



Increasing cognitive learning and sports massage skills through a project-based blended learning model

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ABSTRACT

Background: Low achievement and poor learning skills among current students. **Research Objectives:** This research analysed the project-based blended learning model on cognitive learning achievement and sports massage skills. **Methods:** This research is a quasi-experiment. The population was 9 classes (180 students) in the Department of Physical Education. There were 4 classes (80 students) of the samples in this study. A random sampling technique was utilised in this study. A post-test-only control group design was used. Learning achievement was measured by multiple-choice tests, and the skills were measured by a massage skills test. The data were analysed using MANCOVA with SPSS at a 5% significance level. **Finding/Results:** The research finding showed that (1) there was a difference in massage learning achievement and massage skills between students who studied with project-based blended learning assisted by interactive multimedia and those with direct instruction with a significance number of 0.001 which is smaller than 0.05, (2) there was a difference in massage learning achievement between students who studied with project-based blended learning assisted by interactive multimedia and those with direct instruction, with a value of $F = 8.400$ and (3) there was a difference in massage skills between students who studied with project-based blended learning assisted with interactive multimedia and those with direct instruction, with a value of $F = 13.817$. **Conclusion:** It can be summarised that the project-based blended learning model could improve learning achievement and massage skills. The level of digital literacy has not been considered in this research; it is recommended that future research pay attention to this variable.

Keywords: Cognitive learning; sports massage; project-based blended learning; learning outcomes and skills

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INTRODUCTION

Disruption has characterised every sector in the twenty-first century, including science and technology, which has led to modifications in the paradigm of learning through adjustments to media, curriculum, and technology (Aslamiah et al., 2021; Jaiz et al., 2022; Rahayu et al., 2022). Technological development in the twenty-first century can improve the quality of learning (Rosnaeni, 2021). 21st-century learning encourages more

activities to train students' skills in learning activities (Elitasari, 2022; Mardhiyah et al., 2021). The 4Cs creative thinking, critical thinking and problem-solving, communication, and collaboration are the 21st-century competences that can eventually boost learning accomplishment in the cognitive, affective, and skills domains (Fernández-Gutiérrez et al., 2020).

In order to prepare the nation's generation to have 21st century skills, the learning process must be transformed towards a student centre learning achievement is an indicator of success in the teaching and learning process. The implication of renewing the learning process is an increase in learning achievement (Gumantan et al., 2021). Learning that incorporates cognitive, emotional, and psychomotor components leads to learning achievement (Afandi, 2019). Learning achievement is a crucial indicator for measuring student success, including cognitive, affective, and psychomotor factors after participating in a learning process (Ekpenyong et al., 2022). Learning achievement is influenced by internal factors, which include students' attitudes towards learning, students who have no interest, and students' low learning motivation. Meanwhile, environmental, familial, and educational factors are examples of external factors (Maesaroh, 2023). Thus, there must be concrete efforts, such as implementing innovative learning models, so that student learning achievement can increase and equip students with 21st-century skills. For students to actively participate in the learning process, the current learning model needs to be updated (Kuncahyono et al., 2020).

In learning in higher education, especially learning with dominant characteristics of practice, educators must be able to apply learning models that suit the characteristics of students or their subjects. The implementation of innovative learning models aims to help each learner increase his or her full potential, including learning achievement (Huang et al., 2022; Kwangmuang et al., 2021). Students who are studying courses with dominant practice are required to be active and increase their practice experience in order to improve their skills (learning achievement). Based on previous findings regarding practical learning in massage courses, low learning achievement and sports massage skills are caused by students not getting the opportunity to develop their knowledge, students not practicing sports massage outside of lectures, and the learning process is still conventional, so it is less interesting for students (Darni et al., 2018; Sugiarto et al., 2020; Widhiyanti et al., 2023).

Sports massage is a course that requires every student to have knowledge and skills in the field of sports massage therapy (Tisna MS et al., 2023). The study of massage material consists of the history of sports massage, the benefits of sports massage, massage management, anatomy and physiology of the body, manipulation in massage, sports massage, and sports massage manipulation (Salvo, S. G., 2023). The goal of sports massage is to manipulate, or massage, specific body areas with the hands in a rhythmic manner to achieve physiological, therapeutic, or treatment benefits (Brilian et al., 2021).

Students will have good knowledge and skills in sports massage if they learn with the right learning media and models, because learning media will help students obtain information (Selwyn et al., 2020), and the right learning model can be a guide that directs students achieve their goals (Oke & Fernandes, 2020). Previously, researchers had developed learning media for digital-based sports massage lectures called D-MESS (Tisna MS et al., 2023) whose implication was as an additional reference that suited the characteristics of its users (generation Z). Furthermore, it has also implemented a quantum learning model in sports massage lectures using a quantum learning model (Astra & Tisna, 2023). However, the results only revealed limited improvements in aspects of the students' character. So now it is necessary to study more holistically

regarding learning outcomes in the form of student knowledge and skills by implementing innovative learning models that are able to integrate D-MESS as a learning medium. In order to address the issues raised above and those pertaining to the massage course, it is essential to integrate learning models and strategies with learning media in order to enhance learning achievement and sports massage skills. A learning model offered that is in line with the above problems as well as in line with 21st-century learning, and has not been widely implemented is the project-based blended learning model (Azzahra et al., 2023). By delving into significant challenges, the project-based blended learning (PjBL) paradigm fosters conceptual knowledge and produces real products (Wu & Wu, 2020).

There are many research reports regarding the success of using PjBL in improving learning achievement (Lazić et al., 2021; Maros et al., 2023; Mursid et al., 2021). The impact can be seen in the learning outcomes of mathematics and engineering education students. Meanwhile, the implementation of the PjBL model on learning outcomes in movement or sports learning needs to be studied, especially in sports massage lectures, so that current findings can expand the scientific knowledge of learning. Therefore, the aim of this research is to reveal the effect of implementing the project-based learning model on learning achievement and massage skills.

METHOD

Type of Research

This is a quasi-experimental study. A pretest-posttest non-equivalent control group design was used in the study (Figure 1) (González-Alonso et al., 2020).

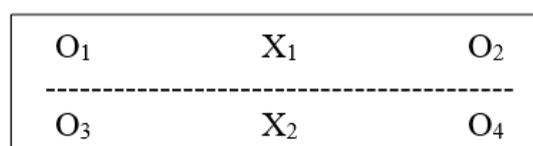


Figure 1. A Pretest-Posttest Non-Equivalent Control Group Design

Description:

- O_1 : The pretest in the experimental group
- O_2 : The posttest in the experimental group
- O_3 : The pretest in the control group
- O_4 : The posttest in the control group
- X_1 : The treatment in the experimental class
- X_2 : The treatment in the control class

Participants

180 students of the Department of Physical Education who enrolled in nine sports massage classes made up the study's population. Group random sampling was the method used for sampling. 80 samples were divided into experimental and control groups.

Instrument

Data on learning achievement and massage skills were collected using a multiple-choice test with an item score range of 0-1. The learning achievement test was developed based on the cognitive domain of Anderson's revised Bloom's taxonomy, namely the domain of remembering, understanding, applying, analysing, evaluating, and creating

(Parwati, 2019). Massage skills are the scores obtained by students when practicing sports massage, which were measured through a sports massage practice assessment rubric with a score range of 1-4 (Table 1). Skills tests based on skill domains follow Anderson's revised Bloom's taxonomy, which at least includes aspects following the operational verbs of basic competence (Susanto, 2018).

Table 1. Massage Skill Assessment Rubric

Skill Indicator	Score	Description
Calf/back/arm massage	4	Students practice all massage manipulations on the calves/back/arms in the correct order and the massage techniques are all correct.
	3	Students practice all massage manipulations on the calves/back/arms out of sequence, but the massage techniques are all correct or Students practice 3 (three) massage manipulations in accordance with the sequence and the massage technique is correct.
	2	Students practice 3 (three) massage manipulations on the calves/back/arms, not in the order, but the massage technique is correct or Students practice 2 (two) massage manipulations in accordance with the sequence and the massage technique is correct.
	1	Students only practice 2 (two) massage manipulations on the calves/back/arms, not in the correct order, but the massage technique is correct or Students practice more than 1 (one) massage manipulation in sequence with the correct massage technique.

Research Procedures

To collect information on learning achievement and massage skills, data collection was done during the pretest and posttest. For 8 meetings, the experimental group studied project-based blended learning supported by interactive multimedia and the control group studied direct teaching.

Data Analysis

The data analysis technique used was MANCOVA with SPSS at a significance level of 5%. The Shapiro-Wilk test was utilised in the data distribution normality test. Levene's test was incorporated into the Homogeneity Test of Variance between Groups. Box's M test was utilised for the variance-covariance matrix's homogeneity test. The collinearity test was tested with the variance inflation factor (VIF). Next, the data was analysed descriptively and by multivariate covariance analysis (MANCOVA). A significance level of 5% was used for the hypothesis testing.

RESULTS AND DISCUSSION

The results of the study revealed that there were differences in cognitive massage learning achievement and massage skills between students who studied with project-based blended learning assisted by interactive multimedia and those who studied with direct instruction. Multivariate analysis was used to assess the hypothesis based on the outcomes of the prerequisite tests that had been passed. This multivariate analysis was carried out with SPSS 26.0 for Windows. Table 3 displays the findings of the multivariate analysis performed on the research data.

Table 2. The Result of the Multivariate Test

Effect	Value	F	Hypothesis df	Error df	Sig.	
IK_LA	Pillai's Trace	0.361	21.204	2.000	75.000	0.000
	Wilks' Lambda	0.639	21.204	2.000	75.000	0.000
	Hotelling's Trace	0.565	21.204	2.000	75.000	0.000
	Roy's Largest Root	0.565	21.204	2.000	75.000	0.000
IK_S	Pillai's Trace	0.277	14.362	2.000	75.000	0.000
	Wilks' Lambda	0.723	14.362	2.000	75.000	0.000
	Hotelling's Trace	0.383	14.362	2.000	75.000	0.000
	Roy's Largest Root	0.383	14.362	2.000	75.000	0.000
LM	Pillai's Trace	0.175	7.980	2.000	75.000	0.001
	Wilks' Lambda	0.825	7.980	2.000	75.000	0.001
	Hotelling's Trace	0.213	7.980	2.000	75.000	0.001
	Roy's Largest Root	0.213	7.980	2.000	75.000	0.001

Description:

IK_LA : Initial Knowledge of the Learning Achievement

IK_S : Initial Knowledge of the Skills

LM : Learning Model

Based on Table 2, the result was in line with the statistical scores of Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root, with a statistical score of $F = 7.980$ and a significant score of 0.001 , and this score is smaller than the significant score of 0.05 ($p < 0.05$). It may be inferred that students who studied with project-based blended learning supported by interactive multimedia and those who studied with direct teaching differed in their achievement in massage learning achievement and skills. Furthermore, in testing the second and third hypotheses, the outcomes of the Test of Between-Subjects Effect study confirm this. The results of this analysis display significance values for each unit of analysis, namely for data on massage learning achievement and massage skills. The results of the statistical test analysis for testing the second and third hypotheses are presented in Table 3.

Table 3. The Result of Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	
IK_LA	LA	704.598	1	704.598	39.469	0.000
	S	1196.178	1	1196.178	17.950	0.000
IK_S	LA	83.183	1	83.183	4.660	0.034
	S	893.705	1	893.705	13.411	0.000
LM	LA	149.949	1	149.949	8.400	0.005
	S	920.750	1	920.750	13.817	0.000
Error	LA	1356.753	76	17.852		
	S	5064.662	76	66.640		
Total	LA	453326.245	80			
	S	473945.313	80			
Corrected Total	LA	2822.104	79			
	S	7866.699	79			

Description:

IK_LA : Initial Knowledge of the Learning Achievement

IK_S : Initial Knowledge of the Skills

LA : Learning Achievement

S : Skill

LM : Learning Model

According to Table 3 test findings for the Test of Between-Subjects Effects, the statistical value $F = 8.400$ with a significant number of 0.005 is the cause of the learning model's (LM) influence on massage learning achievement. After adjusting for prior

knowledge, it can be said that there is a difference in the learning achievement of students who studied with project-based blended learning supported by interactive multimedia and those who studied with direct teaching. This conclusion is strengthened by pairwise comparisons of learning model data as presented in Table 4.

Table 4. Pairwise Comparisons of Learning Models on Massage Learning Achievement Variables

Dependent Variable		Mean Difference (I-J)	Std. Error	Sig.
Massage Learning Achievement	Experiment (I) Control (J)	2.782	0.960	0.005

Table 4 indicates that the significance score of 0.05 is not as high as the difference between the experimental and control groups, with a positive value of 2.782 and a significance score of 0.005. This indicates that, in comparison to the group of students who studied with direct teaching, the group of students who studied with project-based blended learning supported by interactive multimedia achieved more in their massage learning.

Based on the interpretation of the Test of Between Subject Effect as presented in Table 3, it was found that the source of the influence of the learning model (LM) on massage skills appears to be a statistical value of $F = 13.817$ with a significant number of 0.000. The obtained significance score of 0.000 was smaller than the specified significance level of 0.05. After controlling the initial knowledge, it can be determined that there was a difference in massage skills between the group of students who studied with direct teaching and the group of students who studied with project-based blended learning supported by interactive multimedia. This conclusion is strengthened by pairwise comparisons of learning model data on the massage skill variable, as presented in Table 5.

Table 5. Pairwise Comparisons Learning Models on Massage Skill Variables

Dependent Variable		Mean Difference (I-J)	Std. Error	Sig.
Massage Skill	Experiment (I) Control (J)	6.894	1.855	0.000

Table 5 shows that the experimental group-control group difference has a positive value of 6.894 with a significance score of 0.000, which is less than the predetermined significance level of 0.05. This demonstrates that, in comparison to the group of students who studied with direct teaching, the attainment of massage skills is higher in the group of students who studied with project-based blended learning supported by interactive multimedia.

The value of initial knowledge of massage skills achieved by students in the experimental group ranged from 25.00 to 75.00, and in the control group, it ranged from 25.00 to 81.25. The massage skill scores achieved by students in the experimental group ranged from 62.50 to 100.00, and those in the control group ranged from 50.00 to 93.75 (Figure 2). The experimental group who studied with project-based blended learning assisted by interactive multimedia obtained a pretest score for massage learning achievement of 48.83 and a posttest score of 76.42, while the control group who studied with direct teaching obtained a pretest score of 49.58 and a posttest 73.67. This means that students who study with project-based blended learning assisted by interactive multimedia have better massage learning achievement scores than students who study with direct teaching (Figure 3).

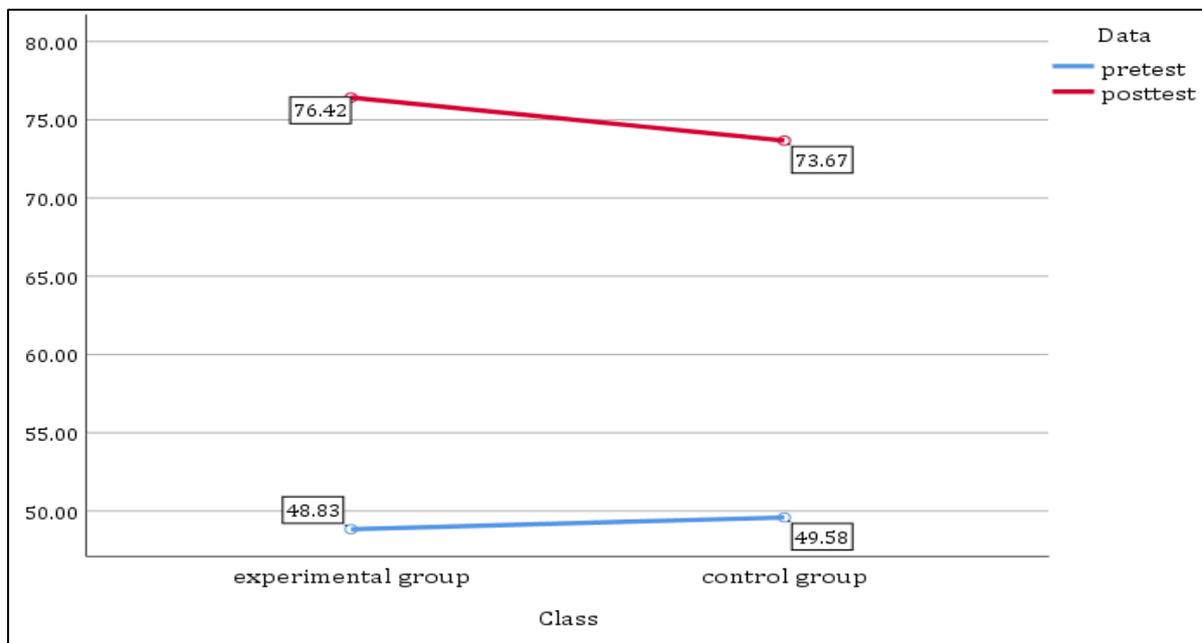


Figure 2. Result of the Learning Achievement

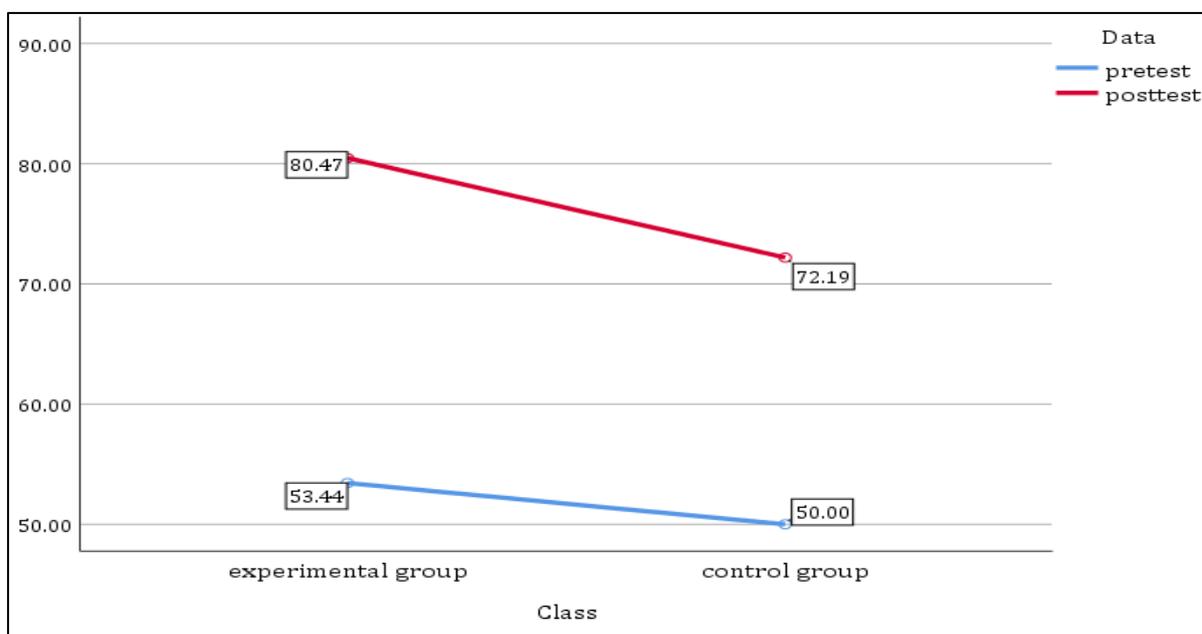


Figure 3. Result of the Skill

Based on these findings, several things can be reviewed regarding the superiority of the massage learning achievement and massage skills of the group of students who studied with project-based blended learning assisted by interactive multimedia compared to the group of students who studied with direct instruction. A blended learning method is integrated with a project-based learning model to create the project-based blended learning (PjBL-BL) model. Project-based learning model with a blended learning strategy that is suitable for 21st-century learning (Marsiti et al., 2023; Tong et al., 2020). One method of instruction that can raise student competency is the PjBL model (Schmid et al., 2023; Tong et al., 2022). This learning model invites students to carry out investigations by directing students to create or develop products related to the real world (Arizona et al., 2020; Hernáiz-Pérez et al., 2021).

PjBL is a cutting-edge teaching strategy that involves student participation by having them start with fundamental questions and then thoroughly research them (Medina Herrera et al., 2020). This PjBL model also provides students with experience in planning interesting learning by carrying out collaborative projects to produce products according to real-world problems (Retno, 2022). In order to help students solve problems in the actual world, this approach also enables inquiry, teamwork, and solution-building among students (Almulla, 2020).

A blended learning approach combines traditional in-person instruction with virtual learning (Puspitarini, 2022; Zydney et al., 2020). Blended learning is a strategy of combining traditional classrooms and online environments to enable students to receive meaningful real-world learning experiences (Çiftçi, 2020; Mielikäinen, 2022). According to one study demonstrating the efficacy of blended learning, students can benefit from the ongoing blended learning approach to the physical education curriculum (Saputra et al., 2023). Particularly in physical education programmes, hybrid or blended learning has the consequence of creating more efficient methods for raising students' levels of physical fitness (Putra et al., 2023).

First, is in terms of constructivist learning theory which underlies project-based blended learning. Based on constructivist learning theory, project-based blended learning has the following features: (1) interaction with problem scenarios and the learning environment leads to understanding; (2) problem solving and the process of problem discovery create cognitive dissonance that promotes learning; and (3) knowledge is acquired through a cooperative process of social negotiation and assessment of opposing viewpoints (Ahdhani, 2021; Arizona et al., 2020; Jazuli & Zakir, 2022). Based on constructivist learning theory, project-based blended learning teaches students not to take the knowledge they gain for granted but to actively build knowledge independently (Dewi & Fauziati, 2021; Handhika et al., 2021).

The second review can be seen from the learning steps in project-based blended learning. When adopting project-based blended learning, there are five steps that need to be completed: (1) formulating fundamental questions; (2) creating a project plan; (3) creating a schedule; (4) keeping track of students' and projects' progress; (5) testing the findings; and (6) evaluating the experience (Alhayat et al., 2023; Nurasiah et al., 2022). Based on these stages, obviously, the students play a more active role during learning process, so that they produce meaningful knowledge (Yustina et al., 2020). The integration of PjBL and blended learning will enable the implementation of discussion forums and assignments to work independently, collaboratively, and online (Chua & Islam, 2021). Students can interactively pour their thoughts into concrete solutions that can be turned into innovative and creative production works, identify and solve problems and evaluate through the teaching platform (Azmi et al., 2022; Mursid et al., 2021; Tong et al., 2020).

Third, it is in terms of the learning process that took place during the research. Students were shown to be more engaged in group discussions during the learning process when using a project-based blended learning paradigm supported by interactive multimedia. Students actively discussed real-world problems given by the teacher to find solutions. In this instance, the teacher has acted as a facilitator, and the focus of the lesson has been on the needs of the individual students (Potvin et al., 2021). The project-based blended learning approach fosters students' development as autonomous learners. In order to become active learners who actively seek out knowledge and create a learning product rather than only being passive recipients of information, students will build

strong connections between the concepts and facts they are studying (Agustina et al., 2023).

Numerous earlier research, such as those showing that the project-based-blended learning approach can enhance learning achievement and higher-order thinking, support the aforementioned opinion (Alamri, 2021; Demir & Önal, 2021; Hujjatusnaini et al., 2022; Mursid et al., 2021; Tika & Agustiana, 2021). This learning model enables students to build their knowledge, discover their knowledge, and study concepts in depth while also improving their learning outcomes. The findings of studies on how learning models affect massage abilities are consistent with those of studies carried out by (Distyasa et al., 2021; Jazuli & Zakir, 2022; Surahman et al., 2019). Enhancing students' skills is one of the learning outcomes that the project-based blended learning approach influences more than the direct instruction.

Project-based blended learning can improve students' critical thinking, creativity, and problem-solving abilities, which will impact their academic performance. Students will be more independent in student-centred learning to complete projects in accordance with real-world problems (Mursid et al., 2021). Students will receive the following application of the project-based, integrated learning model: 1) The project-based blended learning model can help students practice and apply more effectively; 2) It can help students learn on their own by training them to conduct investigations and increase their level of inquiry; and 3) It can more successfully encourage collaboration amongst student teams (Tong et al., 2020).

This explanation suggests that the findings of this study are in line with the findings of earlier studies and accepted hypotheses. Therefore, in order to acquire higher massage learning achievement and massage skills, it is more appropriate to adopt the project-based-blended learning approach supported by interactive multimedia rather than direct instruction. The limitation of this research is that the researcher did not consider the level of digital literacy in the sample. This is an opportunity for further research, so that the results obtained will be more comprehensive.

CONCLUSION

The findings of this study suggest that implementation of project-based blended learning into sports massage courses can enhance students' cognitive learning achievement and skills. When used with blended learning, the project-based learning paradigm can yield significant educational gains. The project-based blended learning model is in accordance with 21st-century learning, which necessitates technological proficiency and the acquisition of 4C skills. Apart from that, the model also provides real learning activities that suit students' needs and are better prepared to face real-world demands or challenges. Combining project-based learning and the blended learning approach constitutes the originality of this study. Blended learning requires students to use interactive learning media. Meanwhile, project-based learning encourages students to explore their abilities with various references or literature to produce understanding in the form of products. So this learning model can be applied to higher education, especially in sports massage theory and practical courses, but it is recommended for further research to consider the level of digital literacy as a moderating variable.

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CONFLICT OF INTEREST

Clearly explain whether there are any conflicts of interest related to the reported research.

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