Material Expert

Table 3. Reliability Test of Material Experts

Number of Items	Alpha Cronbach	R_{table} Sig. 5%	Decision
15	0.976	0,754	Reliable

Based on the results of the table above, it can be concluded that the reliability value of the instrument with a Cronbach Alpha = 0.976, which is greater than the table value R_{table} = 0.754 at a significance level of 5%. This means it can be concluded that the subject matter expert instrument in this study is Reliable.

b. Media Expert

Table 4. Expert Media Reliability Test

Number of Items	Alpha Cronbach	R_{table} Sig. 5%	Decision
19	0.980	0,754	Reliable

Based on the results of the table above, it can be concluded that the reliability value of the instrument with a Cronbach Alpha = 0.980, which is greater than the table value R_{table} = 0.754 at a significance level of 5%. This means it can be concluded that the media expert instrument in this study is Reliable.

3. Effectiveness Test

The effectiveness of the product is tested by observing the difference in the athletes' performance scores in basketball shooting before and after the treatment is applied. Based on this statement, it is known that the paired t-test falls under parametric statistics, which

requires the assumption of normally distributed and homogeneous data. Here are the prerequisite tests that will be necessary for the effectiveness test.

a. Normality Test

Table 5. Normality Test

Variable	P-Value	Significance	Information
Pretest	0,150	0,05	Normal
Posttest	0,245		Normal

Based on the table above, it is known that the significance value is more than 0.05 which means the data is normally distributed.

b. Homogeneity Test

Table 6. Homogeneity Test

Levene Statistic	df1	df2	Sig.
14,346	1	38	0,175

Based on the table above, a significance value of more than 0.05 means the data is homogeneous.

c. Testing Effectiveness

Table 7. Paired T-test

Variable	t	df	Sig. (2-tailled)
Pretest-posttest	7,499	19	0,000

Based on the hypothesis calculation results in the table above, it is known that each variable has a significance value of 0.000 < 0.05, which means it can be concluded that 3D animated video-based basketball shooting learning has a significant effect on basketball shooting results. In addition, the product has been proven effective in improving basketball shooting.

Discussion

The animal name exercise is a practice that involves placing athletes in game situations through role-playing. In this exercise, the ability to shoot, especially free throws, is developed using animal names such as frog, kangaroo, and giraffe with the progression of the game. The improvement of an athlete's skills is not easy, as it requires a considerable amount of time to stabilize an athlete's skills in a particular activity. The increase or decrease in an athlete's skills is influenced by two important factors: intrinsic factors and extrinsic factors. Intrinsic factors come from the athlete's own personality, while extrinsic factors come from outside the athlete's personality. Another factor that affects the improvement of an athlete's skills is the coach's role in selecting the appropriate learning model to serve as a medium for presenting the necessary material for an athlete, rather than just the coach's needs.

As time goes by, technology continues to develop, however in the use of technology as a training medium, there

are several factors that need to be considered such as athlete characteristics, the surrounding environment, and the type of training media used. Modifications become a very important element during the training process (Jildeh et al., 2021). Because there are several advantages of this 3D Digital animation media, among them are: Media that contains a combination of motion or images and sound. The combination of motion or images and sound is a blend of media collected in one medium that can convey information. In addition, it can be used directly and in any location, meaning this media is not confined to one room or place, it can be used immediately anywhere, and it can also be applied for classic or individual settings. Everyone can use this media regardless of the size of the group, and it can even be used for just one person. The appropriate use of training media can help improve the quality of athletes and assist athletes in gaining broader insights (Hasan et al., 2023). In addition, the 3D Digital Animation-based video training media can make the training process more interactive and inspiring, encouraging athletes to participate more actively in the training process and to develop their creativity through role-playing modifications. Role-playing can instill characteristic traits in athletes' classes (Nakase et al., 2020), one of which involves using animal names such as frog, kangaroo, and giraffe. The results from these three animals are a manifestation of the implementation of basic movement techniques for shooting free throws in basketball.

In addition, the motivation and active training of athletes must align with their own interests and talents/wishes, not from the coercion of others. When motivation, learning models, the role of sports lecturers, and the creative will of an athlete are fulfilled, then automatically the skills of an athlete will undergo changes or improvements, as well as the formation of an athlete's character through sports, because sports ultimately leads to an improvement in culture and achievements. Therefore, it can be concluded that coaches must have a creative and innovative mindset in the training process. Because basically, not all clubs can meet all the needs for sports facilities and infrastructure. This becomes a big task for coaches to facilitate athletes to continue optimizing the training process. The advantage of training using the animal names model is that providing the animal names training model can help increase the enthusiasm and activity of athletes during the training process, making it less monotonous. Furthermore, this finding aligns with and is supported by the research conducted by (Munir et al., 2021), which states that in a teaching and learning process, modifying a game is very much needed by educators because the game modification can engage students actively in the learning process, and during that learning, the enthusiasm of the students is very optimal and not relatively monotonous.

Conclusion

Based on the results of this research, it can be concluded that it is very important for coaches to choose and apply the right training to develop the accuracy of the free throw shooting technique in amateur athletes. This means that if amateur athletes are provided with a training model that suits their characteristics, they will feel happy and motivated to participate in the training process. Moreover, this 3D Digital Animation-based animal name training program has a very significant positive impact on athletes, especially in the amateur class. This is because the animal name training program does not require additional

facilities and infrastructure; athletes only learn to improve their shooting skills through role-playing, so the time allocation required by the coach is not entirely consumed. In other words, the time allocation for the training process can run optimally. The implications of this research focus on the process of providing treatment to athletes so that coaches can have many innovative training programs to enhance athletes' skills as expected.

References

Allahabadi, S., Galivanche, A. R., Coss, N., Tenzing, N., Gatto, A. P., Murray, J. C., Allahabadi, S., & Pandya, N. K. (2024). Severe Acute Respiratory Syndrome Coronavirus 2 Did Not Substantially Impact Injury Patterns or Performance of Players in the National Basketball Association From 2016 to 2021. *Arthroscopy, Sports Medicine, and Rehabilitation*, *6*(1), 100841. https://doi.org/10.1016/j.asmr.2023.10 0841

Di Mattia, A., & Krumer, A. (2023). Fewer teams, more games, larger attendance? Evidence from the structural change in basketball's EuroLeague. *European Journal of Operational Research*, *309*(1), 359–370. https://doi.org/10.1016/j.ejor.2023.01. 002

Fazel, F., Morris, T., Watt, A. P., & Maher, R. (2022). A Real-world Examination of Progressive Imagery Delivery in Competitive Basketball. *Asian Journal of Sport and Exercise Psychology*, *2*(2), 106–113. https://doi.org/10.1016/j.ajsep.2022.09 .002

Griffin, Z. D., Pollock, J. R., Moore, M. L., McQuivey, K. S., Arthur, J. R., & Chhabra, A. (2022). The Most Highly Cited Publications on Basketball Originate From English-Speaking Countries, Are Published After 2000, Are Focused on Medicine-Related Topics, and Are Level III Evidence.

Arthroscopy, Sports Medicine, and Rehabilitation, *4*(3), e891–e898. https://doi.org/10.1016/j.asmr.2021.12 .020

Hasan, S. S., Shaikh, H., Visahan, K., Navarro, S., Sulapas, I., & Shybut, T. (2023). The Social Media Presence of Professional Sports Team Physicians Is High Among Major League Soccer, Major League Lacrosse, Major League Rugby, Winter Olympics, and Women's National Basketball Association, But Highest Among MLS Team Physicians. *Arthroscopy, Sports Medicine, and Rehabilitation*, *5*(1), e59–e65. https://doi.org/10.1016/j.asmr.2022.10 .008

Hassan, A. K., Bursais, A. K., Ata, S. N., Selim, H. S., Alibrahim, M. S., & Hammad, B. E. (2023). The effect of TRX, combined with vibration training, on BMI, the body fat percentage, myostatin and follistatin, the strength endurance and layup shot skills of female basketball players. *Heliyon*, *9*(10), e20844. https://doi.org/10.1016/j.heliyon.2023. e20844

Jildeh, T. R., Meta, F., Young, J., Page, B., Nwachukwu, B., Westermann, R. W., & Okoroha, K. R. (2021). Concussion Is Associated With Increased Odds of Acute Lower-Extremity Musculoskeletal Injury Among National Basketball Association Players. *Arthroscopy, Sports Medicine, and Rehabilitation*, *3*(1), e219–e225. https://doi.org/10.1016/j.asmr.2020.09 .014

Lin, E., Tummala, S. V., Morikawa, L., Vij, N., Petty, S. B., McQuivey, K. S., & Chhabra, A. (2023). Strains/Sprains and Fractures Are the Most Common Hand and Wrist Injuries in National Basketball Association Athletes Who Return to Preinjury Player Efficiency and Equal or Greater True Shooting Percentage Within Two Years of Injury. *Arthroscopy, Sports Medicine, and Rehabilitation*, *5*(6), 100829.

https://doi.org/10.1016/j.asmr.2023.10
0829

Martínez, J. A., Langohr, K., Felipo, J., Consuegra, L., & Casals, M. (2022). Data set on mortality of national basketball association (NBA) players. *Data in Brief*, *45*, 1–8. https://doi.org/10.1016/j.dib.2022.108 615

Munir, A., Arief Nur Wahyudi, & Aba Sandi Prayoga. (2021). Pendekatan Model Discovery Learning dalam Keterampilan Teknik Shooting Permainan Bola Basket. *Jurnal Pendidikan Modern*, *6*(2), 68–73. https://doi.org/10.37471/jpm.v6i2.190

Nakase, J., Kitaoka, K., Shima, Y., Oshima, T., Sakurai, G., & Tsuchiya, H. (2020). Risk factors for noncontact anterior cruciate ligament injury in female high school basketball and handball players: A prospective 3-year cohort study. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, *22*, 34–38. https://doi.org/10.1016/j.asmart.2020. 06.002

Osken, C., & Onay, C. (2022). Predicting the winning team in basketball: A novel approach. *Heliyon*, *8*(12), e12189. https://doi.org/10.1016/j.heliyon.2022. e12189

Patrick, H., United, G. M. D., Gausden, E. B., States, U., Dodson, C. C., States, U., & Voos, J. E. (2023). Effects of Early Sports Specialization on Collegiate Basketball Players: Injury, Career Outcomes, and Gender Differences. *Journal of ISAKOS*, *8*, S168–S169. https://doi.org/10.1016/j.jisako.2023.0 3.429

Siu, R., Ling, S. K., Fung, N., Pak, N., & Yung, P. S. (2020). Prognosis of elite basketball players after an Achilles tendon rupture. *Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology*, *21*, 5–10. https://doi.org/10.1016/j.asmart.2020. 03.002

Tummala, S. V., Morikawa, L., Brinkman, J., Crijns, T. J., Economopoulos, K., & Chhabra, A. (2022). Knee Injuries and Associated Risk Factors in National Basketball Association Athletes. *Arthroscopy, Sports Medicine, and Rehabilitation*, *4*(5), e1639–e1645. https://doi.org/10.1016/j.asmr.2022.06 .009

Yang, F., Ren, L., & Gu, C. (2022). A study of college students' intention to use metaverse technology for basketball learning based on UTAUT2. *Heliyon*, *8*(9), e10562. https://doi.org/10.1016/j.heliyon.2022. e10562

Zhang, J., & Mao, H. (2022). WKNN indoor positioning method based on spatial feature partition and basketball motion capture. *Alexandria Engineering Journal*, *61*(1), 125–134. https://doi.org/10.1016/j.aej.2021.0 4.078