BUKTI KORESPONDENSI

ARTIKEL JURNAL INTERNASIONAL BEREPUTASI

Judul artikel	Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills
Jurnal	Physical Education of Students
Penulis	Mashud

No.	Perihal	Tanggal
1	Bukti konfirmasi submit artikel dan artikel yang disbumit	30 April 2023
2	Bukti konfirmasi review dan hasil review	17 Mei 2023
3	Bukti konfirmasi submit revisi, respon kepada reviewer, dan artikel yang diresubmit	18 Mei 2023
4	Bukti konfirmasi artikel accepted	31 Mei 2023
5	Bukti konfirmasi artikel published online	30 Juni 2023

Bukti konfirmasi submit artikel dan artikel yang disbumit

(30 April 2023)

Submission Files

Search

3707 Article Page Title.docx	April 30, 2023	Other
3708 Information about the authors.docx	April 30, 2023	Other
3709 A main document file.docx	April 30, 2023	Article Text
3710 Author Agreement Form.pdf	April 30, 2023	Other

Download All Files

Pre-Review Discussions

Add discussion

Name	From	Last Reply	Replies	Closed
Comments for the Editor	mashud2023-04-30 09:48 AM	-	0	

Comments for the Editor

Participants Edit

Mashud (mashud)

Messages

Note	From
Dear Editor We have sent a manuscript with the title " Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breastsquee swimming skills," we hope our manuscript can be considered in the Journal “Physical Education of Students". Thank You	mashud2023-05-12 09:48 AM

Add Message

3708 Information about the authors.docx	May 12, 2023	Other	
3709 A main document file.docx	May 12, 2023	Article Text	
3710 Author Agreement Form.pdf	May 12, 2023	Other	

Download All Files

Pre-Review Discussions

Add discussion

Name	From	Last Reply	Replies	Closed
Comments for the Editor	mashud2023-05-12 09:48 AM	-	0	

PHYSICAL EDUCATION OF STUDENTS e-ISSN 2308-7250

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breastsquee swimming skills

Mashud[1ABCDE], Syamsul Arifin[1ABCD], AR. Shadiqin[1ABCDD], Y Touvan Juni Samodra[2BCDE], I Gusti Putu Ngurah Adi Santika[3BDE], Didi Suryadi[4ACDE]

[1]Departement Physical Education, Sport and Health, Universitas Lambung mangkurat, Banjarmasin, Indonesia
[2]Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura, Pontianak, Indonesia
[3]Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education, Universitas PGRI Mahadewa, Bali, Indonesia
[4]Department of Spost Science, , Faculty of Spost Science and Health, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: mashud, e-mail: mashud@ulm.ac.id

Abstract.

Background and Study Aim. Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills**.**

*Material and Methods.*This research is a quasi-experimental type with a pretest posttest nonequivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totaled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing.

Results. The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score.

Conclusions. This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Keywords: learning model, project based learning, interactive multimedia , swimming breaststroke

PHYSICAL EDUCATION OF STUDENTS e-ISSN 2308-7250

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breastsquee swimming skills

Anonymous

Abstract

Background and Study Aim. Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills**.**

*Material and Methods.*This research is a quasi-experimental type with a pretest posttest nonequivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totaled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing.

Results. The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score.

Conclusions. This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Keywords: learning model, project based learning, interactive multimedia , swimming breaststroke

Introduction

Sport is a physical activity that can be carried out by various groups [1]. Along with its development, technological advances in sports coaching are needed [2]. Where technological advances are increasingly sophisticated and modern, so that they are very close to digital devices both online and offline [3]. Therefore, the rapid development of various technologies gives hope for the modernization of new technologies in the world of education [4], including reforms in the world of sports [5]. In addition, models and media that are currently developing rapidly cause various demands and lifestyle changes, including sports, especially swimming [6].

Swimming is a sport that is done in water [7], and all levels of society can do this sport regardless of age and gender [8], and it is one of the most popular sports in the world [9]. Swimming activity is an important resource so as not to drown [10], besides that it also requires good and prime physical condition. Thus, physical fitness is also maintained [11–15], which is related to physical health [16–18]. A study based on the results of clinical trials showed that swimmers found specific improvements in lung function [19]. The results of this review have provided an illustration that swimming is a very important water sport, both for physical abilities and health-related fitness. However, special attention is needed as said by Pharr et al that few studies have an understanding of predictors of swimming ability. There are various styles in swimming, one of which is the breaststroke [10].

Breaststroke swimming or what is often known as frog style is a swimming style facing the surface of the water, where the legs are moved outwards like kicking backwards. The movement starts from the first arm swing after sliding and the body must remain face down and both shoulders parallel to the surface of the water[20]. In addition, the breaststroke becomes the only competitive stroke [21], and the complex is also characterized by an intermittent propulsion phase [22]. A study by Strzała says that success in breaststroke swimming turns out that most of the power is reinforced by the kicking motion of the breaststroke and is considered the most responsible [23]. Therefore, it is very important to coordinate limb movements optimally for swimmers, this aims to maintain the best possible speed [21]. In addition, breaststroke swimming is a compulsory subject for students majoring in sports education at the Teaching and Education Faculty (FKIP) of Lambung Mangkurat University. Where the existence of swimming practice courses is the basis for the creation of experienced and potential teachers, thus providing an important role in the community environment.

Implementation of breaststroke swimming practice lectures to students by providing basic technical practice materials and swimming skills based on contracts and lecture teaching materials. Thus students are required to be able to do and practice breaststroke swimming, this is intended for preparation after graduating from university later. Therefore, to obtain maximum results, it is necessary to have a learning design so that it is not monotonous [24–28]. Where sports teachers are also a consideration in seeing student success [29]. Furthermore, harnessing the advancement of technology in a few decades may be an option to replace the traditional way [3]. The solutions offered use a project-based learning model with interactive multimedia, this is also considered in line with technological advances and their use in the world of sports. As is the case with what was said Jumaat & Tasir that sports science and technology needs appreciation, especially for coaches in Indonesia [2]. The results are the same as research conducted by Widiastuti & Mashud interactive multimedia developed will facilitate swimming training and is feasible to implement [3,30].

Although previously Sugiyanto research had been carried out on the integration of mobile learning and project-based learning [31], and Haryanto innovation media learning, online project-based learning (O-PBL) [32]. However, researchers have not found research on the integration of project-based learning models with interactive multimedia in physical education, especially those that discuss breaststroke swimming. So that this can be a research update and strengthen the importance of this research to be carried out. That way, this research will be able to contribute to the strategies and learning models used. In his research Saeed applying multimedia provides an advantage in the learning process [33]. Based on these problems, this study aims to provide evidence of the integration of project-based learning models with interactive multimedia to improve students' breaststroke swimming skills.

Materials and Methods

Participants. This research will be conducted in a swimming pool located on the main campus of the Department of Sports and Health Education, Teaching and Education Faculty, Lambung Mangkurat University from September 2022 to November 2022. The researchers determined the sample in this study using purposive sampling with a total sample of 90 students, namely 45 experimental groups and 45 control groups.

Research Design. The effectiveness model used in this study is experimental. The method used is a quasi-experimental design with pretest posttest nonequivalent control group design. In this method given different

treatment in the experimental group and the control group. In this study the experimental class will be treated with a project based learning model with interactive multimedia while the control class will be treated with a conventional learning model. This study was initiated by administering a pretest to the experimental and control groups, then the experimental group was given a project based learning model treatment with interactive multimedia for 8 meetings. Then a posttest was given to the experimental and control groups to see the effect of the treatment on the experimental group.

>>>Figure 1. figure attached<<<

The instrument for the results of breaststroke swimming skills was designed by researchers, based on the theory of swimming experts. Especially for the breaststroke swimming instrument, it is divided into; 1) concept; 2) breaststroke swimming indicator; and 3) descriptors (description of indicators). The concept is breaststroke swimming which is divided into 7 (seven) indicators, namely; 1) start; 2) body position; 3) leg movements; 4) arm movement and recovery; 5) breath movement; 6) coordination movement; and 7) reversal movement. Of the 7 (seven) indicators, each is further divided into 5 descriptors. So the total number of descriptors for the breaststroke swimming instrument is 35 items. It is from these 35 descriptor items that the testee scores are obtained.

In order to find out whether the instrument used was feasible, testers 1 and 2 were first tested with a sample of 15 students of the Physical Education Study Program. Where the results show for n = 15 and an error rate of 5%, it is obtained r table = 0.514 and an error level of 1% r table = 0.641, because r count is greater than r table (0.966 > 0.641 > 0.514), it can be concluded that the swimming ability instrument reliable.

Statistical Analysis. The research data was analyzed in a quantitative descriptive manner to provide a summary of research data and to facilitate the presentation of research data. Data showing normal distribution were analyzed using the t test to test the difference in the average pretest and posttest results in the experimental group and the control group, as well as the significance assisted using the SPSS 26 application.

Results

Quasi-experimental research, namely the existence of different treatments in the experimental group and the control group. In this study the experimental group was treated with a project based learning model with interactive multimedia (PBL-interactive multimedia) and the control group (Conventional). Before being given the effect test and the different test, first carry out the normality prerequisite test, if the data is normal, it will use the t-test and if it is not normal, it will proceed with the nonparametric test.

>>>Table 1. table attached<<<

Based on the results of the normality test with the Kolmogorov-Smirnov formula, it shows that the significance value is p> 0.05, so in conclusion the data shows normal, then the t-test will be continued. The results of the normality test can be seen in table 1.

>>>Table 2. table attached<<<

The results in table 2 of the hypothesis test on the indicators of the experimental group with the PBL-Multimedia Interactive treatment show a significance value of 0.000 <0.05, so these results provide evidence that the PBL-multimedia interactive model provides a significant increase in the results of breaststroke swimming skills.

Furthermore, the control group showed a significance value of 0.000 <0.05, so these results also provide evidence that the conventional model actually provides a significant increase in the results of breaststroke swimming skills. Based on the results of the analysis of hypothesis testing, it can be concluded that the PBL-interactive multimedia model and the conventional model can be applied to improve breaststroke swimming skills. Seeing these results, the researcher wants to see the difference in the effect given, so that the model can be proven more effective to use.

>>>Table 3. table attached<<<

Based on the results of the homogeneity test, it shows a significance value of 0.085 > 0.05, so the result is homogeneous, then it will be followed by a different test with the Independent Samples t Test formula. The normality test results can be seen in table 3.

>>>Table 4. table attached<<<

The results in table 4 to find out the difference in the pre-test scores of the experimental group and the pre-test of the control group, the results show a significance value of 0.912 > 0.05 so there is no significant difference in the pre-test of the PBL-Multimedia Interactive experimental group with the pre-test control group (Conventional).

>>>Table 5. table attached<<<

The results in table 4 to find out the difference in the pre-test values of the experimental group and the pre-test of the control group, the results show a significance value of 0.001 <0.05, so the post-test of the PBL- Multimedia Interactive experimental group and the post-test of the control group (Conventional) there is a difference significant influence. Based on these results, it proves that the PBL-Multimedia Interactive model is more effective than the conventional learning model. So the PBL-Multimedia Interactive model is more recommended to improve breaststroke swimming skills.

>>>Table 6. table attached<<<

Based on table 6 it can be seen that the minimum, maximum, mean, and standard deviation on pretest and posttest data with PBL-Multimedia Interactive model treatment proves that the posttest scores are better, but the difference is not too big. For more details can be seen in Figure 2.

>>>Figure 2. figure attached<<<

Discussion

This study aims to provide evidence of the effect of integrating project-based learning models with interactive multimedia on improving students' breaststroke swimming skills. The results showed that the average value of the posttest experimental group (26.51) and the control group (22.98) was greater than the pretest value of the experimental group (20.04) and the control group (19.89). Furthermore, the result of the calculated t value is greater than t table, and the results also show significant. From these results it can be concluded that the PBL-Multimedia Interactive model and the conventional model show a significant increase in the learning outcomes of breaststroke swimming. Previous research by Sugiyanto provides evidence that the Integration of Mobile Learning and Project Based Learning has an increasing effect on the competency of vocational high schools [31]. Furthermore, it has been proven that media-based online project-based learning is appropriate for use in automotive engineering drawing subjects [32].

Other studies have found that swimming skills can also be improved by doing swimming exercises for 33 weeks, and have a positive effect on health [34]. In addition, providing special training to swimmers can improve performance during competitions [35]. Research by . Gülbin that the performance of male swimmers is also influenced by using core training, where this exercise has a positive effect [36]. Several studies have shown that playing approaches, authoritarian teaching styles, and democratic influences affect students' swimming abilities [37,38]. To improve safety skills in swimming, you can apply traditional swimming teaching, but do not reduce student drowning injuries [39]. Subsequent studies, to improve performance in swimming do more strength training [40].

The results of the study also show the difference in the influence of the PBL-Multimedia Interactive model and the conventional model , where the PBL-Multimedia Interactive model is more effective. These results are reinforced by Susena proving that swimming based on interactive multimedia applications shows very good criteria [7]. A study has proven that multimedia-based swimming learning provides an increase in backstroke swimming [33], and multimedia learning proves its superiority compared to learning without multimedia. The results of this study are reinforced by Widiastuti that with the existence of a learning model with interactive multimedia that is being developed [3], it is hoped that it can be an alternative to conventional methods. Based on this review, it reaffirms the application of interactive multimedia-based learning, where this is done following increasingly advanced technological developments. In this way, the results of research on the integration of project-based learning models with interactive multimedia can also be considered as a learning model that utilizes technological advances in the field of sports.

Conclusions

The results of the research and discussion have a strong foundation related to the Interactive PBL-Multimedia model, on the basis of references from the research listed previously in the discussion of results and discussion. Where these findings have resulted in several conclusions. The results of the study prove that the PBL-Multimedia Interactive model and the conventional model have a significant effect on improving students' breaststroke swimming skills. These findings also show a significant difference between the Interactive PBL-Multimedia model and the conventional model, namely the Interactive PBL-Multimedia model is more effective for improving breaststroke swimming skills. The results of this study have provided a new reference related to breaststroke swimming practice learning, and added evidence that the integration of project-based learning models with interactive multimedia is more advisable to improve swimming skills, especially breaststroke. The weakness of the research lies in the activities and warm-up carried out by students before the final test is carried out. In addition, the physical condition of students who are not fully monitored is also one of the research weaknesses. Recommendations for further research can apply the PBL-Multimedia Interactive model to other swimming skills, it is known that swimming is popular with 4 styles namely freestyle, butterfly, backstroke and breaststroke.

Acknowledgement

Sincere gratitude to all participants for their unwavering desire to join in and contribute to the research, revealing closeness while also granting us entire trust.

Conflict of interest

There is no conflict of interest.

References

1. Suryadi D, Gustian U, Fauziah E. The Somatotype of Martial Athletes in the Fighter Category Against Achievement. *JUARA J Olahraga*. 2022;7(1):116–25. https://doi.org/10.33222/juara.v7i1.1484

2. Jumaat NF, Tasir Z. Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation. *Procedia - Soc Behav Sci.* 2013;103(26):526–33. https://doi.org/10.1016/j.sbspro.2013.10.369

3. Widiastuti W, Sulaiman I, Susilo S, Hernawan H, Mashud M, Solahuddin S, et al. Interactive multimedia development for swimming learning and training. *IOP Conf Ser Mater Sci Eng*. 2021;1098:1–6. https://doi.org/10.1088/1757-899x/1098/3/032038

4. Zeng Q. Research on Multimedia Swimming Teaching under Informatization. In: *Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020*. 2020. p. 60–3. https://doi.org/10.1109/CIPAE51077.2020.00023

5. Félix ER, da Silva HP, Olstad BH, Cabri J, Correia PL. Swimbit: A novel approach to stroke analysis during swim training based on attitude and heading reference system (ahrs). *Sports.* 2019;7(11):238. https://doi.org/10.3390/sports7110238

6. de Zeeuw M, Smolianov P, Dion S, Schoen C. Comparing the practices of Dutch swimming against a global model for integrated development of mass and high performance sport. *Manag Sport Leis*. 2017;22(2):91–112. https://doi.org/10.1080/23750472.2017.1394797

7. Susena SJ, Sugiharto S, Kusuma DWY. Development of Swimming Learning Media Based on Interactive Multimedia Applications Through Computers and Smartphones. *J Phys Educ Sport.* 2021;10(2):156–64. https://doi.org/10.15294/JPES.V10I2.46269

8. Usra M. Swimming Learning Model Using Rope As Aid For Beginners. In: *Proceedings of the First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017)*. 2018. p. 388–93. https://doi.org/10.2991/ice-17.2018.83

9. Khodaee M, Edelman GT, Spittler J, Wilber R, Krabak BJ, Solomon D, et al. Medical Care for Swimmers. *Sports Medicine - Open.* 2016. https://doi.org/10.1186/s40798-016-0051-2

10. Pharr J, Irwin C, Layne T, Irwin R. Predictors of swimming ability among children and adolescents in the united states. *Sports.* 2018;6(1):1–11. https://doi.org/10.3390/sports6010017

11. Baek KW, Lee MC, Jeon TB, Yoo J Il, Park JS, Moon HY, et al. Effects of exercise on physical fitness and strength according to the frailty level of female elderly with hypertension. *Exerc Sci.* 2020;29(4):368–76. https://doi.org/10.15857/ksep.2020.29.4.368

12. González-Fernández FT, González-Víllora S, Baena-Morales S, Pastor-Vicedo JC, Clemente FM, Badicu G, et al. Effect of physical exercise program based on active breaks on physical fitness and vigilance performance. *Biology (Basel).* 2021; https://doi.org/10.3390/biology10111151

13. Suryadi D, Samodra YTJ, Purnomo E. Efektivitas latihan weight training terhadap kebugaran jasmani. *J RESPECS*. 2021;3(2):9–19. https://doi.org/10.31949/respecs.v3i2.1029

14. Rubiyatno, Perdana RP, Fallo IS, Arifin Z, Nusri A, Suryadi D, et al. Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagog Phys Cult Sport.* 2023;27(3):208–14. https://doi.org/10.15561/26649837.2023.0304

15. Suryadi D, Suganda MA, Sacko M, Samodra YTJ, Rubiyatno R, Supriatna E, et al. Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. *Phys Educ Sport Stud Res.* 2023;2(1):59–71. https://doi.org/10.56003/pessr.v2i1.182

16. Suryadi D. Analisis kebugaran jasmani siswa: Studi komparatif antara ekstrakurikuler bolabasket dan futsal. *Edu Sport Indones J Phys Educ.* 2022;3(2):100–10. https://doi.org/10.25299/es:ijope.2022.vol3(2).9280

17. Suryadi D, Rubiyatno. Kebugaran jasmani pada siswa yang mengikuti ekstrakulikuler futsal. *J Ilmu Keolahragaan.* 2022;5(1):1–8. https://doi.org/10.26418/jilo.v5i1.51718

18. Samodra YTJ, Suryadi D, Wati IDP, Supriatna E, Santika IGPNA, Suganda MA, et al. Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagog Phys Cult Sport*. 2023;27(2):139–145. https://doi.org/0.15561/26649837.2023.0206

19. Päivinen M, Keskinen K, Tikkanen H. Swimming-induced changes in pulmonary function: special observations for clinical testing. *BMC Sports Sci Med Rehabil*. 2021; https://doi.org/10.1186/s13102-021-00277-1

20. Abdul Gani R, Setiawan E, Jumareng H, Unju Subandi O. Implementation Of Modification Game Methods To Improve Breaststroke Swimming Skills. *Hal Olahraga Nusant (Jurnal Ilmu Keolahragaan)*. 2021;4(2):255–70. https://doi.org/10.31851/hon.v4i25404

21. Nicol E, Adani N, Lin B, Tor E. The temporal analysis of elite breaststroke swimming during competition. *Sport Biomech*. 2021; https://doi.org/10.1080/14763141.2021.1975810

22. Nicol E, Pearson S, Saxby D, Minahan C, Tor E. Stroke kinematics, temporal patterns, neuromuscular activity, pacing and kinetics in elite breaststroke swimming: A systematic review. *Sport Med - Open*. 2022;8(1):1–24. https://doi.org/10.1186/s40798-022-00467-2

23. Strzała M, Krezałek P, Kaca M, Głab G, Ostrowski A, Stanula A, et al. Swimming speed of the breaststroke kick. *J Hum Kinet.* 2012; https://doi.org/10.2478/v10078-012-0087-4

24. Suryadi D, Samodra YTJ, Gustian U, Yosika GF, B PS, Dewintha R, et al. Problem-based learning model: Can it improve learning outcomes for long serve in badminton. *Edu Sport Indones J Phys Educ*. 2023;4(1):29–36. https://doi.org/10.25299/es:ijope.2023.vol4(1).10987

25. Suryadi D, Saputra E, Wahyudi I. Tinggi Badan dan Keseimbangan Dinamis dengan Kemampuan Lay Up Permainan Bola Basket : Apakah Saling Berhubungan? *Indones J Phys Educ Sport Sci.* 2022;2(2):67–74. https://doi.org/10.52188/ijpess.v2i2.276

26. Rubiyatno R, Suryadi D. Penerapan Media Audio Visual Dalam Meningkatkan Hasil Belajar Servis Bulutangkis di MTs Mujahidin Pontianak. *Musamus J Phys Educ Sport.* 2022;4(2):140–9. https://doi.org/10.35724/mjpes.v4i02.4303

27. Hardinata R, Yosika GF, Haïdara Y, Perdana RP, Gustian U, Suryadi D, et al. Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? *Indones J Phys Educ Sport Sci.* 2023;3(1):69–80. https://doi.org/10.52188/ijpess.v3i1.387

28. Perdana RP, Supriatna E, Yanti N, Suryadi D. Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? *Edu Sport Indones J Phys Educ*. 2023;4(1):86–96. https://doi.org/10.25299/es:ijope.2023.vol4(1).12130

29. Haïdara Y, Okilanda A, Dewintha R, Suryadi D. Analysis of students' basic basketball skills: A

comparative study of male and female students. *Tanjungpura J Coach Res.* 2023;1(1):1–5. https://doi.org/10.26418/tajor.v1i1.63796

30. Mashud M, Tangkudung J, Widiastuti W. Swimming Lesson Based on Interactive Multimedia. *Int J Sport Sci.* 2018;8(3):91–6. https://doi.org/10.5923/j.sports.20180803.04

31. Sugiyanto, Setiawan A, Hamidah I, Ana A. Integration of mobile learning and project-based learning in improving vocational school competence. *J Tech Educ Train*. 2020; https://doi.org/10.30880/jtet.2020.12.02.006

32. Haryanto, Kusuma WM, Mutohhari F, Nurtanto M, Suyitno S. Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering Using Video on YouTube. In: *Journal of Physics: Conference Series.* 2021. https://doi.org/10.1088/1742-6596/2111/1/012020

33. Saeed OA. The impact and clarity of presentation using multimedia learning system in the learning of swimming of back among students Specialized schools. *Sci J Phys Educ [Internet]*. 2016;9(3):1–16. https://www.iasj.net/iasj/article/125482

34. Naczk A, Gajewska E, Naczk M. Effectiveness of swimming program in adolescents with down syndrome. *Int J Environ Res Public Health.* 2021;18(14):7441. https://doi.org/10.3390/ijerph18147441 PMID: 34299891

35. Pupišová Z, Pupiš M, Sykora J, Brunn D, Giničová J, Pavlović R. The impact of a specific training programme on the selected parameters of swimming turns. *Turkish J Kinesiol.* 2019;5(1):36–42. https://doi.org/10.31459/turkjkin.511533

36. Gülbin C, Mardin E, Üniversitesi A, Gül M, Gül GK, Gülbin Eskiyecek C, et al. The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance. *20International J Appl Exerc Physiol [Internet]*. 2020;9(3):213–20. http://www.ijaep.com/index.php/IJAE/article/view/789

37. Nosko M, Arkhypov O, Khudolii O, Filatova Z, Yevtushok M. Pedagogical Conditions for Swimming Skills Development in Students of Pedagogical Educational Institutions. *Rev Rom pentru Educ Multidimens.* 2019;11(2):240. https://doi.org/10.18662/rrem/127

38. Lenneis V, Agergaard S, Evans AB. Women-only swimming as a space of belonging. *Qual Res Sport Exerc Heal.* 2022;14(1):37–52. https://doi.org/10.1080/2159676X.2020.1844790

39. Zhang S, Dai J, Nie Z. Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China. *Discret Dyn Nat Soc.* 2022;2022:1–8. https://doi.org/10.1155/2022/6141342

40. Fone L, van den Tillaar R. Effect of Different Types of Strength Training on Swimming Performance in Competitive Swimmers: A Systematic Review. *Sports Medicine - Open*. 2022. p. 8(1).19. https://doi.org/10.1186/s40798-022-00410-5

TABLES AND FIGURES

Tables

Table 1. Kolmogorov-Smirnov Normality Prerequisite Test

	Statistics	df	Sig.
Experiment Pretest	0.097	45	.200 *
Posttest Experiment	0.117	45	.144
Pretest Control	0.107	45	.200 *
Posttest Control	0.118	45	.129

Table 2. Paired Samples Test Results of the t-test

		Means	std. Deviation	t	df	Sig. (2-tailed)
Pair 1	Experimental Pretest - Experimental Posttest	-6,467	3,653	-11,875	44	0.000
Pair 2	Pretest Control - Posttest Control	-3,089	3,502	-5,917	44	0.000

Table 3. Test of Homogeneity of Variances

		Levene Statistics	df1	df2	Sig.
Breaststroke Swimming Results	Based on Means	2,240	3	176	0.085

Table 4. Difference Test of Experimental Pre-test (PBL-Multimedia Interactive) and Control Pre-test

Results	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Pre-test and Control Pre-test	0.282	0.596	0.111	88	0912

Table 5. Difference Test of Experimental Post-test (PBL-Multimedia Interactive) and Control Post-test

Result _	group _	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Post-test and Control Post-test	0.266	0.607	3,408	88	0.001

Table 6. Descriptive Analysis of Pre-test and Post-test Data on Breaststroke Swimming Ability Results

Group	N	Minimum	Maximum	Means	std. Deviation
Pre-test Experiment	45	4	35	20.04	6,759
Post-test Experimental	45	15	35	26.51	4,888
Pre-test Control	45	6	29	19.89	6,516
Post-test Control	45	10	32	22.98	4,947

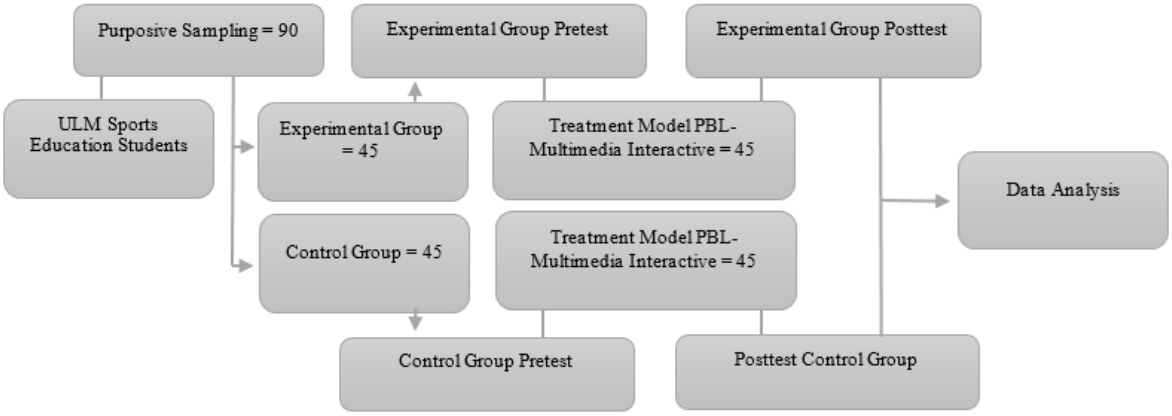


Figure 1. Chart of Research Procedures

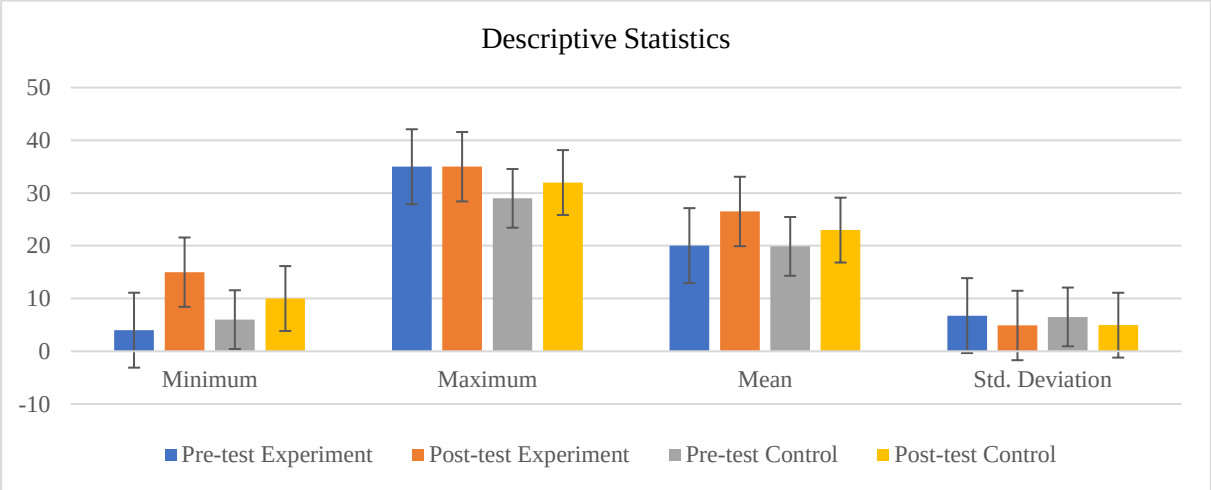


Figure 2. Descriptive Data of Pre-test and Post-test of Breaststroke Swimming Ability

Bukti konfirmasi review dan hasil review

(17 Mei 2023)

UNIVERSITAS
LAMBUNG MANGKURAT

Mashud Mashud <mashud@ulm.ac.id>

(no subject)

1 message

Sergii Iermakov <sportart@gmail.com> Wed, May 17, 2023 at 7:26 PM
To: mashud@ulm.ac.id

Dear Mashud

We would like to inform you that our editorial team has made some changes to the text of your article to ensure clarity and improve the overall readability. Additionally, we have incorporated the recommended revisions as footnotes placed in the right margin of the pages.

These revisions and recommendations aim to enhance the quality of your article and make it more accessible to readers. We appreciate your understanding and cooperation in implementing these changes.

If you have any questions or concerns regarding the revisions or the placement of the recommendations as footnotes, please don't hesitate to contact us. We value your contribution and look forward to the publication of your revised article.

Yours sincerely,
Sergii Iermakov
Editor-in-chief
Kharkiv, Ukraine (Al Jazeera)
Kharkiv, Ukraine(The Economist)

https://sportedu.org.ua/index.php/PES/workflow/index/1817/3
Review Discussions

1817-Mashud et al ed-2.docx
237K

Round 1 Status
Submission accepted.

Reviewer's Attachments

Search

No Files

Revisions

Search | Upload File

No Files

Review Discussions

Add discussion

Name	From	Last Reply	Replies	Closed
recommendations	sergii2023-05-17 03:22 PM	-	0	☐
▸ Revision completed	mashud2023-05-18 05:31 AM	-	0	☐

recommendations

Participants

prof. Sergii Iermakov (sergii)

Mashud (mashud)

Messages

Note	From
We would like to inform you that our editorial team has made some changes to the text of your article to ensure clarity and improve the overall readability. Additionally, we have incorporated the recommended revisions as footnotes placed in the right margin of the pages. These revisions and recommendations aim to enhance the quality of your article and make it more accessible to readers. We appreciate your understanding and cooperation in implementing these changes. If you have any questions or concerns regarding the revisions or the placement of the recommendations as footnotes, please don't hesitate to contact us. We value your contribution and look forward to the publication of your revised article. 1817-Mashud et al ed-2.docx	sergii2023-05-17 03:22 PM

Add Message

Review Discussions

Add discussion

Name	From	Last Reply	Replies	Closed
recommendations	sergii2023-05-17 03:22 PM	-	0	
Revision completed	mashud2023-05-18 05:31 AM	-	0	

PHYSICAL EDUCATION OF STUDENTS e-ISSN 2308-7250

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills

Mashud[1ABCDE], Syamsul Arifin[1ABCD], AR. Shadiqin[1ABCDD], Y Touvan Juni Samodra[2BCDE], I Gusti Putu Ngurah Adi Santika[3BDE], Didi Suryadi[4ACDE]

[1]Departement Physical Education, Sport and Health, Universitas Lambung Mangkurat, Banjarmasin, Indonesia
[2]Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura, Pontianak, Indonesia
[3]Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education, Universitas PGRI Mahadewa, Bali, Indonesia
[4]Department of Sport Science, Faculty of Sport Science and Health, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: mashud, e-mail: mashud@ulm.ac.id

Abstract

Background and Study Aim. Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills.

Material and Methods. This research is a quasi-experimental type with a pretest posttest nonequivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totaled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing.

Results. The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score.

Conclusions. This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Keywords: learning model, project based learning, interactive multimedia , swimming breaststroke

Introduction

Sport is a physical activity that can be carried out by various groups [1]. Along with its development, technological advances in sports coaching are needed [2]. Where technological advances are increasingly sophisticated and modern, so that they are very close to digital devices both online and offline [3]. Therefore, the rapid development of various technologies gives hope for the modernization of new technologies in the world of education [4], including reforms in the world of sports [5]. In addition, models and media that are currently developing rapidly cause various demands and lifestyle changes, including sports, especially swimming [6].

Swimming is a sport that is done in water [7], and all levels of society can do this sport regardless of age and gender [8], and it is one of the most popular sports in the world

Commented [MOU1]: We have noticed that you have used automatic referencing and the creation of the References section in your article, which does not comply with the journal's author guidelines. It is important to follow the specified guidelines for referencing and creating the References section manually.

We would like to inform you that, in this instance, our editorial team will make the necessary corrections. However, we kindly request that you take this into consideration for future submissions. Please ensure that you adhere to the journal's guidelines regarding referencing and the creation of the References section in your future work.

[9]. Swimming activity is an important resource so as not to drown [10], besides that it also requires good and prime physical condition. Thus, physical fitness is also maintained [11–15], which is related to physical health [16–18]. A study based on the results of clinical trials showed that swimmers found specific improvements in lung function [19]. The results of this review have provided an illustration that swimming is a very important water sport, both for physical abilities and health-related fitness. However, special attention is needed as said by Pharr et al that few studies have an understanding of predictors of swimming ability. There are various styles in swimming, one of which is the breaststroke [10].

Breaststroke swimming or what is often known as frog style is a swimming style facing the surface of the water, where the legs are moved outwards like kicking backwards. The movement starts from the first arm swing after sliding and the body must remain face down and both shoulders parallel to the surface of the water[20]. In addition, the breaststroke becomes the only competitive stroke [21], and the complex is also characterized by an intermittent propulsion phase [22]. A study by Strzała says that success in breaststroke swimming turns out that most of the power is reinforced by the kicking motion of the breaststroke and is considered the most responsible [23]. Therefore, it is very important to coordinate limb movements optimally for swimmers, this aims to maintain the best possible speed [21]. In addition, breaststroke swimming is a compulsory subject for students majoring in sports education at the Teaching and Education Faculty (FKIP) of Lambung Mangkurat University. Where the existence of swimming practice courses is the basis for the creation of experienced and potential teachers, thus providing an important role in the community environment.

Implementation of breaststroke swimming practice lectures to students by providing basic technical practice materials and swimming skills based on contracts and lecture teaching materials. Thus students are required to be able to do and practice breaststroke swimming, this is intended for preparation after graduating from university later. Therefore, to obtain maximum results, it is necessary to have a learning design so that it is not monotonous [24–28]. Where sports teachers are also a consideration in seeing student success [29]. Furthermore, harnessing the advancement of technology in a few decades may be an option to replace the traditional way [3]. The solutions offered use a project-based learning model with interactive multimedia, this is also considered in line with technological advances and their use in the world of sports. As is the case with what was said Jumaat & Tasir that sports science and technology needs appreciation, especially for coaches in Indonesia [2]. The results are the same as research conducted by Widiastuti & Mashud interactive multimedia developed will facilitate swimming training and is feasible to implement [3,30].

Although previously Sugiyanto research had been carried out on the integration of mobile learning and project-based learning [31], and Haryanto innovation media learning, online project-based learning (O-PBL) [32]. However, researchers have not found research on the integration of project-based learning models with interactive multimedia in physical education, especially those that discuss breaststroke swimming. So that this can be a research update and strengthen the importance of this research to be carried out. That way, this research will be able to contribute to the strategies and learning models used. In his research Saeed applying multimedia provides an advantage

in the learning process [33]. Based on these problems, this study aims to provide evidence of the integration of project-based learning models with interactive multimedia to improve students' breaststroke swimming skills.

Materials and Methods

Participants

This research will be conducted in a swimming pool located on the main campus of the Department of Sports and Health Education, Teaching and Education Faculty, Lambung Mangkurat University from September 2022 to November 2022. The researchers determined the sample in this study using purposive sampling with a total sample of 90 students, namely 45 experimental groups and 45 control groups.

Research Design

The effectiveness model used in this study is experimental. The method used is a quasi-experimental design with pretest posttest nonequivalent control group design. In this method given different treatment in the experimental group and the control group. In this study the experimental class will be treated with a project based learning model with interactive multimedia while the control class will be treated with a conventional learning model. This study was initiated by administering a pretest to the experimental and control groups, then the experimental group was given a project based learning model treatment with interactive multimedia for 8 meetings. Then a posttest was given to the experimental and control groups to see the effect of the treatment on the experimental group.

Figure 1. Chart of Research Procedures

Commented [MOU2]: Regarding Figure 1 in your article, it is important to note that the text within the figure should be presented as actual text rather than an image. According to the journal's author guidelines, textual content within figures should be editable and searchable. Therefore, please ensure that any text appearing in Figure 1 is provided as text elements within the figure file itself, rather than as an image.

The instrument for the results of breaststroke swimming skills was designed by researchers, based on the theory of swimming experts. Especially for the breaststroke swimming instrument, it is divided into; 1) concept; 2) breaststroke swimming indicator; and 3) descriptors (description of indicators). The concept is breaststroke swimming which is divided into 7 (seven) indicators, namely; 1) start; 2) body position; 3) leg movements; 4) arm movement and recovery; 5) breath movement; 6) coordination movement; and 7) reversal movement. Of the 7 (seven) indicators, each is further divided into 5 descriptors. So the total number of descriptors for the breaststroke swimming instrument is 35 items. It is from these 35 descriptor items that the testee scores are obtained.

In order to find out whether the instrument used was feasible, testers 1 and 2 were first tested with a sample of 15 students of the Physical Education Study Program. Where the results show for n = 15 and an error rate of 5%, it is obtained r table = 0.514 and an error level of 1% r table = 0.641, because r count is greater than r table (0.966 > 0.641 > 0.514), it can be concluded that the swimming ability instrument reliable.

Statistical Analysis

The research data was analyzed in a quantitative descriptive manner to provide a summary of research data and to facilitate the presentation of research data. Data showing normal distribution were analyzed using the t test to test the difference in the average pretest and posttest results in the experimental group and the control group, as well as the significance assisted using the SPSS 26 application.

Results

Quasi-experimental research, namely the existence of different treatments in the experimental group and the control group. In this study the experimental group was treated with a project based learning model with interactive multimedia (PBL-interactive multimedia) and the control group (Conventional). Before being given the effect test

and the different test, first carry out the normality prerequisite test, if the data is normal, it will use the t-test and if it is not normal, it will proceed with the nonparametric test.

Table 1. Kolmogorov-Smirnov Normality Prerequisite Test

???????	Statistics	df	Sig.
Experiment Pretest	0.097	45	.200 *
Posttest Experiment	0.117	45	.144
Pretest Control	0.107	45	.200 *
Posttest Control	0.118	45	.129

Commented [MOU3]: Each column, including the first, must have a heading

Based on the results of the normality test with the Kolmogorov-Smirnov formula, it shows that the significance value is p> 0.05, so in conclusion the data shows normal, then the t-test will be continued. The results of the normality test can be seen in table 1.

Table 2. Paired Samples Test Results of the t-test

???????	???????	Means	std. Deviation	t	df	Sig. (2-tailed)
Pair 1	Experimental Pretest - Experimental Posttest	-6,467	3,653	-11,875	44	0.000
Pair 2	Pretest Control - Posttest Control	-3,089	3,502	-5,917	44	0.000

Commented [MOU4]: Each column, including the first, must have a heading

The results in table 2 of the hypothesis test on the indicators of the experimental group with the PBL-Multimedia Interactive treatment show a significance value of 0.000 <0.05, so these results provide evidence that the PBL-multimedia interactive model provides a significant increase in the results of breaststroke swimming skills.

Furthermore, the control group showed a significance value of 0.000 <0.05, so these results also provide evidence that the conventional model actually provides a significant increase in the results of breaststroke swimming skills. Based on the results of the analysis of hypothesis testing, it can be concluded that the PBL-interactive multimedia model and the conventional model can be applied to improve breaststroke swimming skills. Seeing these results, the researcher wants to see the difference in the effect given, so that the model can be proven more effective to use.

Table 3. Test of Homogeneity of Variances

???????	???????	Levene Statistics	df1	df2	Sig.
Breaststroke Swimming Results	Based on Means	2,240	3	176	0.085

Commented [MOU5]: Each column, including the first, must have a heading

Based on the results of the homogeneity test, it shows a significance value of 0.085 > 0.05, so the result is homogeneous, then it will be followed by a different test with the Independent Samples t Test formula. The normality test results can be seen in table 3.

Table 4. Difference Test of Experimental Pre-test (PBL-Multimedia Interactive) and Control Pre-test

Results	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Pre-test and Control Pre-test	0.282	0.596	0.111	88	0912

The results in table 4 to find out the difference in the pre-test scores of the experimental group and the pre-test of the control group, the results show a significance value of 0.912 > 0.05 so there is no significant difference in the pre-test of the PBL-Multimedia Interactive experimental group with the pre-test control group (Conventional).

Table 5. Difference Test of Experimental Post-test (PBL-Multimedia Interactive) and Control Post-test

Result	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Post-test and Control Post-test	0.266	0.607	3,408	88	0.001

The results in table 4 to find out the difference in the pre-test values of the experimental group and the pre-test of the control group, the results show a significance value of 0.001 <0.05, so the post-test of the PBL- Multimedia Interactive experimental group and the post-test of the control group (Conventional) there is a difference significant influence. Based on these results, it proves that the PBL-Multimedia Interactive model is more effective than the conventional learning model. So the PBL-Multimedia Interactive model is more recommended to improve breaststroke swimming skills.

Based on table 6 it can be seen that the minimum, maximum, mean, and standard deviation on pretest and posttest data with PBL-Multimedia Interactive model treatment proves that the posttest scores are better, but the difference is not too big. For more details can be seen in Figure 2.

Table 6. Descriptive Analysis of Pre-test and Post-test Data on Breaststroke Swimming Ability Results

Group	N	Minimum	Maximum	Means	std. Deviation
Pre-test Experiment	45	4	35	20.04	6,759
Post-test Experimental	45	15	35	26.51	4,888
Pre-test Control	45	6	29	19.89	6,516
Post-test Control	45	10	32	22.98	4,947

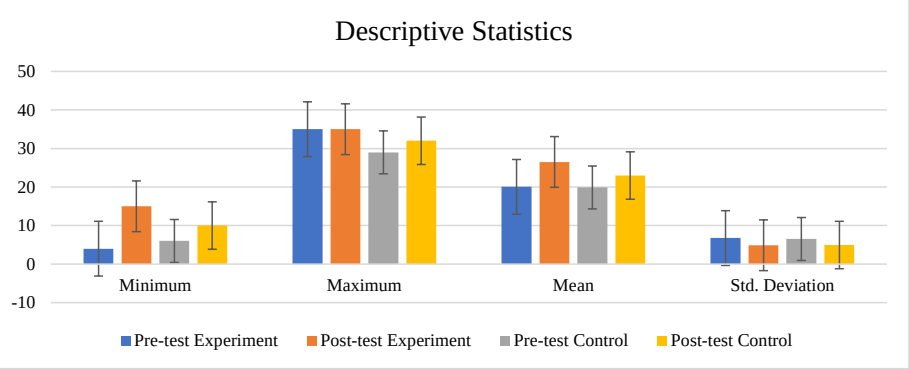


Figure 2. Descriptive Data of Pre-test and Post-test of Breaststroke Swimming Ability

Commented [MOU6]: Axis scales and labels. The horizontal (X-axis) and vertical (Y-axis) axes require scales and labels that identify the variables being graphed and the units of measure.

Discussion

This study aims to provide evidence of the effect of integrating project-based learning models with interactive multimedia on improving students' breaststroke swimming skills. The results showed that the average value of the posttest experimental group (26.51) and the control group (22.98) was greater than the pretest value of the experimental group (20.04) and the control group (19.89). Furthermore, the result of the calculated t value is greater than t table, and the results also show significant. From these results it can be concluded that the PBL- Multimedia Interactive model and the

conventional model show a significant increase in the learning outcomes of breaststroke swimming. Previous research by Sugiyanto provides evidence that the Integration of Mobile Learning and Project Based Learning has an increasing effect on the competency of vocational high schools [31]. Furthermore, it has been proven that media-based online project-based learning is appropriate for use in automotive engineering drawing subjects [32].

Other studies have found that swimming skills can also be improved by doing swimming exercises for 33 weeks, and have a positive effect on health [34]. In addition, providing special training to swimmers can improve performance during competitions [35]. Research by . Gülbin that the performance of male swimmers is also influenced by using core training, where this exercise has a positive effect [36]. Several studies have shown that playing approaches, authoritarian teaching styles, and democratic influences affect students' swimming abilities [37,38]. To improve safety skills in swimming, you can apply traditional swimming teaching, but do not reduce student drowning injuries [39]. Subsequent studies, to improve performance in swimming do more strength training [40].

The results of the study also show the difference in the influence of the PBL-Multimedia Interactive model and the conventional model , where the PBL-Multimedia Interactive model is more effective. These results are reinforced by Susena proving that swimming based on interactive multimedia applications shows very good criteria [7]. A study has proven that multimedia-based swimming learning provides an increase in backstroke swimming [33], and multimedia learning proves its superiority compared to learning without multimedia. The results of this study are reinforced by Widiastuti that with the existence of a learning model with interactive multimedia that is being developed [3], it is hoped that it can be an alternative to conventional methods. Based on this review, it reaffirms the application of interactive multimedia-based learning, where this is done following increasingly advanced technological developments. In this way, the results of research on the integration of project-based learning models with interactive multimedia can also be considered as a learning model that utilizes technological advances in the field of sports.

Conclusions

The results of the research and discussion have a strong foundation related to the Interactive PBL-Multimedia model, on the basis of references from the research listed previously in the discussion of results and discussion. Where these findings have resulted in several conclusions. The results of the study prove that the PBL-Multimedia Interactive model and the conventional model have a significant effect on improving students' breaststroke swimming skills. These findings also show a significant difference between the Interactive PBL-Multimedia model and the conventional model, namely the Interactive PBL-Multimedia model is more effective for improving breaststroke swimming skills. The results of this study have provided a new reference related to breaststroke swimming practice learning, and added evidence that the integration of project-based learning models with interactive multimedia is more advisable to improve swimming skills, especially breaststroke. The weakness of the research lies in the activities and warm-up carried out by students before the final test is carried out. In addition, the physical condition of students who are not fully monitored is also one of the research weaknesses. Recommendations for further research can apply the PBL-Multimedia Interactive model to other swimming skills, it is known that swimming is popular with 4 styles namely freestyle, butterfly, backstroke and breaststroke.

Acknowledgement

Sincere gratitude to all participants for their unwavering desire to join in and contribute to the research, revealing closeness while also granting us entire trust.

Conflict of interest

There is no conflict of interest.

References

1. Suryadi D, Gustian U, Fauziah E. The Somatotype of Martial Athletes in the Fighter Category Against Achievement. *JUARA J Olahraga*. 2022;7(1):116–25. https://doi.org/10.33222/juara.v7i1.1484
2. Jumaat NF, Tasir Z. Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation. *Procedia - Soc Behav Sci.* 2013;103(26):526–33. https://doi.org/10.1016/j.sbspro.2013.10.369
3. Widiastuti W, Sulaiman I, Susilo S, Hernawan H, Mashud M, Solahuddin S, et al. Interactive multimedia development for swimming learning and training. *IOP Conf Ser Mater Sci Eng*. 2021;1098:1–6. https://doi.org/10.1088/1757-899x/1098/3/032038
4. Zeng Q. Research on Multimedia Swimming Teaching under Informatization. In: *Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020*. 2020. p. 60–3. https://doi.org/10.1109/CIPAE51077.2020.00023
5. Félix ER, da Silva HP, Olstad BH, Cabri J, Correia PL. Swimbit: A novel approach to stroke analysis during swim training based on attitude and heading reference system (ahrs). *Sports.* 2019;7(11):238. https://doi.org/10.3390/sports7110238
6. de Zeeuw M, Smolianov P, Dion S, Schoen C. Comparing the practices of Dutch swimming against a global model for integrated development of mass and high performance sport. *Manag Sport Leis*. 2017;22(2):91–112. https://doi.org/10.1080/23750472.2017.1394797
7. Susena SJ, Sugiharto S, Kusuma DWY. Development of Swimming Learning Media Based on Interactive Multimedia Applications Through Computers and Smartphones. *J Phys Educ Sport.* 2021;10(2):156–64. https://doi.org/10.15294/JPES.V10I2.46269
8. Usra M. Swimming Learning Model Using Rope As Aid For Beginners. In: *Proceedings of the First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017)*. 2018. p. 388–93. https://doi.org/10.2991/ice-17.2018.83
9. Khodaee M, Edelman GT, Spittler J, Wilber R, Krabak BJ, Solomon D, et al. Medical Care for Swimmers. *Sports Medicine - Open.* 2016. https://doi.org/10.1186/s40798-016-0051-2
10. Pharr J, Irwin C, Layne T, Irwin R. Predictors of swimming ability among children and adolescents in the united states. *Sports.* 2018;6(1):1–11. https://doi.org/10.3390/sports6010017
11. Baek KW, Lee MC, Jeon TB, Yoo J Il, Park JS, Moon HY, et al. Effects of exercise on physical fitness and strength according to the frailty level of

female elderly with hypertension. *Exerc Sci.* 2020;29(4):368–76. https://doi.org/10.15857/ksep.2020.29.4.368

12. González-Fernández FT, González-Víllora S, Baena-Morales S, Pastor-Vicedo JC, Clemente FM, Badicu G, et al. Effect of physical exercise program based on active breaks on physical fitness and vigilance performance. *Biology (Basel).* 2021; https://doi.org/10.3390/biology10111151
13. Suryadi D, Samodra YTJ, Purnomo E. Efektivitas latihan weight training terhadap kebugaran jasmani. *J RESPECS*. 2021;3(2):9–19. https://doi.org/10.31949/respecs.v3i2.1029
14. Rubiyatno, Perdana RP, Fallo IS, Arifin Z, Nusri A, Suryadi D, et al. Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagog Phys Cult Sport.* 2023;27(3):208–14. https://doi.org/10.15561/26649837.2023.0304
15. Suryadi D, Suganda MA, Sacko M, Samodra YTJ, Rubiyatno R, Supriatna E, et al. Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. *Phys Educ Sport Stud Res.* 2023;2(1):59–71. https://doi.org/10.56003/pessr.v2i1.182
16. Suryadi D. Analisis kebugaran jasmani siswa: Studi komparatif antara ekstrakurikuler bolabasket dan futsal. *Edu Sport Indones J Phys Educ.* 2022;3(2):100–10. https://doi.org/10.25299/es:ijope.2022.vol3(2).9280
17. Suryadi D, Rubiyatno. Kebugaran jasmani pada siswa yang mengikuti ekstrakulikuler futsal. *J Ilmu Keolahragaan.* 2022;5(1):1–8. https://doi.org/10.26418/jilo.v5i1.51718
18. Samodra YTJ, Suryadi D, Wati IDP, Supriatna E, Santika IGPNA, Suganda MA, et al. Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagog Phys Cult Sport*. 2023;27(2):139–145. https://doi.org/0.15561/26649837.2023.0206
19. Päivinen M, Keskinen K, Tikkanen H. Swimming-induced changes in pulmonary function: special observations for clinical testing. *BMC Sports Sci Med Rehabil.* 2021; https://doi.org/10.1186/s13102-021-00277-1
20. Abdul Gani R, Setiawan E, Jumareng H, Unju Subandi O. Implementation Of Modification Game Methods To Improve Breaststroke Swimming Skills. *Hal Olahraga Nusant (Jurnal Ilmu Keolahragaan)*. 2021;4(2):255–70. https://doi.org/10.31851/hon.v4i25404
21. Nicol E, Adani N, Lin B, Tor E. The temporal analysis of elite breaststroke swimming during competition. *Sport Biomech*. 2021; https://doi.org/10.1080/14763141.2021.1975810
22. Nicol E, Pearson S, Saxby D, Minahan C, Tor E. Stroke kinematics, temporal patterns, neuromuscular activity, pacing and kinetics in elite breaststroke swimming: A systematic review. *Sport Med - Open*. 2022;8(1):1–24. https://doi.org/10.1186/s40798-022-00467-2

23. Strzała M, Krezałek P, Kaca M, Głab G, Ostrowski A, Stanula A, et al. Swimming speed of the breaststroke kick. *J Hum Kinet.* 2012; https://doi.org/10.2478/v10078-012-0087-4

24. Suryadi D, Samodra YTJ, Gustian U, Yosika GF, B PS, Dewintha R, et al. Problem-based learning model: Can it improve learning outcomes for long serve in badminton. *Edu Sport Indones J Phys Educ*. 2023;4(1):29–36. https://doi.org/10.25299/es:ijope.2023.vol4(1).10987

25. Suryadi D, Saputra E, Wahyudi I. Tinggi Badan dan Keseimbangan Dinamis dengan Kemampuan Lay Up Permainan Bola Basket : Apakah Saling Berhubungan? *Indones J Phys Educ Sport Sci.* 2022;2(2):67–74. https://doi.org/10.52188/ijpess.v2i2.276

26. Rubiyatno R, Suryadi D. Penerapan Media Audio Visual Dalam Meningkatkan Hasil Belajar Servis Bulutangkis di MTs Mujahidin Pontianak. *Musamus J Phys Educ Sport.* 2022;4(2):140–9. https://doi.org/10.35724/mjpes.v4i02.4303

27. Hardinata R, Yosika GF, Haïdara Y, Perdana RP, Gustian U, Suryadi D, et al. Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? *Indones J Phys Educ Sport Sci.* 2023;3(1):69–80. https://doi.org/10.52188/ijpess.v3i1.387

28. Perdana RP, Supriatna E, Yanti N, Suryadi D. Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? *Edu Sport Indones J Phys Educ*. 2023;4(1):86–96. https://doi.org/10.25299/es:ijope.2023.vol4(1).12130

29. Haïdara Y, Okilanda A, Dewintha R, Suryadi D. Analysis of students' basic basketball skills: A comparative study of male and female students. *Tanjungpura J Coach Res.* 2023;1(1):1–5. https://doi.org/10.26418/tajor.v1i1.63796

30. Mashud M, Tangkudung J, Widiastuti W. Swimming Lesson Based on Interactive Multimedia. *Int J Sport Sci.* 2018;8(3):91–6. https://doi.org/10.5923/j.sports.20180803.04

31. Sugiyanto, Setiawan A, Hamidah I, Ana A. Integration of mobile learning and project-based learning in improving vocational school competence. *J Tech Educ Train.* 2020; https://doi.org/10.30880/jtet.2020.12.02.006

32. Haryanto, Kusuma WM, Mutohhari F, Nurtanto M, Suyitno S. Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering Using Video on YouTube. In: *Journal of Physics: Conference Series.* 2021. https://doi.org/10.1088/1742-6596/2111/1/012020

33. Saeed OA. The impact and clarity of presentation using multimedia learning system in the learning of swimming of back among students Specialized schools. *Sci J Phys Educ [Internet].* 2016;9(3):1–16. https://www.iasj.net/iasj/article/125482

34. Naczk A, Gajewska E, Naczk M. Effectiveness of swimming program in adolescents with down syndrome. *Int J Environ Res Public Health.* 2021;18(14):7441. https://doi.org/10.3390/ijerph18147441 PMID: 34299891

35. Pupišová Z, Pupiš M, Sykora J, Brunn D, Giničová J, Pavlović R. The impact of a specific training programme on the selected parameters of swimming turns. *Turkish J Kinesiol.* 2019;5(1):36–42. https://doi.org/10.31459/turkjkin.511533

36. Gülbin C, Mardin E, Üniversitesi A, Gül M, Gül GK, Gülbin Eskiyecek C, et al. The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance. *20International J Appl Exerc Physiol [Internet]*. 2020;9(3):213–20. http://www.ijaep.com/index.php/IJAE/article/view/789

37. Nosko M, Arkhypov O, Khudolii O, Filatova Z, Yevtushok M. Pedagogical Conditions for Swimming Skills Development in Students of Pedagogical Educational Institutions. *Rev Rom pentru Educ Multidimens.* 2019;11(2):240. https://doi.org/10.18662/rrem/127

38. Lenneis V, Agergaard S, Evans AB. Women-only swimming as a space of belonging. *Qual Res Sport Exerc Heal.* 2022;14(1):37–52. https://doi.org/10.1080/2159676X.2020.1844790

39. Zhang S, Dai J, Nie Z. Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China. *Discret Dyn Nat Soc.* 2022;2022:1–8. https://doi.org/10.1155/2022/6141342

40. Fone L, van den Tillaar R. Effect of Different Types of Strength Training on Swimming Performance in Competitive Swimmers: A Systematic Review. *Sports Medicine - Open*. 2022. p. 8(1).19. https://doi.org/10.1186/s40798-022-00410-5

Aurhor Information.

Author, First Name*	**Mashud**	**Syamsul**	**AR.**
Author, Middle Name - Initials:	-	-	-
Author, Last Name*	-	**Arifin**	**Shadiqin**
ORCID (register) *	https://orcid.org/0000-0003-3107-7134	https://orcid.org/0009-0006-2330-2564	https://orcid.org/0009-0005-4775-6862
e-mail*	mashud@ulm.ac.id	syamsul_arifin@ulm.ac.id	ar.shadiqin@ulm.ac.id
Affiliation*	Universitas Lambung Mangkurat	Universitas Lambung Mangkurat	Universitas Lambung Mangkurat
City, Country*	**Banjarmasin, Indonesia**	**Banjarmasin, Indonesia**	**Banjarmasin, Indonesia**

Author, First Name*	**Y Touvan**	**I Gusti**	**Didi**
Author, Middle Name - Initials:	**Juni**	**Putu**	-
Author, Last Name*	**Samodra**	**Ngurah Adi Santika**	**Suryadi**

Commented [MOU7]: Syamsul Arifin and AR. Shadiqin ORCID profile must have at least information (work, publications etc.).

PHYSICAL EDUCATION OF STUDENTS e-ISSN 2308-7250

ORCID (register) *	https://orcid.org/0000-0003-4850-1990	https://orcid.org/0000-0001-7873-0060	https://orcid.org/0000-0002-0206-9197
e-mail*	tovan@fkip.untan.ac.id	ngurahadisantika@gmail.com	didisurya1902@gmail.com
Affiliation*	Universitas Tanjungpura	Universitas PGRI Mahadewa	Universitas Negeri Yogyakarta
City, Country*	**Pontianak, Indonesia**	**Bali, Indonesia**	**Yogyakarta, Indonesia**

Bukti konfirmasi submit revisi, respon kepada reviewer, dan artikel yang diresubmit

(18 Mei 2023)

Revision completed

Participants Edit

prof. Sergii Iermakov (sergii)

Mashud (mashud)

Messages

Note	From
Dear Editor We have made improvements, we hope our improvements match the requests given. Thank you 1817-Mashud+et+al+ed-2.docx	mashud2023-05-18 05:31 AM

Add Message

← Back to Submissions

Reviewer's Attachments

Search

No Files

Revisions

Search Upload File

No Files

Review Discussions

Add discussion

Name	From	Last Reply	Replies	Closed
recommendations	sergii2023-05-17 03:22 PM	-	0	☐
▸ Revision completed	mashud2023-05-18 05:31 AM	-	0	☐

PHYSICAL EDUCATION OF STUDENTS e-ISSN 2308-7250

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills

Mashud[1ABCDE], Syamsul Arifin[1ABCD], Advendi Kristiyandaru[2ABDE], Y Touvan Juni Samodra[3BCDE], I Gusti Putu Ngurah Adi Santika[3BDE], Didi Suryadi[3,5ACDE]

[1]Departement Physical Education, Sport and Health, Universitas Lambung Mangkurat, Banjarmasin, Indonesia
[2]Departement Physical Education, Sport and Health, Universitas Negeri Surabaya, Surabaya, Indonesia
[3]Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura, Pontianak, Indonesia
[4]Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education, Universitas PGRI Mahadewa, Bali, Indonesia
[5]Department of Sport Science, Faculty of Sport Science and Health, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: mashud, e-mail: mashud@ulm.ac.id

Abstract

Background and Study Aim. Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills.
Material and Methods. This research is a quasi-experimental type with a pretest posttest nonequivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totaled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing.
Results. The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score.
Conclusions. This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Keywords: learning model, project based learning, interactive multimedia , swimming breaststroke

Introduction

Sport is a physical activity that can be carried out by various groups [1]. Along with its development, technological advances in sports coaching are needed [2]. Where technological advances are increasingly sophisticated and modern, so that they are very close to digital devices both online and offline [3]. Therefore, the rapid development of various technologies gives hope for the modernization of new technologies in the world of education [4], including reforms in the world of sports [5]. In addition, models and media that are currently developing rapidly cause various demands and lifestyle changes, including sports, especially swimming [6].

Swimming is a sport that is done in water [7], and all levels of society can do this sport regardless of age and gender [8], and it is one of the most popular sports in the world [9]. Swimming activity is an important resource so as not to drown [10], besides that it also requires good and prime physical condition. Thus, physical fitness is also maintained [11–15], which is related to physical health [16–18]. A study based on the results of clinical trials

showed that swimmers found specific improvements in lung function [19]. The results of this review have provided an illustration that swimming is a very important water sport, both for physical abilities and health-related fitness. However, special attention is needed as said by Pharr et al that few studies have an understanding of predictors of swimming ability. There are various styles in swimming, one of which is the breaststroke [10].

Breaststroke swimming or what is often known as frog style is a swimming style facing the surface of the water, where the legs are moved outwards like kicking backwards. The movement starts from the first arm swing after sliding and the body must remain face down and both shoulders parallel to the surface of the water[20]. In addition, the breaststroke becomes the only competitive stroke [21], and the complex is also characterized by an intermittent propulsion phase [22]. A study by Strzała says that success in breaststroke swimming turns out that most of the power is reinforced by the kicking motion of the breaststroke and is considered the most responsible [23]. Therefore, it is very important to coordinate limb movements optimally for swimmers, this aims to maintain the best possible speed [21]. In addition, breaststroke swimming is a compulsory subject for students majoring in sports education at the Teaching and Education Faculty (FKIP) of Lambung Mangkurat University. Where the existence of swimming practice courses is the basis for the creation of experienced and potential teachers, thus providing an important role in the community environment.

Implementation of breaststroke swimming practice lectures to students by providing basic technical practice materials and swimming skills based on contracts and lecture teaching materials. Thus students are required to be able to do and practice breaststroke swimming, this is intended for preparation after graduating from university later. Therefore, to obtain maximum results, it is necessary to have a learning design so that it is not monotonous [24–28]. Where sports teachers are also a consideration in seeing student success [29]. Furthermore, harnessing the advancement of technology in a few decades may be an option to replace the traditional way [3]. The solutions offered use a project-based learning model with interactive multimedia, this is also considered in line with technological advances and their use in the world of sports. As is the case with what was said Jumaat & Tasir that sports science and technology needs appreciation, especially for coaches in Indonesia [2]. The results are the same as research conducted by Widiastuti & Mashud interactive multimedia developed will facilitate swimming training and is feasible to implement [3,30].

Although previously Sugiyanto research had been carried out on the integration of mobile learning and project-based learning [31], and Haryanto innovation media learning, online project-based learning (O-PBL) [32]. However, researchers have not found research on the integration of project-based learning models with interactive multimedia in physical education, especially those that discuss breaststroke swimming. So that this can be a research update and strengthen the importance of this research to be carried out. That way, this research will be able to contribute to the strategies and learning models used. In his research Saeed applying multimedia provides an advantage in the learning process [33]. Based on these problems, this study aims to provide evidence of the integration of project-based learning models with interactive multimedia to improve students' breaststroke swimming skills.

Materials and Methods

Participants

This research will be conducted in a swimming pool located on the main campus of the Department of Sports and Health Education, Teaching and Education Faculty, Lambung Mangkurat University from September 2022 to November 2022. The researchers determined the sample in this study using purposive sampling with a total sample of 90 students, namely 45 experimental groups and 45 control groups.

Research Design

The effectiveness model used in this study is experimental. The method used is a quasi-experimental design with pretest posttest nonequivalent control group design. In this method given different treatment in the experimental group and the control group. In this study the experimental class will be treated with a project based learning model with interactive multimedia while the control class will be treated with a conventional learning model. This study was initiated by administering a pretest to the experimental and control groups, then the experimental group was given a project based learning model treatment with interactive multimedia for 8 meetings. Then a posttest was given to the experimental and control groups to see the effect of the treatment on the experimental group.

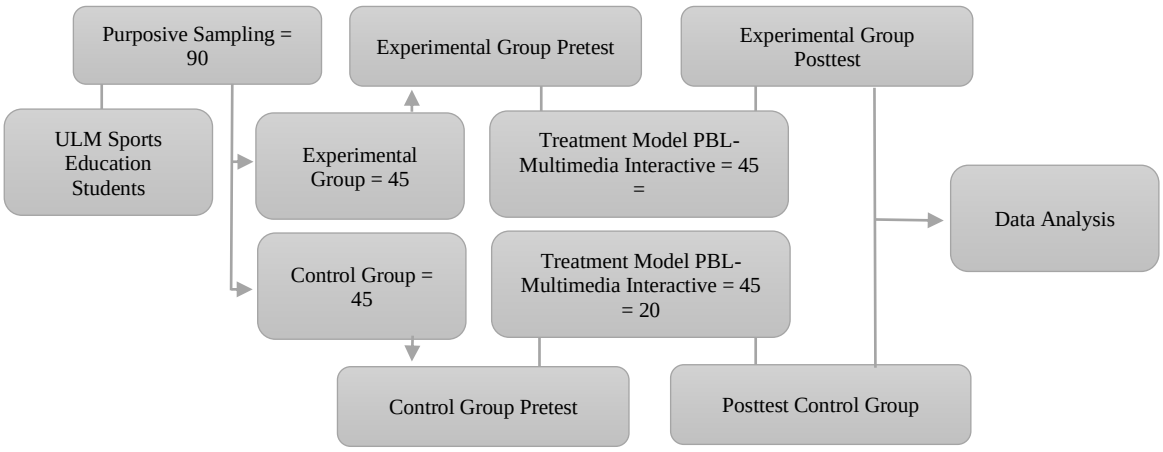


Figure 1. Chart of Research Procedures

The instrument for the results of breaststroke swimming skills was designed by researchers, based on the theory of swimming experts. Especially for the breaststroke swimming instrument, it is divided into; 1) concept; 2) breaststroke swimming indicator; and 3) descriptors (description of indicators). The concept is breaststroke swimming which is divided into 7 (seven) indicators, namely; 1) start; 2) body position; 3) leg movements; 4) arm movement and recovery; 5) breath movement; 6) coordination movement; and 7) reversal movement. Of the 7 (seven) indicators, each is further divided into 5 descriptors. So the total number of descriptors for the breaststroke swimming instrument is 35 items. It is from these 35 descriptor items that the testee scores are obtained.

In order to find out whether the instrument used was feasible, testers 1 and 2 were first tested with a sample of 15 students of the Physical Education Study Program. Where the results show for n = 15 and an error rate of 5%, it is obtained r table = 0.514 and an error level of 1% r table = 0.641, because r count is greater than r table (0.966 > 0.641 > 0.514), it can be concluded that the swimming ability instrument reliable.

Statistical Analysis

The research data was analyzed in a quantitative descriptive manner to provide a summary of research data and to facilitate the presentation of research data. Data showing normal distribution were analyzed using the t test to test the difference in the average pretest and posttest results in the experimental group and the control group, as well as the significance assisted using the SPSS 26 application.

Results

Quasi-experimental research, namely the existence of different treatments in the experimental group and the control group. In this study the experimental group was treated with a project based learning model with interactive multimedia (PBL-interactive multimedia) and the control group (Conventional). Before being given the effect test and the different test, first carry out the normality prerequisite test, if the data is normal, it will use the t-test and if it is not normal, it will proceed with the nonparametric test.

Table 1. Kolmogorov-Smirnov Normality Prerequisite Test

Result	Statistics	df	Sig.
Experiment Pretest	0.097	45	.200 *
Posttest Experiment	0.117	45	.144
Pretest Control	0.107	45	.200 *
Posttest Control	0.118	45	.129

Based on the results of the normality test with the Kolmogorov-Smirnov formula, it shows that the significance value is p> 0.05, so in conclusion the data shows normal, then the t-test will be continued. The results of the normality test can be seen in table 1.

Table 2. Paired Samples Test Results of the t-test

Pairs	Result	Means	std. Deviation	t	df	Sig. (2-tailed)
Pair 1	Experimental Pretest - Experimental Posttest	-6,467	3,653	-11,875	44	0.000
Pair 2	Pretest Control - Posttest Control	-3,089	3,502	-5,917	44	0.000

The results in table 2 of the hypothesis test on the indicators of the experimental group with the PBL-Multimedia Interactive treatment show a significance value of 0.000 <0.05, so these results provide evidence that the PBL-multimedia interactive model provides a significant increase in the results of breaststroke swimming skills.

Furthermore, the control group showed a significance value of 0.000 <0.05, so these results also provide evidence that the conventional model actually provides a significant increase in the results of breaststroke swimming skills. Based on the results of the analysis of hypothesis testing, it can be concluded that the PBL-interactive multimedia model and the conventional model can be applied to improve breaststroke swimming skills. Seeing these results, the researcher wants to see the difference in the effect given, so that the model can be proven more effective to use.

Table 3. Test of Homogeneity of Variances

Learning	Result	Levene Statistics	df1	df2	Sig.
Breaststroke Swimming	Based on Means	2,240	3	176	0.085

Based on the results of the homogeneity test, it shows a significance value of 0.085 > 0.05, so the result is homogeneous, then it will be followed by a different test with the Independent Samples t Test formula. The normality test results can be seen in table 3.

Table 4. Difference Test of Experimental Pre-test (PBL-Multimedia Interactive) and Control Pre-test

Results	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Pre-test and Control Pre-test	0.282	0.596	0.111	88	0912

The results in table 4 to find out the difference in the pre-test scores of the experimental group and the pre-test of the control group, the results show a significance value of 0.912 > 0.05 so there is no significant difference in the pre-test of the PBL-Multimedia Interactive experimental group with the pre-test control group (Conventional).

Table 5. Difference Test of Experimental Post-test (PBL-Multimedia Interactive) and Control Post-test

Result	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Post-test and Control Post-test	0.266	0.607	3,408	88	0.001

The results in table 4 to find out the difference in the pre-test values of the experimental group and the pre-test of the control group, the results show a significance value of 0.001 <0.05, so the post-test of the PBL- Multimedia Interactive experimental group and the post-test of the control group (Conventional) there is a difference significant influence. Based on these results, it proves that the PBL-Multimedia Interactive model is more effective than the conventional learning model. So the PBL-Multimedia Interactive model is more recommended to improve breaststroke swimming skills.

Based on table 6 it can be seen that the minimum, maximum, mean, and standard deviation on pretest and posttest data with PBL-Multimedia Interactive model treatment proves that the posttest scores are better, but the difference is not too big. For more details can be seen in Figure 2.

Table 6. Descriptive Analysis of Pre-test and Post-test Data on Breaststroke Swimming Ability Results

Group	N	Minimum	Maximum	Means	std. Deviation
Pre-test Experiment	45	4	35	20.04	6,759
Post-test Experimental	45	15	35	26.51	4,888
Pre-test Control	45	6	29	19.89	6,516
Post-test Control	45	10	32	22.98	4,947

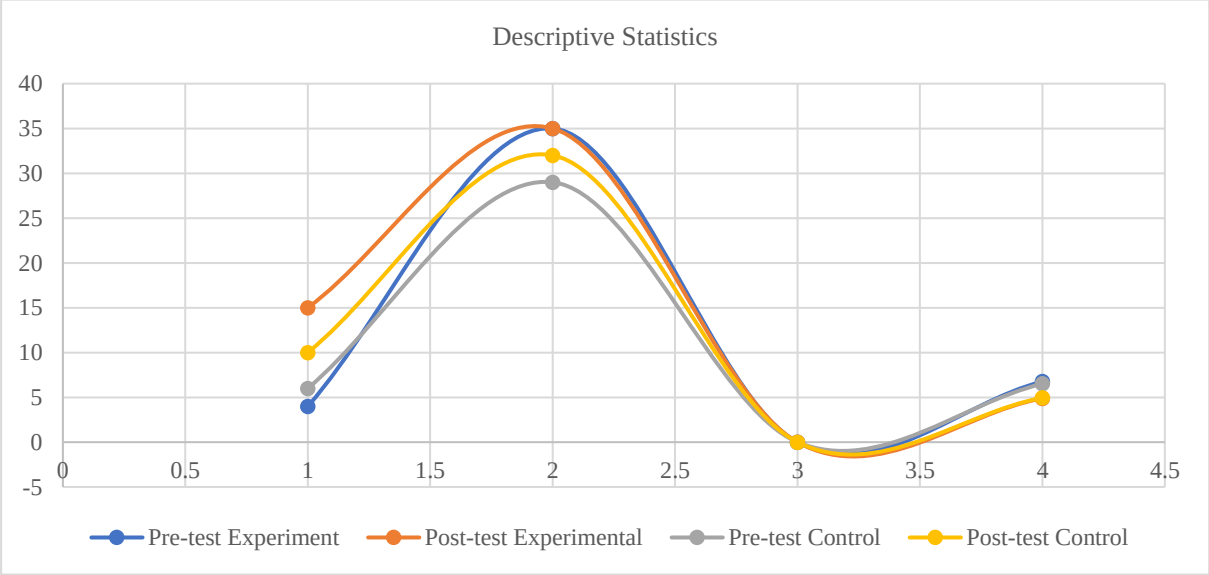


Figure 2. Descriptive Data of Pre-test and Post-test of Breaststroke Swimming Ability

Discussion

This study aims to provide evidence of the effect of integrating project-based learning models with interactive multimedia on improving students' breaststroke swimming skills. The results showed that the average value of the posttest experimental group (26.51) and the control group (22.98) was greater than the pretest value of the experimental group (20.04) and the control group (19.89). Furthermore, the result of the calculated t value is greater than t table, and the results also show significant. From these results it can be concluded that the PBL-Multimedia Interactive model and the conventional model show a significant increase in the learning outcomes of breaststroke swimming. Previous research by Sugiyanto provides evidence that the Integration of Mobile Learning and Project Based Learning has an increasing effect on the competency of vocational high schools [31]. Furthermore, it has been proven that media-based online project-based learning is appropriate for use in automotive engineering drawing subjects [32].

Other studies have found that swimming skills can also be improved by doing swimming exercises for 33 weeks, and have a positive effect on health [34]. In addition, providing special training to swimmers can improve performance during competitions [35]. Research by . Gülbin that the performance of male swimmers is also influenced by using core training, where this exercise has a positive effect [36]. Several studies have shown that playing approaches, authoritarian teaching styles, and democratic influences affect students' swimming abilities [37,38]. To improve safety skills in swimming, you can apply traditional swimming teaching, but do not reduce student drowning injuries [39]. Subsequent studies, to improve performance in swimming do more strength training [40].

The results of the study also show the difference in the influence of the PBL-Multimedia Interactive model and the conventional model , where the PBL-Multimedia Interactive model is more effective. These results are reinforced by Susena proving that swimming based on interactive multimedia applications shows very good

criteria [7]. A study has proven that multimedia-based swimming learning provides an increase in backstroke swimming [33], and multimedia learning proves its superiority compared to learning without multimedia. The results of this study are reinforced by Widiastuti that with the existence of a learning model with interactive multimedia that is being developed [3], it is hoped that it can be an alternative to conventional methods. Based on this review, it reaffirms the application of interactive multimedia-based learning, where this is done following increasingly advanced technological developments. In this way, the results of research on the integration of project-based learning models with interactive multimedia can also be considered as a learning model that utilizes technological advances in the field of sports.

Conclusions

The results of the research and discussion have a strong foundation related to the Interactive PBL-Multimedia model, on the basis of references from the research listed previously in the discussion of results and discussion. Where these findings have resulted in several conclusions. The results of the study prove that the PBL-Multimedia Interactive model and the conventional model have a significant effect on improving students' breaststroke swimming skills. These findings also show a significant difference between the Interactive PBL-Multimedia model and the conventional model, namely the Interactive PBL-Multimedia model is more effective for improving breaststroke swimming skills. The results of this study have provided a new reference related to breaststroke swimming practice learning, and added evidence that the integration of project-based learning models with interactive multimedia is more advisable to improve swimming skills, especially breaststroke. The weakness of the research lies in the activities and warm-up carried out by students before the final test is carried out. In addition, the physical condition of students who are not fully monitored is also one of the research weaknesses. Recommendations for further research can apply the PBL-Multimedia Interactive model to other swimming skills, it is known that swimming is popular with 4 styles namely freestyle, butterfly, backstroke and breaststroke.

Acknowledgement

Sincere gratitude to all participants for their unwavering desire to join in and contribute to the research, revealing closeness while also granting us entire trust.

Conflict of interest

There is no conflict of interest.

References

1. Suryadi D, Gustian U, Fauziah E. The Somatotype of Martial Athletes in the Fighter Category Against Achievement. *JUARA J Olahraga*. 2022;7(1):116–25. https://doi.org/10.33222/juara.v7i1.1484
2. Jumaat NF, Tasir Z. Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation. *Procedia - Soc Behav Sci.* 2013;103(26):526–33. https://doi.org/10.1016/j.sbspro.2013.10.369
3. Widiastuti W, Sulaiman I, Susilo S, Hernawan H, Mashud M, Solahuddin S, et al. Interactive multimedia development for swimming learning and training. *IOP Conf Ser Mater Sci Eng*. 2021;1098:1–6. https://doi.org/10.1088/1757-899x/1098/3/032038
4. Zeng Q. Research on Multimedia Swimming Teaching under Informatization. In: *Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020*. 2020. p. 60–3. https://doi.org/10.1109/CIPAE51077.2020.00023
5. Félix ER, da Silva HP, Olstad BH, Cabri J, Correia PL. Swimbit: A novel approach to stroke analysis during swim training based on attitude and heading reference system (ahrs). *Sports.* 2019;7(11):238. https://doi.org/10.3390/sports7110238
6. de Zeeuw M, Smolianov P, Dion S, Schoen C. Comparing the practices of Dutch swimming against a global model for integrated development of mass and high performance sport. *Manag Sport Leis*. 2017;22(2):91–112. https://doi.org/10.1080/23750472.2017.1394797
7. Susena SJ, Sugiharto S, Kusuma DWY. Development of Swimming Learning Media Based on Interactive Multimedia Applications Through Computers and Smartphones. *J Phys Educ Sport.* 2021;10(2):156–64. https://doi.org/10.15294/JPES.V10I2.46269
8. Usra M. Swimming Learning Model Using Rope As Aid For Beginners. In: *Proceedings of the First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017)*. 2018. p. 388–93. https://doi.org/10.2991/ice-17.2018.83
9. Khodaee M, Edelman GT, Spittler J, Wilber R, Krabak BJ, Solomon D, et al. Medical Care for Swimmers. *Sports Medicine - Open*. 2016. https://doi.org/10.1186/s40798-016-0051-2
10. Pharr J, Irwin C, Layne T, Irwin R. Predictors of swimming ability among children and adolescents in the united states. *Sports.* 2018;6(1):1–11. https://doi.org/10.3390/sports6010017

11. Baek KW, Lee MC, Jeon TB, Yoo J Il, Park JS, Moon HY, et al. Effects of exercise on physical fitness and strength according to the frailty level of female elderly with hypertension. *Exerc Sci.* 2020;29(4):368–76. https://doi.org/10.15857/ksep.2020.29.4.368
12. González-Fernández FT, González-Víllora S, Baena-Morales S, Pastor-Vicedo JC, Clemente FM, Badicu G, et al. Effect of physical exercise program based on active breaks on physical fitness and vigilance performance. *Biology (Basel).* 2021; https://doi.org/10.3390/biology10111151
13. Suryadi D, Samodra YTJ, Purnomo E. Efektivitas latihan weight training terhadap kebugaran jasmani. *J RESPECS*. 2021;3(2):9–19. https://doi.org/10.31949/respecs.v3i2.1029
14. Rubiyatno, Perdana RP, Fallo IS, Arifin Z, Nusri A, Suryadi D, et al. Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagog Phys Cult Sport.* 2023;27(3):208–14. https://doi.org/10.15561/26649837.2023.0304
15. Suryadi D, Suganda MA, Sacko M, Samodra YTJ, Rubiyatno R, Supriatna E, et al. Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. *Phys Educ Sport Stud Res.* 2023;2(1):59–71. https://doi.org/10.56003/pessr.v2i1.182
16. Suryadi D. Analisis kebugaran jasmani siswa: Studi komparatif antara ekstrakurikuler bolabasket dan futsal. *Edu Sport Indones J Phys Educ.* 2022;3(2):100–10. https://doi.org/10.25299/es:ijope.2022.vol3(2).9280
17. Suryadi D, Rubiyatno. Kebugaran jasmani pada siswa yang mengikuti ekstrakulikuler futsal. *J Ilmu Keolahragaan.* 2022;5(1):1–8. https://doi.org/10.26418/jilo.v5i1.51718
18. Samodra YTJ, Suryadi D, Wati IDP, Supriatna E, Santika IGPNA, Suganda MA, et al. Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagog Phys Cult Sport*. 2023;27(2):139–145. https://doi.org/0.15561/26649837.2023.0206
19. Päivinen M, Keskinen K, Tikkanen H. Swimming-induced changes in pulmonary function: special observations for clinical testing. *BMC Sports Sci Med Rehabil.* 2021; https://doi.org/10.1186/s13102-021-00277-1
20. Abdul Gani R, Setiawan E, Jumareng H, Unju Subandi O. Implementation Of Modification Game Methods To Improve Breaststroke Swimming Skills. *Hal Olahraga Nusant (Jurnal Ilmu Keolahragaan)*. 2021;4(2):255–70. https://doi.org/10.31851/hon.v4i25404
21. Nicol E, Adani N, Lin B, Tor E. The temporal analysis of elite breaststroke swimming during competition. *Sport Biomech*. 2021; https://doi.org/10.1080/14763141.2021.1975810
22. Nicol E, Pearson S, Saxby D, Minahan C, Tor E. Stroke kinematics, temporal patterns, neuromuscular activity, pacing and kinetics in elite breaststroke swimming: A systematic review. *Sport Med - Open*. 2022;8(1):1–24. https://doi.org/10.1186/s40798-022-00467-2
23. Strzała M, Krezałek P, Kaca M, Głab G, Ostrowski A, Stanula A, et al. Swimming speed of the breaststroke kick. *J Hum Kinet.* 2012; https://doi.org/10.2478/v10078-012-0087-4
24. Suryadi D, Samodra YTJ, Gustian U, Yosika GF, B PS, Dewintha R, et al. Problem-based learning model: Can it improve learning outcomes for long serve in badminton. *Edu Sport Indones J Phys Educ*. 2023;4(1):29–36. https://doi.org/10.25299/es:ijope.2023.vol4(1).10987
25. Suryadi D, Saputra E, Wahyudi I. Tinggi Badan dan Keseimbangan Dinamis dengan Kemampuan Lay Up Permainan Bola Basket : Apakah Saling Berhubungan? *Indones J Phys Educ Sport Sci.* 2022;2(2):67–74. https://doi.org/10.52188/ijpess.v2i2.276
26. Rubiyatno R, Suryadi D. Penerapan Media Audio Visual Dalam Meningkatkan Hasil Belajar Servis Bulutangkis di MTs Mujahidin Pontianak. *Musamus J Phys Educ Sport.* 2022;4(2):140–9. https://doi.org/10.35724/mjpes.v4i02.4303
27. Hardinata R, Yosika GF, Haïdara Y, Perdana RP, Gustian U, Suryadi D, et al. Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? *Indones J Phys Educ Sport Sci.* 2023;3(1):69–80. https://doi.org/10.52188/ijpess.v3i1.387
28. Perdana RP, Supriatna E, Yanti N, Suryadi D. Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? *Edu Sport Indones J Phys Educ*. 2023;4(1):86–96. https://doi.org/10.25299/es:ijope.2023.vol4(1).12130
29. Haïdara Y, Okilanda A, Dewintha R, Suryadi D. Analysis of students' basic basketball skills: A comparative study of male and female students. *Tanjungpura J Coach Res.* 2023;1(1):1–5. https://doi.org/10.26418/tajor.v1i1.63796
30. Mashud M, Tangkudung J, Widiastuti W. Swimming Lesson Based on Interactive Multimedia. *Int J Sport Sci.* 2018;8(3):91–6. https://doi.org/10.5923/j.sports.20180803.04
31. Sugiyanto, Setiawan A, Hamidah I, Ana A. Integration of mobile learning and project-based learning in improving vocational school competence. *J Tech Educ Train*. 2020; https://doi.org/10.30880/jtet.2020.12.02.006
32. Haryanto, Kusuma WM, Mutohhari F, Nurtanto M, Suyitno S. Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering Using Video on

YouTube. In: *Journal of Physics: Conference Series.* 2021. https://doi.org/10.1088/1742-6596/2111/1/012020
33. Saeed OA. The impact and clarity of presentation using multimedia learning system in the learning of swimming of back among students Specialized schools. *Sci J Phys Educ [Internet].* 2016;9(3):1–16. https://www.iasj.net/iasj/article/125482
34. Naczk A, Gajewska E, Naczk M. Effectiveness of swimming program in adolescents with down syndrome. *Int J Environ Res Public Health.* 2021;18(14):7441. https://doi.org/10.3390/ijerph18147441 PMID: 34299891
35. Pupišová Z, Pupiš M, Sykora J, Brunn D, Giničová J, Pavlović R. The impact of a specific training programme on the selected parameters of swimming turns. *Turkish J Kinesiol.* 2019;5(1):36–42. https://doi.org/10.31459/turkjkin.511533
36. Gülbin C, Mardin E, Üniversitesi A, Gül M, Gül GK, Gülbin Eskiyecek C, et al. The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance. *20International J Appl Exerc Physiol [Internet].* 2020;9(3):213–20. http://www.ijaep.com/index.php/IJAE/article/view/789
37. Nosko M, Arkhypov O, Khudolii O, Filatova Z, Yevtushok M. Pedagogical Conditions for Swimming Skills Development in Students of Pedagogical Educational Institutions. *Rev Rom pentru Educ Multidimens.* 2019;11(2):240. https://doi.org/10.18662/rrem/127
38. Lenneis V, Agergaard S, Evans AB. Women-only swimming as a space of belonging. *Qual Res Sport Exerc Heal.* 2022;14(1):37–52. https://doi.org/10.1080/2159676X.2020.1844790
39. Zhang S, Dai J, Nie Z. Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China. *Discret Dyn Nat Soc.* 2022;2022:1–8. https://doi.org/10.1155/2022/6141342
40. Fone L, van den Tillaar R. Effect of Different Types of Strength Training on Swimming Performance in Competitive Swimmers: A Systematic Review. *Sports Medicine - Open*. 2022. p. 8(1).19. https://doi.org/10.1186/s40798-022-00410-5

Aurhor Information.

Author, First Name*	**Mashud**	**Syamsul**	**Advendi**
Author, Middle Name - Initials:	-	-	-
Author, Last Name*	-	**Arifin**	**Kristiyandaru**
ORCID (register) *	https://orcid.org/0000-0003-3107-7134	https://orcid.org/0009-0006-2330-2564	https://orcid.org/0000-0003-0085-6063
e-mail*	mashud@ulm.ac.id	syamsul_arifin@ulm.ac.id	advendikristiyandaru@unesa.ac.id
Affiliation*	Universitas Lambung Mangkurat	Universitas Lambung Mangkurat	Universitas Negeri Surabaya
City, Country*	**Banjarmasin, Indonesia**	**Banjarmasin, Indonesia**	**Surabaya, Indonesia**

Author, First Name*	**Y Touvan**	**I Gusti**	**Didi**
Author, Middle Name - Initials:	**Juni**	**Putu**	-
Author, Last Name*	**Samodra**	**Ngurah Adi Santika**	**Suryadi**
ORCID (register) *	https://orcid.org/0000-0003-4850-1990	https://orcid.org/0000-0001-7873-0060	https://orcid.org/0000-0002-0206-9197
e-mail*	tovan@fkip.untan.ac.id	ngurahadisantika@gmail.com	didisurya1902@gmail.com
Affiliation*	Universitas Tanjungpura	Universitas PGRI Mahadewa	Universitas Negeri Yogyakarta
City, Country*	**Pontianak, Indonesia**	**Bali, Indonesia**	**Yogyakarta, Indonesia**

Bukti konfirmasi artikel accepted
(31 Mei 2023)

UNIVERSITAS
LAMBUNG MANGKURAT

Mashud Mashud <mashud@ulm.ac.id>

APC

2 messages

Sergii Iermakov <sportart@gmail.com> Thu, Jun 1, 2023 at 12:04 AM
To: mashud@ulm.ac.id

Dear Mashud,
Congratulations! Your article has been recommended for publication. You can find information about the article in the site section at
MANUSCRIPTS UNDER EVALUATION:
NEXT ISSUE:
Physical Education of Students, 2023, 27(3), June
https://sportedu.org.ua/index.php/PES/next

4.	Mashud, Syamsul Arifin, Advendi Kristiyandaru, Y Touvan Juni Samodra, I Gusti Putu Ngurah Adi Santika, Did

To complete the editorial process for your article, the corresponding author must pay an Article Processing Charge (APC) of $270.
You can learn more about the APC payment process at
https://sportedu.org.ua/index.php/PES/about/submissions#25
We have sent a link to an invoice for APC payment to your email through our Fondy system:

https://pay.fondy.eu/invoice/activate/?id=792193&sign=db9241709bd060fcaf84559c8732ef28099115fc

Please note that our payment system has no commissions. Once the APC payment is successfully made, your article will be published and shown in the "EARLY ACCESS" section of the site. On the announced day of publication of the next issue of the journal, the article will be moved to the "CURRENT ISSUE" section, and the DOI of the article will be activated.

After making the payment, please send a copy of the payment document confirming the fact of payment for the services of the magazine to our email at sportart@gmail.com
We will also send you the layout of the article in PDF format. Please check the layout thoroughly and highlight any possible corrections using a color or a comment. If you find any errors or mistakes, please send us the corrected article layout, and we will make the necessary corrections.

We wanted to take a moment to thank you for submitting such a valuable and informative research article to our publication. Your contribution is highly appreciated and we believe that it will make a significant impact on the scientific community.
We wish you all the best in your future research endeavors and hope that you will continue to produce such high-quality work.
Please know that we will do our best to present your article to a wide range of scientific community, and we are confident that it will be well-received.

Yours sincerely,
prof. Sergii Iermakov
Editor-in-chief
Kharkiv, Ukraine (Al Jazeera)
Kharkiv, Ukraine(The Economist)

03Mashud.pdf
283K

Mashud Mashud <mashud@ulm.ac.id> Thu, Jun 1, 2023 at 8:37 PM
To: didisurya1902@gmail.com

[Quoted text hidden]

03Mashud.pdf
283K

Bukti konfirmasi artikel published online

(30 Juni 2023)

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills

Mashud
Universitas Lambung Mangkurat
https://orcid.org/0000-0003-3107-7134

Syamsul Arifin
Universitas Lambung Mangkurat
https://orcid.org/0009-0006-2330-2564

Advendi Kristiyandaru
Universitas Negeri Surabaya
https://orcid.org/0000-0003-0085-6063

Y Touvan Juni Samodra
Universitas Tanjungpura
https://orcid.org/0000-0003-4850-1990

I Gusti Putu Ngurah Adi Santika
PGRI Mahadewa University
https://orcid.org/0000-0001-7873-0060

Didi Suryadi
Universitas Negeri Yogyakarta
https://orcid.org/0000-0002-0206-9197

DOI: https://doi.org/10.15561/20755279.2023.0304

Keywords: learning model, project based learning, interactive multimedia, swimming breaststroke

Abstract

Background and Study Aim. Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills. Material and Methods. This research is a quasi-experimental type with a pretest posttest non-equivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totalled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing. Results. The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score. Conclusions. This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on

improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Author Biographies

Mashud, Universitas Lambung Mangkurat
mashud@ulm.ac.id; Departement Physical Education, Sport and Health; Banjarmasin, Indonesia.

Syamsul Arifin, Universitas Lambung Mangkurat
syamsul_arifin@ulm.ac.id; Departement Physical Education, Sport and Health; Banjarmasin, Indonesia.

Advendi Kristiyandaru, Universitas Negeri Surabaya
advendikristiyandaru@unesa.ac.id; Departement Physical Education, Sport and Health; Surabaya, Indonesia.

Y Touvan Juni Samodra, Universitas Tanjungpura
tovan@fkip.untan.ac.id; Department of Sport Coaching Education, Faculty of Teacher Training and Education, ; Pontianak, Indonesia.

I Gusti Putu Ngurah Adi Santika, PGRI Mahadewa University
ngurahadisantika@gmail.com; Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education; Bali, Indonesia.

Didi Suryadi, Universitas Negeri Yogyakarta
didisurya1902@gmail.com; Department of Sport Science, Faculty of Sport Science and Health (Yogyakarta, Indonesia). Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura (Pontianak, Indonesia).

References

Suryadi D, Gustian U, Fauziah E. The Somatotype of Martial Athletes in the Fighter Category Against Achievement. JUARA J Olahraga. 2022;7(1):116–25. https://doi.org/10.33222/juara.v7i1.1484

Jumaat NF, Tasir Z. Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation. Procedia - Soc Behav Sci. 2013;103(26):526–33. https://doi.org/10.1016/j.sbspro.2013.10.369

Widiastuti W, Sulaiman I, Susilo S, Hernawan H, Mashud M, Solahuddin S, et al. Interactive multimedia development for swimming learning and training. IOP Conf Ser Mater Sci Eng. 2021;1098:1–6. https://doi.org/10.1088/1757-899x/1098/3/032038

Zeng Q. Research on Multimedia Swimming Teaching under Informatization. In: Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020. 2020. P. 60–63. https://doi.org/10.1109/CIPAE51077.2020.00023

Félix ER, da Silva HP, Olstad BH, Cabri J, Correia PL. Swimbit: A novel approach to stroke analysis during swim training based on attitude and heading reference system (ahrs). Sports. 2019;7(11):238. https://doi.org/10.3390/sports7110238

de Zeeuw M, Smolianov P, Dion S, Schoen C. Comparing the practices of Dutch swimming against a global model for integrated development of mass and high performance sport. Manag Sport Leis. 2017;22(2):91–112. https://doi.org/10.1080/23750472.2017.1394797

Susena SJ, Sugiharto S, Kusuma DWY. Development of Swimming Learning Media Based on Interactive Multimedia Applications Through Computers and Smartphones. J Phys Educ Sport. 2021;10(2):156–64. https://doi.org/10.15294/JPES.V10I2.46269

Usra M. Swimming Learning Model Using Rope As Aid For Beginners. In: Proceedings of the First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017). 2018. P. 388–93. https://doi.org/10.2991/ice-17.2018.83

Khodaee M, Edelman GT, Spittler J, Wilber R, Krabak BJ, Solomon D, et al. Medical Care for Swimmers. Sports Medicine - Open, 2016;2(1): 27. https://doi.org/10.1186/s40798-016-0051-2

Pharr J, Irwin C, Layne T, Irwin R. Predictors of swimming ability among children and adolescents in the United States. Sports. 2018;6(1):1–11. https://doi.org/10.3390/sports6010017

Baek KW, Lee MC, Jeon TB, Yoo J Il, Park JS, Moon HY, et al. Effects of exercise on physical fitness and strength according to the frailty level of female elderly with hypertension. Exerc Sci. 2020;29(4):368–76. https://doi.org/10.15857/ksep.2020.29.4.368

González-Fernández FT, González-Víllora S, Baena-Morales S, Pastor-Vicedo JC, Clemente FM, Badicu G, et al. Effect of Physical Exercise Program Based on Active Breaks on Physical Fitness and Vigilance Performance. Biology, 2021;10(11): 1151. https://doi.org/10.3390/biology10111151

Suryadi D, Samodra YTJ, Purnomo E. Efektivitas latihan weight training terhadap kebugaran jasmani [The effectiveness of weight training exercises on physical fitness]. J RESPECS. 2021;3(2):9–19. (In Indonesian). https://doi.org/10.31949/respecs.v3i2.1029

Rubiyatno, Perdana RP, Fallo IS, Arifin Z, Nusri A, Suryadi D, et al. Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. Pedagog Phys Cult Sport. 2023;27(3):208–14. https://doi.org/10.15561/26649837.2023.0304

Suryadi D, Suganda MA, Sacko M, Samodra YTJ, Rubiyatno R, Supriatna E, et al. Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. Phys Educ Sport Stud Res. 2023;2(1):59–71. https://doi.org/10.56003/pessr.v2i1.182

Suryadi D. Analisis kebugaran jasmani siswa: Studi komparatif antara ekstrakurikuler bolabasket dan futsal [Analysis of students' physical fitness: Comparative study between basketball and futsal extracurriculars]. Edu Sport Indones J Phys Educ. 2022;3(2):100–10. (In Indonesian). https://doi.org/10.25299/es:ijope.2022.vol3(2).9280

Suryadi D, Rubiyatno. Kebugaran jasmani pada siswa yang mengikuti ekstrakulikuler futsal [Physical fitness of students who take part in extracurricular futsal]. J Ilmu Keolahragaan. 2022;5(1):1–8. (In Indonesian). https://doi.org/10.26418/jilo.v5i1.51718

Samodra YTJ, Suryadi D, Wati IDP, Supriatna E, Santika IGPNA, Suganda MA, et al. Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. Pedagog Phys Cult Sport. 2023;27(2):139–145. https://doi.org/0.15561/26649837.2023.0206

Päivinen M, Keskinen K, Tikkanen H. Swimming-induced changes in pulmonary function: special observations for clinical testing. BMC Sports Science, Medicine and Rehabilitation, 2021;13(1): 55. https://doi.org/10.1186/s13102-021-00277-1

Abdul Gani R, Setiawan E, Jumareng H, Unju Subandi O. Implementation Of Modification Game Methods To Improve Breaststroke Swimming Skills. Hal Olahraga Nusant (Jurnal Ilmu Keolahragaan).

2021;4(2):255–70. https://doi.org/10.31851/hon.v4i25404

Nicol E, Adani N, Lin B, Tor E. The temporal analysis of elite breaststroke swimming during competition. Sports Biomechanics, 2021; 1–13. https://doi.org/10.1080/14763141.2021.1975810

Nicol E, Pearson S, Saxby D, Minahan C, Tor E. Stroke kinematics, temporal patterns, neuromuscular activity, pacing and kinetics in elite breaststroke swimming: A systematic review. Sport Med - Open. 2022;8(1):1–24. https://doi.org/10.1186/s40798-022-00467-2

Strzała M, Krężałek P, Kaca M, Głąb G, Ostrowski A, Stanula A, et al. Swimming Speed of The Breaststroke Kick. Journal of Human Kinetics, 2012;35(1): 133–139. https://doi.org/10.2478/v10078-012-0087-4

Suryadi D, Samodra YTJ, Gustian U, Yosika GF, B PS, Dewintha R, et al. Problem-based learning model: Can it improve learning outcomes for long serve in badminton. Edu Sport Indones J Phys Educ. 2023;4(1):29–36. https://doi.org/10.25299/es:ijope.2023.vol4(1).10987

Suryadi D, Saputra E, Wahyudi I. Tinggi Badan dan Keseimbangan Dinamis dengan Kemampuan Lay Up Permainan Bola Basket: Apakah Saling Berhubungan? [Height and Dynamic Balance with Lay Up Ability in Basketball: Are They Related?]. Indones J Phys Educ Sport Sci. 2022;2(2):67–74. (In Indonesian). https://doi.org/10.52188/ijpess.v2i2.276

Rubiyatno R, Suryadi D. Penerapan Media Audio Visual Dalam Meningkatkan Hasil Belajar Servis Bulutangkis di MTs Mujahidin Pontianak [Application of Audio Visual Media in Improving Badminton Service Learning Outcomes at MTs Mujahidin Pontianak]. Musamus J Phys Educ Sport. 2022;4(2):140–9. (In Indonesian). https://doi.org/10.35724/mjpes.v4i02.4303

Hardinata R, Yosika GF, Haïdara Y, Perdana RP, Gustian U, Suryadi D, et al. Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? Indones J Phys Educ Sport Sci. 2023;3(1):69–80. https://doi.org/10.52188/ijpess.v3i1.387

Perdana RP, Supriatna E, Yanti N, Suryadi D. Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? Edu Sport Indones J Phys Educ. 2023;4(1):86–96. https://doi.org/10.25299/es:ijope.2023.vol4(1).12130

Haïdara Y, Okilanda A, Dewintha R, Suryadi D. Analysis of students' basic basketball skills: A comparative study of male and female students. Tanjungpura J Coach Res. 2023;1(1):1–5. https://doi.org/10.26418/tajor.v1i1.63796

Mashud M, Tangkudung J, Widiastuti W. Swimming Lesson Based on Interactive Multimedia. Int J Sport Sci. 2018;8(3):91–6. https://doi.org/10.5923/j.sports.20180803.04

Sugiyanto, Setiawan A, Hamidah I, Ana A. Integration of mobile learning and project-based learning in improving vocational school competence. J Tech Educ Train. 2020;2. https://doi.org/10.30880/jtet.2020.12.02.006

Haryanto, Kusuma WM, Mutohhari F, Nurtanto M, Suyitno S. Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering Using Video on YouTube. Journal of Physics: Conference Series, 2021;2111(1): 012020. https://doi.org/10.1088/1742-6596/2111/1/012020

Saeed OA. The impact and clarity of presentation using multimedia learning system in the learning of swimming of back among students Specialized schools. Sci J Phys Educ. 2016;9(3):1–16.

https://www.iasj.net/iasj/article/125482

Naczk A, Gajewska E, Naczk M. Effectiveness of swimming program in adolescents with down syndrome. Int J Environ Res Public Health. 2021;18(14):7441. https://doi.org/10.3390/ijerph18147441

Pupišová Z, Pupiš M, Sykora J, Brunn D, Giničová J, Pavlović R. The impact of a specific training programme on the selected parameters of swimming turns. Turkish J Kinesiol. 2019;5(1):36–42. https://doi.org/10.31459/turkjkin.511533

Gülbin C, Mardin E, Üniversitesi A, Gül M, Gül GK, Gülbin Eskiyecek C, et al. The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance. International J Appl Exerc Physiol. 2020;9(3):213–20.

Nosko M, Arkhypov O, Khudolii O, Filatova Z, Yevtushok M. Pedagogical Conditions for Swimming Skills Development in Students of Pedagogical Educational Institutions. Rev Rom pentru Educ Multidimens. 2019;11(2):240. https://doi.org/10.18662/rrem/127

Lenneis V, Agergaard S, Evans AB. Women-only swimming as a space of belonging. Qual Res Sport Exerc Heal. 2022;14(1):37–52. https://doi.org/10.1080/2159676X.2020.1844790

Zhang S, Dai J, Nie Z. Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China. Discret Dyn Nat Soc. 2022;2022:1–8. https://doi.org/10.1155/2022/6141342

Fone L, Van Den Tillaar R. Effect of Different Types of Strength Training on Swimming Performance in Competitive Swimmers: A Systematic Review. Sports Medicine - Open, 2022;8(1):19. https://doi.org/10.1186/s40798-022-00410-5

PDF

Published
— Updated on 2023-06-29

Check for updates

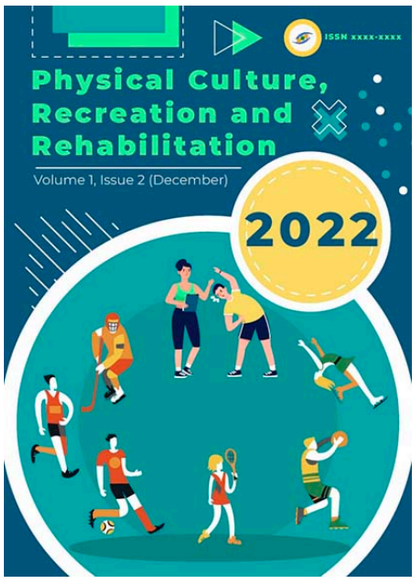
How to Cite

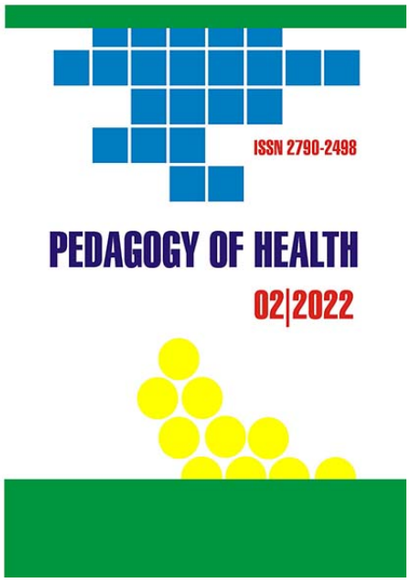
Mashud, Arifin S, Kristiyandaru A, Samodra YTJ, Santika IGPNA, Suryadi D. Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills. *Physical Education of Students*. 2023;27(3):118-25. https://doi.org/10.15561/20755279.2023.0304

Issue

Vol. 27 No. 3 (2023)

Rahmadi, Riyan Hardinata, M. Tami Rosadi Ahwan, Rubiyatno, Didi Suryadi (2023) **Enhancing 21st century collaboration skills in physical education through the problem-based learning model.** Edu Sportivo: Indonesian Journal of Physical Education , 4(3), 270. 10.25299/esijope.2023.vol4(3).14112





ISSN 2308-7250

Publisher: IP Iermakov S.S.

This site is owned and operated by Sergii Iermakov

PHYSICAL EDUCATION OF STUDENTS

ORIGINAL ARTICLE

Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills

Mashud[1ABCDE], Syamsul Arifin[1ABCD], Advendi Kristiyandaru[2ABDE], Y Touvan Juni Samodra[3BCDE], I Gusti Putu Ngurah Adi Santika[4BDE], Didi Suryadi[3,5ACDE]

[1] *Departement Physical Education, Sport and Health, Universitas Lambung Mangkurat, Banjarmasin, Indonesia*
[2] *Departement Physical Education, Sport and Health, Universitas Negeri Surabaya, Surabaya, Indonesia*
[3] *Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura, Pontianak, Indonesia*
[4] *Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education, Universitas PGRI Mahadewa, Bali, Indonesia*
[5] *Department of Sport Science, Faculty of Sport Science and Health, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia*

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Abstract

Background and Study Aim: Breaststroke swimming is one of the compulsory subjects for students majoring in sports education at Lambung Mangkurat University. Thus, it is important to have good breaststroke swimming skills so that later it will become the basis for creating experienced and potential teachers. Therefore, there is a need for special treatment to improve breaststroke swimming skills. This study aims to provide evidence of the integration of project based learning models with interactive multimedia on improving students' breaststroke swimming skills.

Material and Methods: This research is a quasi-experimental type with a pretest posttest non-equivalent control group design. The sampling technique used purposive sampling so that as many as 90 sports education students were sampled, namely 45 experimental groups and 45 control groups. The instrument resulting from breaststroke swimming skills was designed by the researcher, based on the theory of swimming experts, all descriptors for the breaststroke swimming instrument totalled 35 items. Furthermore, the analysis of the data in this study through the stages of normality test, homogeneity test, and hypothesis testing.

Results: The hypothesis test on the experimental group indicator with the PBL-Multimedia Interactive treatment showed a significance value of 0.000 <0.05 which means it is significant. Furthermore, the results on the control group indicator showed a significance value of 0.000 <0.05, so there was a significant increase. The results also show a difference with a significance of 0.001 <0.05, which means that the PBL- Multimedia Interactive experimental group and the control group (Conventional) have a significant difference in the effect on the posttest score.

Conclusions: This study shows that the PBL-Multimedia Interactive model integration treatment has a significant effect on improving students' breaststroke swimming skills. Where the integration of the PBL-Multimedia Interactive model is proven to be more effective than the conventional model. That way, the integration of the PBL-Multimedia Interactive model is effective and can be applied in swimming learning, especially in improving breaststroke swimming.

Keywords: learning model, project based learning, interactive multimedia, swimming breaststroke

Introduction

Sport is a physical activity that can be carried out by various groups [1]. Along with its development, technological advances in sports coaching are needed [2]. Where technological advances are increasingly sophisticated and modern, so that they are very close to digital devices both online and offline [3]. Therefore, the rapid development of various technologies gives hope for the modernization of new technologies in the world of education [4], including reforms in the world of sports [5]. In addition, models and media that are currently developing rapidly cause various demands and lifestyle changes, including sports, especially swimming [6].

Swimming is a sport that is done in water [7], and all levels of society can do this sport regardless of age and gender [8], and it is one of the most popular sports in the world [9]. Swimming activity is an important resource so as not to drown [10], besides that it also requires good and prime physical condition. Thus, physical fitness is also maintained [11, 12, 13, 14, 15], which is related to physical

doi:10.15561/20755279.2023.0304

health [16, 17, 18]. A study based on the results of clinical trials showed that swimmers found specific improvements in lung function [19]. The results of this review have provided an illustration that swimming is a very important water sport, both for physical abilities and health-related fitness. However, special attention is needed as said by Pharr et al that few studies have an understanding of predictors of swimming ability. There are various styles in swimming, one of which is the breaststroke [10].

Breaststroke swimming or what is often known as frog style is a swimming style facing the surface of the water, where the legs are moved outwards like kicking backwards. The movement starts from the first arm swing after sliding and the body must remain face down and both shoulders parallel to the surface of the water [20]. In addition, the breaststroke becomes the only competitive stroke [21], and the complex is also characterized by an intermittent propulsion phase [22]. A study by Strzała says that success in breaststroke swimming turns out that most of the power is reinforced by the kicking motion of the breaststroke and is considered the most responsible [23]. Therefore, it is very important to coordinate limb movements optimally for swimmers, this aims to maintain the best possible speed [21]. In addition, breaststroke swimming is a compulsory subject for students majoring in sports education at the Teaching and Education Faculty (FKIP) of Lambung Mangkurat University. Where the existence of swimming practice courses is the basis for the creation of experienced and potential teachers, thus providing an important role in the community environment.

Implementation of breaststroke swimming practice lectures to students by providing basic technical practice materials and swimming skills based on contracts and lecture teaching materials. Thus students are required to be able to do and practice breaststroke swimming, this is intended for preparation after graduating from university later. Therefore, to obtain maximum results, it is necessary to have a learning design so that it is not monotonous [24–28]. Where sports teachers are also a consideration in seeing student success [29]. Furthermore, harnessing the advancement of technology in a few decades may be an option to replace the traditional way [3]. The solutions offered use a project-based learning model with interactive multimedia, this is also considered in line with technological advances and their use in the world of sports. As is the case with what was said Jumaat & Tasir that sports science and technology needs appreciation, especially for coaches in Indonesia [2]. The results are the same as research conducted by Widiastuti & Mashud interactive multimedia developed will facilitate swimming training and is feasible to implement [3, 30].

Although previously Sugiyanto research had been carried out on the integration of mobile learning and project-based learning [31], and Haryanto innovation media learning, online project-based learning (O-PBL) [32]. However, researchers have not found research on the integration of project-based learning models with interactive multimedia in physical education, especially those that discuss breaststroke swimming. So that this can be a research update and strengthen the importance of this research to be carried out. That way, this research will be able to contribute to the strategies and learning models used. In his research Saeed applying multimedia provides an advantage in the learning process [33]. Based on these problems, this study aims to provide evidence of the integration of project-based learning models with interactive multimedia to improve students' breaststroke swimming skills.

Materials and Methods

Participants

This research will be conducted in a swimming pool located on the main campus of the Department of Sports and Health Education, Teaching and Education Faculty, Lambung Mangkurat University from September 2022 to November 2022. The researchers determined the sample in this study using purposive sampling with a total sample of 90 students, namely 45 experimental groups and 45 control groups.

Research Design

The effectiveness model used in this study is experimental. The method used is a quasi-experimental design with pretest posttest non-equivalent control group design. In this method given different treatment in the experimental group and the control group. In this study the experimental class will be treated with a project based learning model with interactive multimedia while the control class will be treated with a conventional learning model. This study was initiated by administering a pretest to the experimental and control groups, then the experimental group was given a project based learning model treatment with interactive multimedia for 8 meetings. Then a posttest was given to the experimental and control groups to see the effect of the treatment on the experimental group.

The instrument for the results of breaststroke swimming skills was designed by researchers, based on the theory of swimming experts. Especially for the breaststroke swimming instrument, it is divided into: 1) concept; 2) breaststroke swimming indicator; and 3) descriptors (description of indicators). The concept is breaststroke swimming which is divided into 7 (seven) indicators, such as: 1) start; 2) body position; 3) leg movements; 4) arm movement and

recovery; 5) breath movement; 6) coordination movement; and 7) reversal movement. Of the 7 (seven) indicators, each is further divided into 5 descriptors. So the total number of descriptors for the breaststroke swimming instrument is 35 items. It is from these 35 descriptor items that the tests scores are obtained.

In order to find out whether the instrument used was feasible, testers 1 and 2 were first tested with a sample of 15 students of the Physical Education Study Program. Where the results show for n = 15 and an error rate of 5%, it is obtained r table = 0.514 and an error level of 1% r table = 0.641, because r count is greater than r table (0.966 > 0.641 > 0.514), it can be concluded that the swimming ability instrument reliable.

Statistical Analysis

The research data was analyzed in a quantitative descriptive manner to provide a summary of research data and to facilitate the presentation of research data. Data showing normal distribution were analyzed using the t test to test the difference in the average pretest and posttest results in the experimental group and the control group, as well as the significance assisted using the SPSS 26 application.

Results

Quasi-experimental research, such as the existence of different treatments in the experimental group and the control group. In this study the experimental group was treated with a project based learning model with interactive multimedia (PBL-interactive multimedia) and the control group (Conventional). Before being given the effect test and the different test, first carry out the normality prerequisite test, if the data is normal, it will use the t-test and if it is not normal, it will proceed with the nonparametric test.

Based on the results of the normality test with the Kolmogorov-Smirnov formula, it shows that the significance value is p> 0.05, so in conclusion the data shows normal, then the t-test will be continued. The results of the normality test can be seen in table 1.

The results in table 2 of the hypothesis test on the indicators of the experimental group

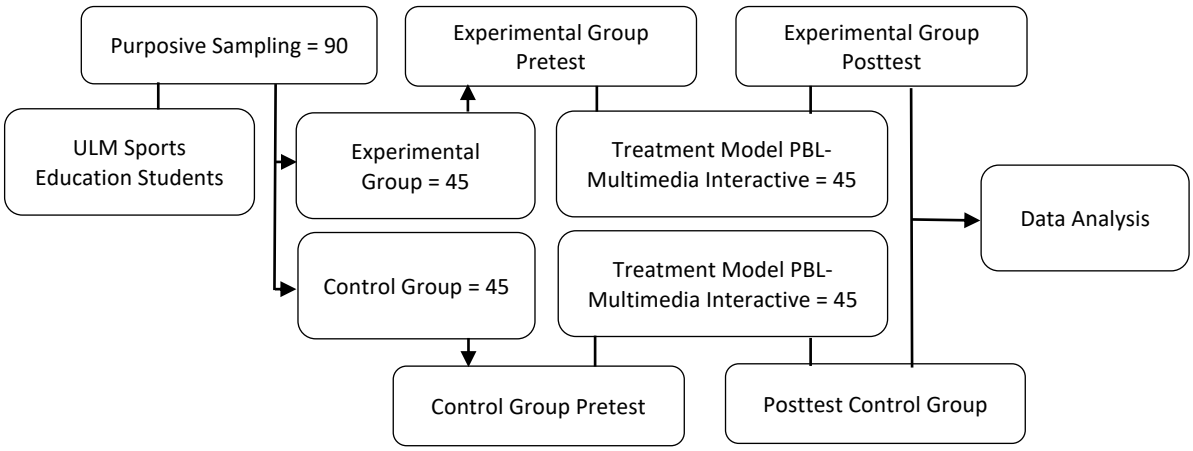


Figure 1. Chart of research procedures

Table 1. Kolmogorov-Smirnov normality prerequisite test

Result	Statistics	df	Sig.
Experiment Pretest	0.097	45	.200 *
Posttest Experiment	0.117	45	.144
Pretest Control	0.107	45	.200 *
Posttest Control	0.118	45	.129

Table 2. Paired samples test results of the t-test

Pairs	Result	Means	std. Deviation	t	df	Sig. (2-tailed)
Pair 1	Experimental Pretest - Experimental Posttest	-6.467	3.653	-11.875	44	0.000
Pair 2	Pretest Control - Posttest Control	-3.089	3.502	-5.917	44	0.000

with the PBL-Multimedia Interactive treatment show a significance value of 0.000 <0.05, so these results provide evidence that the PBL-multimedia interactive model provides a significant increase in the results of breaststroke swimming skills.

Furthermore, the control group showed a significance value of 0.000 <0.05, so these results also provide evidence that the conventional model actually provides a significant increase in the results of breaststroke swimming skills. Based on the results of the analysis of hypothesis testing, it can be concluded that the PBL-interactive multimedia model and the conventional model can be applied to improve breaststroke swimming skills. Seeing these results, the researcher wants to see the difference in the effect given, so that the model can be proven more effective to use.

Based on the results of the homogeneity test, it shows a significance value of 0.085 > 0.05, so the result is homogeneous, then it will be followed by a different test with the Independent Samples t Test formula. The normality test results can be seen in table 3.

The results in table 4 to find out the difference in the pre-test scores of the experimental group and the pre-test of the control group, the results show a significance value of 0.912 > 0.05 so there is no significant difference in the pre-test of the PBL-Multimedia Interactive experimental group with the pre-test control group (Conventional).

The results in table 4 to find out the difference in the pre-test values of the experimental group and the pre-test of the control group, the results show a significance value of 0.001 <0.05, so the post-test of the PBL-Multimedia Interactive experimental group and the post-test of the control group (Conventional) there is a difference significant influence. Based on these results, it proves that the PBL-Multimedia Interactive model is more effective than the conventional learning model (tabl.5). So the PBL-Multimedia Interactive model is more recommended to improve breaststroke swimming skills.

Based on table 6 it can be seen that the minimum, maximum, mean, and standard deviation on pretest and posttest data with PBL-Multimedia Interactive model treatment proves that the posttest scores are better, but the difference is not too big. For more details can be seen in Figure 2.

Table 3. Test of homogeneity of variances

Learning	Result	Levene Statistics	df1	df2	Sig.
Breaststroke Swimming	Based on Means	2.240	3	176	0.085

Table 4. Difference test of experimental pre-test (PBL-multimedia interactive) and control pre-test

Results	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Pre-test and Control Pre-test	0.282	0.596	0.111	88	0.912

Table 5. Difference test of experimental post-test (PBL-multimedia interactive) and control post-test

Result	Group	F	Sig.	t	df	Sig. (2-tailed)
Swimming breaststroke	Experimental Post-test and Control Post-test	0.266	0.607	3.408	88	0.001

Table 6. Descriptive analysis of pre-test and post-test data on breaststroke swimming ability results

Group	N	Minimum	Maximum	Means	std. Deviation
Pre-test Experiment	45	4	35	20.04	6.759
Post-test Experimental	45	15	35	26.51	4.888
Pre-test Control	45	6	29	19.89	6.516
Post-test Control	45	10	32	22.98	4.947

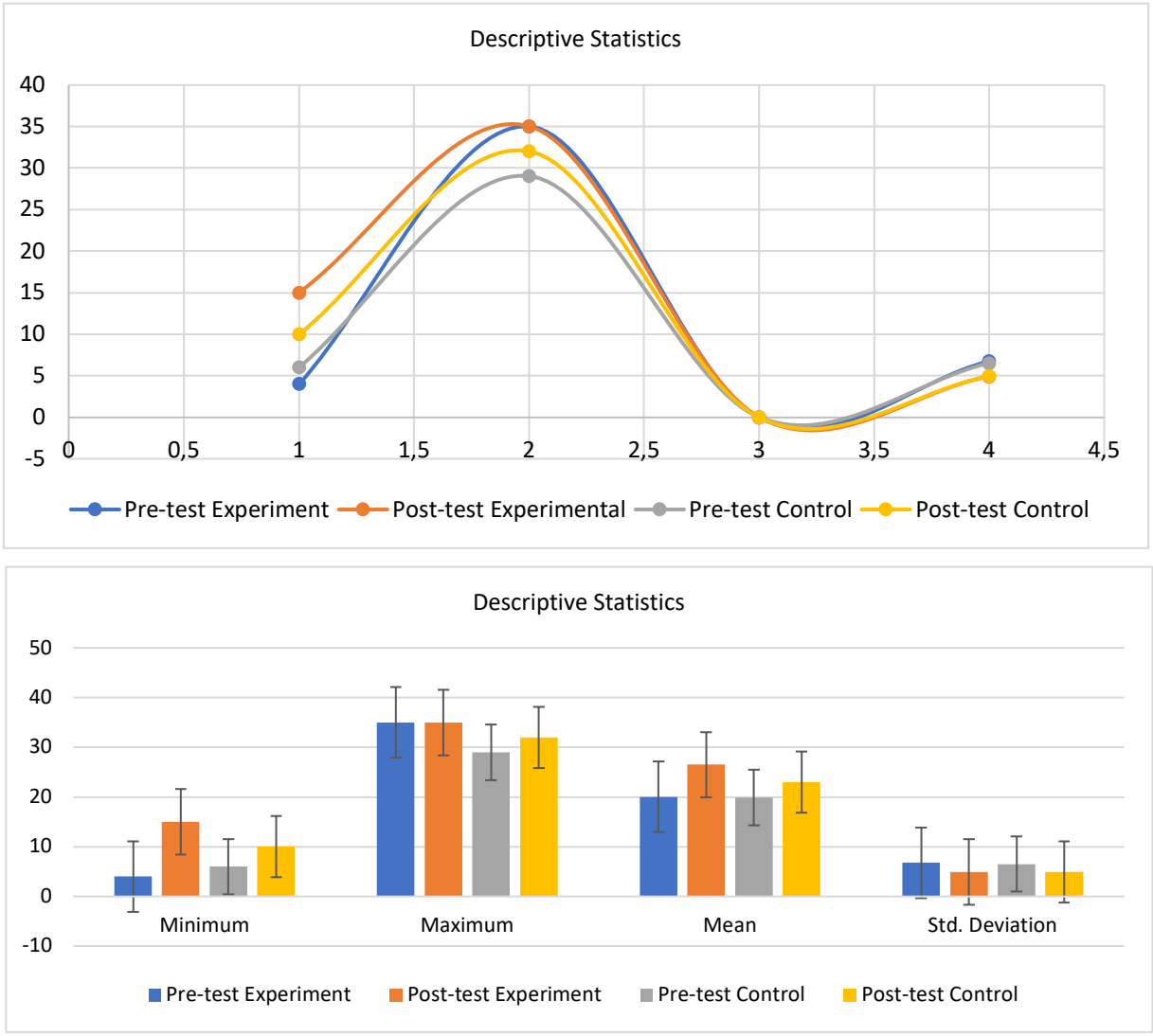


Figure 2. Descriptive data of pre-test and post-test of breaststroke swimming ability

Discussion

This study aims to provide evidence of the effect of integrating project-based learning models with interactive multimedia on improving students' breaststroke swimming skills. The results showed that the average value of the posttest experimental group (26.51) and the control group (22.98) was greater than the pretest value of the experimental group (20.04) and the control group (19.89). Furthermore, the result of the calculated t value is greater than t table, and the results also show significant. From these results it can be concluded that the PBL-Multimedia Interactive model and the conventional model show a significant increase in the learning outcomes of breaststroke swimming. Previous research by Sugiyanto provides evidence that the Integration of Mobile Learning and Project Based Learning has an increasing effect on the competency of vocational high schools [31]. Furthermore, it has been proven that media-based online project-based learning is appropriate for use in automotive engineering drawing subjects [32].

Other studies have found that swimming skills can also be improved by doing swimming exercises for 33 weeks, and have a positive effect on health [33, 34]. In addition, providing special training to swimmers can improve performance during competitions [35]. Research by Gülbin that the performance of male swimmers is also influenced by using core training, where this exercise has a positive effect [36]. Several studies have shown that playing approaches, authoritarian teaching styles, and democratic influences affect students' swimming abilities [37, 38]. To improve safety skills in swimming, you can apply traditional swimming teaching, but do not reduce student drowning injuries [39]. Subsequent studies, to improve performance in swimming do more strength training [40].

The results of the study also show the difference in the influence of the PBL-Multimedia Interactive model and the conventional model, where the PBL-Multimedia Interactive model is more effective. These results are reinforced by Susena proving

that swimming based on interactive multimedia applications shows very good criteria [7]. A study has proven that multimedia-based swimming learning provides an increase in backstroke swimming [33], and multimedia learning proves its superiority compared to learning without multimedia. The results of this study are reinforced by Widiastuti that with the existence of a learning model with interactive multimedia that is being developed [3], it is hoped that it can be an alternative to conventional methods. Based on this review, it reaffirms the application of interactive multimedia-based learning, where this is done following increasingly advanced technological developments. In this way, the results of research on the integration of project-based learning models with interactive multimedia can also be considered as a learning model that utilizes technological advances in the field of sports.

Conclusions

The results of the research and discussion have a strong foundation related to the Interactive PBL-Multimedia model, on the basis of references from the research listed previously in the discussion of results and discussion. Where these findings have resulted in several conclusions. The results of the study prove that the PBL-Multimedia Interactive model and the conventional model have a significant effect on improving students' breaststroke swimming skills. These findings also show a significant difference between the Interactive PBL-Multimedia model and the conventional model, namely the Interactive PBL-Multimedia model is more effective for improving breaststroke swimming skills. The results of this study have provided a new reference related to breaststroke swimming practice learning, and added evidence that the integration of project-based learning models with interactive multimedia is more advisable to improve swimming skills, especially breaststroke. The weakness of the research lies in the activities and warm-up carried out by students before the final test is carried out. In addition, the physical condition of students who are not fully monitored is also one of the research weaknesses. Recommendations for further research can apply the PBL-Multimedia Interactive model to other swimming skills, it is known that swimming is popular with 4 styles namely freestyle, butterfly, backstroke and breaststroke.

Acknowledgement

Sincere gratitude to all participants for their unwavering desire to join in and contribute to the research, revealing closeness while also granting us entire trust.

Conflict of interest

There is no conflict of interest.

References

1. Suryadi D, Gustian U, Fauziah E. The Somatotype of Martial Athletes in the Fighter Category Against Achievement. *JUARA J Olahraga*. 2022;7(1):116–25. https://doi.org/10.33222/juara.v7i1.1484
2. Jumaat NF, Tasir Z. Integrating Project Based Learning Environment into the Design and Development of Mobile Apps for Learning 2D-Animation. *Procedia - Soc Behav Sci*. 2013;103(26):526–33. https://doi.org/10.1016/j.sbspro.2013.10.369
3. Widiastuti W, Sulaiman I, Susilo S, Hernawan H, Mashud M, Solahuddin S, et al. Interactive multimedia development for swimming learning and training. *IOP Conf Ser Mater Sci Eng*. 2021;1098:1–6. https://doi.org/10.1088/1757-899x/1098/3/032038
4. Zeng Q. Research on Multimedia Swimming Teaching under Informatization. In: *Proceedings - 2020 International Conference on Computers, Information Processing and Advanced Education, CIPAE 2020*. 2020. P. 60–63. https://doi.org/10.1109/CIPAE51077.2020.00023
5. Félix ER, da Silva HP, Olstad BH, Cabri J, Correia PL. Swimbit: A novel approach to stroke analysis during swim training based on attitude and heading reference system (ahrs). *Sports*. 2019;7(11):238. https://doi.org/10.3390/sports7110238
6. de Zeeuw M, Smolianov P, Dion S, Schoen C. Comparing the practices of Dutch swimming against a global model for integrated development of mass and high performance sport. *Manag Sport Leis*. 2017;22(2):91–112. https://doi.org/10.1080/23750472.2017.1394797
7. Susena SJ, Sugiharto S, Kusuma DWY. Development of Swimming Learning Media Based on Interactive Multimedia Applications Through Computers and Smartphones. *J Phys Educ Sport*. 2021;10(2):156–64. https://doi.org/10.15294/JPES.V10I2.46269
8. Usra M. Swimming Learning Model Using Rope As Aid For Beginners. In: *Proceedings of the First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017)*. 2018. P. 388–93. https://doi.org/10.2991/ice-17.2018.83
9. Khodaee M, Edelman GT, Spittler J, Wilber R, Krabak BJ, Solomon D, et al. Medical Care for Swimmers. *Sports Medicine - Open*, 2016;2(1): 27. https://doi.org/10.1186/s40798-016-0051-2
10. Pharr J, Irwin C, Layne T, Irwin R. Predictors of swimming ability among children and adolescents in the United States. *Sports*. 2018;6(1):1–11. https://doi.org/10.3390/sports6010017
11. Baek KW, Lee MC, Jeon TB, Yoo J Il, Park JS, Moon HY, et al. Effects of exercise on physical fitness and strength according to the frailty level of female elderly with hypertension. *Exerc Sci*. 2020;29(4):368–76. https://doi.org/10.15857/ksep.2020.29.4.368
12. González-Fernández FT, González-Víllora S,

Baena-Morales S, Pastor-Vicedo JC, Clemente FM, Badicu G, et al. Effect of Physical Exercise Program Based on Active Breaks on Physical Fitness and Vigilance Performance. *Biology*, 2021;10(11): 1151. https://doi.org/10.3390/biology10111151
13. Suryadi D, Samodra YTJ, Purnomo E. Efektivitas latihan weight training terhadap kebugaran jasmani [The effectiveness of weight training exercises on physical fitness]. *J RESPECS*. 2021;3(2):9–19. (In Indonesian). https://doi.org/10.31949/respecs.v3i2.1029
14. Rubiyatno, Perdana RP, Fallo IS, Arifin Z, Nusri A, Suryadi D, et al. Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagog Phys Cult Sport*. 2023;27(3):208–14. https://doi.org/10.15561/26649837.2023.0304
15. Suryadi D, Suganda MA, Sacko M, Samodra YTJ, Rubiyatno R, Supriatna E, et al. Comparative Analysis of Soccer and Futsal Extracurriculars: A Survey Study of Physical Fitness Profiles. *Phys Educ Sport Stud Res*. 2023;2(1):59–71. https://doi.org/10.56003/pessr.v2i1.182
16. Suryadi D. Analisis kebugaran jasmani siswa: Studi komparatif antara ekstrakurikuler bolabasket dan futsal [Analysis of students' physical fitness: Comparative study between basketball and futsal extracurriculars]. *Edu Sport Indones J Phys Educ*. 2022;3(2):100–10. (In Indonesian). https://doi.org/10.25299/es:ijope.2022.vol3(2).9280
17. Suryadi D, Rubiyatno. Kebugaran jasmani pada siswa yang mengikuti ekstrakulikuler futsal [Physical fitness of students who take part in extracurricular futsal]. *J Ilmu Keolahragaan*. 2022;5(1):1–8. (In Indonesian). https://doi.org/10.26418/jilo.v5i1.51718
18. Samodra YTJ, Suryadi D, Wati IDP, Supriatna E, Santika IGPNA, Suganda MA, et al. Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagog Phys Cult Sport*. 2023;27(2):139–145. https://doi.org/0.15561/26649837.2023.0206
19. Päivinen M, Keskinen K, Tikkanen H. Swimming-induced changes in pulmonary function: special observations for clinical testing. *BMC Sports Science, Medicine and Rehabilitation*, 2021;13(1): 55. https://doi.org/10.1186/s13102-021-00277-1
20. Abdul Gani R, Setiawan E, Jumareng H, Unju Subandi O. Implementation Of Modification Game Methods To Improve Breaststroke Swimming Skills. *Hal Olahraga Nusant (Jurnal Ilmu Keolahragaan)*. 2021;4(2):255–70. https://doi.org/10.31851/hon.v4i25404
21. Nicol E, Adani N, Lin B, Tor E. The temporal analysis of elite breaststroke swimming during competition. *Sports Biomechanics*, 2021; 1–13. https://doi.org/10.1080/14763141.2021.1975810
22. Nicol E, Pearson S, Saxby D, Minahan C, Tor E. Stroke kinematics, temporal patterns, neuromuscular activity, pacing and kinetics in elite breaststroke swimming: A systematic review. *Sport Med - Open*. 2022;8(1):1–24. https://doi.org/10.1186/s40798-022-00467-2
23. Strzała M, Krężałek P, Kaca M, Głąb G, Ostrowski A, Stanula A, et al. Swimming Speed of The Breaststroke Kick. *Journal of Human Kinetics*, 2012;35(1): 133–139. https://doi.org/10.2478/v10078-012-0087-4
24. Suryadi D, Samodra YTJ, Gustian U, Yosika GF, B PS, Dewintha R, et al. Problem-based learning model: Can it improve learning outcomes for long serve in badminton. *Edu Sport Indones J Phys Educ*. 2023;4(1):29–36. https://doi.org/10.25299/es:ijope.2023.vol4(1).10987
25. Suryadi D, Saputra E, Wahyudi I. Tinggi Badan dan Keseimbangan Dinamis dengan Kemampuan Lay Up Permainan Bola Basket: Apakah Saling Berhubungan? [Height and Dynamic Balance with Lay Up Ability in Basketball: Are They Related?]. *Indones J Phys Educ Sport Sci*. 2022;2(2):67–74. (In Indonesian). https://doi.org/10.52188/ijpess.v2i2.276
26. Rubiyatno R, Suryadi D. Penerapan Media Audio Visual Dalam Meningkatkan Hasil Belajar Servis Bulutangkis di MTs Mujahidin Pontianak [Application of Audio Visual Media in Improving Badminton Service Learning Outcomes at MTs Mujahidin Pontianak]. *Musamus J Phys Educ Sport*. 2022;4(2):140–9. (In Indonesian). https://doi.org/10.35724/mjpes.v4i02.4303
27. Hardinata R, Yosika GF, Haïdara Y, Perdana RP, Gustian U, Suryadi D, et al. Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? *Indones J Phys Educ Sport Sci*. 2023;3(1):69–80. https://doi.org/10.52188/ijpess.v3i1.387
28. Perdana RP, Supriatna E, Yanti N, Suryadi D. Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? *Edu Sport Indones J Phys Educ*. 2023;4(1):86–96. https://doi.org/10.25299/es:ijope.2023.vol4(1).12130
29. Haïdara Y, Okilanda A, Dewintha R, Suryadi D. Analysis of students' basic basketball skills: A comparative study of male and female students. *Tanjungpura J Coach Res*. 2023;1(1):1–5. https://doi.org/10.26418/tajor.v1i1.63796
30. Mashud M, Tangkudung J, Widiastuti W. Swimming Lesson Based on Interactive Multimedia. *Int J Sport Sci*. 2018;8(3):91–6. https://doi.org/10.5923/j.sports.20180803.04
31. Sugiyanto, Setiawan A, Hamidah I, Ana A. Integration of mobile learning and project-based learning in improving vocational school competence. *J Tech Educ Train*. 2020;2. https://doi.org/10.30880/jtet.2020.12.02.006
32. Haryanto, Kusuma WM, Mutohhari F, Nurtanto M, Suyitno S. Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering Using Video on YouTube. *Journal of Physics: Conference Series*, 2021;2111(1): 012020. https://doi.org/10.1088/1742-6596/2111/1/012020
33. Saeed OA. The impact and clarity of presentation using multimedia learning system in the learning of swimming of back among students Specialized

schools. *Sci J Phys Educ*. 2016;9(3):1–16. https://www.iasj.net/iasj/article/125482
34. Naczk A, Gajewska E, Naczk M. Effectiveness of swimming program in adolescents with down syndrome. *Int J Environ Res Public Health*. 2021;18(14):7441. https://doi.org/10.3390/ijerph18147441
35. Pupišová Z, Pupiš M, Sykora J, Brunn D, Giničová J, Pavlović R. The impact of a specific training programme on the selected parameters of swimming turns. *Turkish J Kinesiol*. 2019;5(1):36–42. https://doi.org/10.31459/turkjkin.511533
36. Gülbin C, Mardin E, Üniversitesi A, Gül M, Gül GK, Gülbin Eskiyecek C, et al. The Effect of 8-Week Core Exercises Applied to 10-12 Age Male Swimmers on Swimming Performance. *International J Appl Exerc Physiol*. 2020;9(3):213–20.
37. Nosko M, Arkhypov O, Khudolii O, Filatova Z, Yevtushok M. Pedagogical Conditions for Swimming Skills Development in Students of Pedagogical Educational Institutions. *Rev Rom pentru Educ Multidimens*. 2019;11(2):240. https://doi.org/10.18662/rrem/127
38. Lenneis V, Agergaard S, Evans AB. Women-only swimming as a space of belonging. *Qual Res Sport Exerc Heal*. 2022;14(1):37–52. https://doi.org/10.1080/2159676X.2020.1844790
39. Zhang S, Dai J, Nie Z. Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China. *Discret Dyn Nat Soc*. 2022;2022:1–8. https://doi.org/10.1155/2022/6141342
40. Fone L, Van Den Tillaar R. Effect of Different Types of Strength Training on Swimming Performance in Competitive Swimmers: A Systematic Review. *Sports Medicine - Open*, 2022;8(1):19. https://doi.org/10.1186/s40798-022-00410-5

Information about the authors:

Mashud; (Corresponding author); https://orcid.org/0000-0003-3107-7134; mashud@ulm.ac.id; Departement Physical Education, Sport and Health, Universitas Lambung Mangkurat; Banjarmasin, Indonesia.

Syamsul Arifin; https://orcid.org/0009-0006-2330-2564; syamsul_arifin@ulm.ac.id; Departement Physical Education, Sport and Health, Universitas Lambung Mangkurat; Banjarmasin, Indonesia.

Advendi Kristiyandaru; https://orcid.org/0000-0003-0085-6063; advendikristiyandaru@unesa.ac.id; Departement Physical Education, Sport and Health, Universitas Negeri Surabaya; Surabaya, Indonesia.

Y Touvan Juni Samodra; https://orcid.org/0000-0003-4850-1990; tovan@fkip.untan.ac.id; Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura; Pontianak, Indonesia.

I Gusti Putu Ngurah Adi Santika; https://orcid.org/0000-0001-7873-0060; ngurahadisantika@gmail.com; Department of Physical Education Health and Recreation, Faculty of Teacher Training and Education, Universitas PGRI Mahadewa; Bali, Indonesia.

Didi Suryadi; https://orcid.org/0000-0002-0206-9197; didisurya1902@gmail.com; Department of Sport Coaching Education, Faculty of Teacher Training and Education, Universitas Tanjungpura (Pontianak, Indonesia). Department of Sport Science, Faculty of Sport Science and Health, Universitas Negeri Yogyakarta (Yogyakarta, Indonesia).

Cite this article as:
Mashud, Arifin S, Kristiyandaru A, Samodra YTJ, Ngurah Adi Santika IGP, Suryadi D. Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills. *Physical Education of Students,* 2023;27(3):118–125.
https://doi.org/10.15561/20755279.2023.0304

Received: 30.04.2023

Accepted: 31.05.2023; **Published**: 30.06.2023

Bukti Indek Web of Science

JIF 0.8 (Q3)

WoS Journal Info

» Physical Education of Students

Abbreviation:	PHYS EDUC STUD
ISSN:	2075-5279
eISSN:	2308-7250
Category:	EDUCATION & EDUCATIONAL RESEARCH - ESCI
WoS Core Citation Indexes:	ESCI - Emerging Sources Citation Index
Journal Impact Factor (JIF):	0.8
5-year Impact Factor:	0.6
Best ranking:	EDUCATION & EDUCATIONAL RESEARCH (Q3) — Percentage rank: 35.4%
Open Access Support:	Fully Open Access — It may take a publication fee. For more info, check it on DOAJ.ORG
Country:	UKRAINE
Status in WoS core:	Active
Publisher:	Sergii Iermakov

Share

Check with Clarivate MJL »

Get Embeded Code

Save the journal to Dashboard

Check with SCIMAGO »

Discover related topics

Q1 Journals

Scopus Indexed Journals

Q1 Q2 Q3 Q4 Journal

Fast Track Publication Journals Scopus

Scopus Wos Indexed Journals

Check with SCOPUS »

Check with ISSN »

» In order to submit a manuscript to this journal, please read the guidelines for authors in the journal's homepage.

» For a more in-depth analysis of the journal, you should subscribe and check it out on Journal Citation Reports (JCR).

» If you need a journal template (Word or Latex), you can read this entry.

» Journals of ESCI (except for fields of Arts and Humanities) are now ranked by JIF as the same with journals of SCIE and SSCI in the release of JCR 2023 (in 2024). Journals of AHCI and ESCI of Arts and Humanities are not ranked.

» Open access (OA) journals are free for readers. To maintain the business model, publishers will account for publication fees from authors, but some funds may cover the fees, and OA journals may not charge any fees.