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ORIGINAL ARTICLE

The Application of Technological Pedagogical and Content Knowledge (TPACK) to Student Learning Motivation and Learning Outcomes in Physical Education

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Abstract:
The development of digital technology supports learning innovations that have the potential to improve student motivation and learning outcomes. This study aims to examine the effect of TPACK-based blended learning implementation on Physical Education (PJOK) learning for eleventh-grade students at SMA Negeri 1 Ploso. The method used was an experiment with a control and treatment group, accompanied by a pretest and posttest. The results of the Kruskal-Wallis test showed a significance value > 0.05, but there were differences in the average values. The treatment group had higher learning motivation (52.62) than the control group (48.38), as well as slightly better learning outcomes (8.614 compared to 8.605). Thus, the implementation of TPACK-based blended learning has a positive effect on increasing student motivation and learning outcomes in PJOK learning.
Keywords: blended learning; TPACK; learning motivation; learning outcomes

1. Introduction

Learning is currently increasingly developing, especially in a learning process concept that utilizes information technology, one of these concepts is Technological Pedagogical and Content Knowledge (TPACK), TPACK is a concept that combines technological knowledge, pedagogical knowledge, and content knowledge. In this concept, learning will provide an interesting concept because it is combined with information technology (Mishra, 2009). Research journals on the review of the use of TPACK in learning have an impact on the implementation of the elementary school teacher learning model given to students as many as 2 task designs, in the second task design it is significantly better than student performance in the first task design, and TPACK competency increases significantly at the end of the course (Angeli C., 2009) it cannot be denied that at the elementary school level students will enjoy learning more when given an interesting learning model, especially the TPACK model which can present interesting learning concepts.

Learning that utilizes technology provides innovation in the learning process and has a positive impact on students, as stated by (Steffi Adam, 2015) stating that the use of media in the information technology-based learning process for class X students of SMA Ananda Batam found good percentage results and information technology-based learning is imaginative, semantic, and motivational learning. In addition, using information technology in learning can align with the education system law (2003) in article 31 concerning distance education. Physical education is a process of educating someone as an individual or member of society that is carried out consciously and systematically through various physical activities to obtain physical growth, health, and physical fitness, abilities and skills, intelligence and harmonious character and personality development in the context of forming quality Indonesian people based on Pancasila (Subarjah, 2020). The nature of PJOK learning is full of physical

movement, learning is carried out in open spaces or on the field. The method for sports education is the deductive method or command method, with a variety of assignments, demonstrations and a little explanation (Supriyadi, 2018). This can be combined with existing technology, such as through learning videos or practical videos that students will do, which in this case can help students understand the material much more easily.

Regulation of the Minister of Education and Culture Number 37 of 2018 explains the components of basic competencies (KD) and core competencies (KI) at the level of high school grade XI. This research was conducted on the material that will run next in accordance with KI and KD as a reference for the learning process. Law of the Republic of Indonesia number 20 of 2003 also explains the objectives of national education, namely "to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens". For this reason, as educators, they must have interesting learning models and media that are used to support student learning motivation and student learning outcomes.

In this e-learning learning, it has benefits when one of the problems occurs as stated by (Setiawati, 2020) "Problems faced by teachers in affective assessment in the 2013 curriculum at SD Negeri Jatibatur 1 include: teachers are unable to attend school". Some other problems in learning during the pandemic are in supporting facilities and infrastructure and the lack of mastery of teachers and students in online learning skills. (Herlina, 2020). To make it easier for educators in providing material that can be done online is by using visual or audiovisual media, multimedia videos as appropriate teaching resources to communicate course content. The learning model with audiovisual media can improve learning outcomes, activeness and motivation for students, the material delivered by the teacher can be understood by students, students are responsible for their tasks, and help students be actively involved in learning activities (Sulfemi, 2020),

The fact that information technology will develop rapidly and will continue to be used in the future. (Emine Aras, 2020). In the learning process during the Covid-19 pandemic, it can be done using a platform that helps and facilitates educators and students to conduct online learning, by using e-learning media, educators and students can improve competencies, acquire relational and communicative skills when they collaborate during learning (Camilleri, 2019). For educators, it will also be able to improve the quality of their knowledge capacity to reflect on teaching skills (Coffey, 2014). Platforms that can be used in this learning are using Google Classroom and Google Meet. It can be explained that the results of the use of Google Classroom in learning are that learning can be accepted by students and run regularly and productively in the learning process (Cristiano, 2019), in addition, Sukmawati (2019) explained that based on the results of the study, the author can conclude that Google Classroom has a role in English learning.

Development of a TPACK-based blended learning model for Physical Education. The study integrates technological, pedagogical, and content knowledge into a structured learning model specifically designed for Physical Education, use of digital learning platforms and audiovisual media. Platforms such as Google Classroom and Google Meet are combined with instructional videos and practice demonstrations to support both online and face-to-face learning. Adaptation to the characteristics of Physical Education. The model is designed to facilitate movement analysis, independent practice, and performance reflection, aligning with the practical nature of physical education. Application in Indonesian high school settings. The study provides empirical evidence from a local educational context, contributing to the relevance and applicability of the findings for Indonesian teachers, comprehensive evaluation of effectiveness. The study assesses the model's impact on student motivation, engagement, cognitive understanding, and practical learning outcomes.

Learning methods that can be used when technology in the learning process continues to develop, provide innovation in the learning process and condition the situation when educators and students cannot meet face to face such as teachers who are on duty outside of school or students who are undergoing training centers for an achievement, both academic and non-academic and if offline learning cannot be implemented, the learning method that can be utilized is using the blended learning method. According to (Jalinus, 2020) blended learning is learning that combines online and face-to-face learning, for its implementation it can be done entirely online, it can also be done in a balanced or varied manner depending on the learning material and learning situation.

The results of this study are expected to provide theoretical and practical contributions. Theoretically, the study enriches the literature on TPACK and blended learning in physical education. Practically, it offers teachers an innovative instructional model that can be implemented in various learning situations, including face-to-face, online, and hybrid settings. In conclusion, the integration of TPACK and blended learning represents a promising approach to modernizing Physical Education instruction. By addressing the identified research gaps and introducing a context-specific instructional innovation, this study is expected to contribute to the improvement of physical education learning quality and to support the broader goals of Indonesian national education.

2. Materials and Methods

This study used a quantitative approach with an experimental method to test the effectiveness of a TPACK-based blended learning model in improving students' learning motivation and learning outcomes in Physical Education, Sports, and Health (PJOK). The design applied was a pretest-posttest control group design, in which two groups of students were observed before and after treatment. This design was selected because it allows the researcher to measure changes in student performance and to compare the effectiveness of the treatment with conventional instruction. The research was conducted at SMA Negeri 1 Ploso, Jombang Regency, East Java. The population consisted of all Grade XI students enrolled in the academic year of the study. Sampling was carried out using probability sampling with a cluster random sampling technique. Two classes were randomly selected from all Grade XI classes. One class was assigned as the experimental group and the other as the control group. All students in the selected classes were included as research participants.

The experimental group received instruction using a TPACK-based blended learning model that integrated technological knowledge, pedagogical knowledge, and content knowledge. The learning process combined online and face-to-face activities. Online instruction was conducted through Google Classroom and Google Meet, where students accessed learning materials, watched instructional videos, participated in discussions, and submitted assignments. Face-to-face meetings were used for practicing movement skills, teacher demonstrations, and direct feedback. The control group studied the same material using conventional teaching methods consisting of explanation, demonstration, and guided practice without structured integration of digital technology. The independent variable in this study was the TPACK-based blended learning model, while the dependent variables were learning motivation and learning outcomes. Learning outcomes were measured using an achievement test developed according to the PJOK learning objectives and curriculum indicators. Learning motivation was measured using a five-point Likert-scale questionnaire covering indicators of interest, persistence, attention, confidence, and perceived usefulness.

Before use, both instruments were validated through expert judgment and pilot testing. Reliability was analyzed using Cronbach's Alpha, with a coefficient of at least 0.70 considered acceptable. Data collection began with the administration of a pretest and an initial motivation

questionnaire to both groups. The treatment was then implemented for four to eight meetings, followed by a posttest and a final motivation questionnaire. Data analysis was conducted using IBM SPSS Statistics. Descriptive statistics were used to summarize the data. The normality of the data was tested using the Shapiro-Wilk test, and homogeneity of variance was examined using Levene's test. Hypothesis testing employed paired-samples t-tests to analyze differences between pretest and posttest scores within each group and independent-samples t-tests to compare the results between groups. Effect size was calculated using Cohen's d to determine the magnitude of the treatment effect. All statistical analyses used a significance level of 0.05.

To ensure research rigor, both groups were taught the same material over the same duration, used the same assessment instruments, and followed standardized lesson plans. Ethical procedures included obtaining permission from the school, informing participants about the purpose of the study, and maintaining the confidentiality of all collected data.

3. Results

Normality Test

A normality test was conducted to determine whether the data obtained from the initial and final tests from all groups were normal using the SPSS 20 application, namely by using the Kolmogorov-Smirnov test. The results of calculations using SPSS 20 to see data normality can be seen in table 1.

Table 1. Normality Test Results

Group	Learning outcomes		Motivation to learn	
	Pretest (Sig)	*Posttest* (Sig)	*Pretest* (Sig)	*Posttest* (Sig)
Control	,155	,000	,091	,027
Treatment	,000	,000	,003	,008
Information	p < 0,05	p < 0,05	p < 0,05	p < 0,05
Status	Abnormal	Abnormal	Abnormal	Abnormal

Based on the results of the data normality test using the Kolmogorov-Smirnov test presented in Table 1, it shows that all pretest and posttest data in the control and treatment groups were not normally distributed. This is because the Sig. value is <0.05, indicating that H0 is rejected. Therefore, it can be concluded that the data were taken from a population with a non-normal distribution.

Wilcoxon test

To find out the differences between the control group and the treatment group, where both groups also underwent a pretest and posttest, a data analysis was carried out using the SPSS 22 application in the Wilcoxon test, namely comparing groups of data that are related or connected to each other. The results of SPSS data processing are presented in table form. The following is an explanation of the calculation results for each variable, including:

Table 2. Results of the Willcoxon Difference Test on learning outcome data

Variables	Pair	z_{hitung}	z_{tabel}	Sig. (*2-tailed*)	Status
Control	Pretest – Posttest	8,605	0,9750	0,000	Different
Treatment	Pretest – Posttest	8,614	0,9750	0,000	Different

Based on table 2, the conclusion of the analysis results shows that to see statistically significant differences can be seen in the z-count number and Sig. (2-tailed) value. In the control group, the z-count shows 8.605 with a probability value of 0.000. From the

calculation results obtained z-count> z-table = 8.605> 0.9750 and Sig. (2-tailed) <0.05, then the H0 hypothesis is rejected and the H1 hypothesis is accepted which means there is a difference between the pretest and posttest learning outcomes of the control group. While in the speed agility variable, the t-count shows 8.614 with a probability value of 0.000. From the calculation results obtained z-count> z-table = 8.614> 0.9750 and Sig. (2-tailed) <0.05, then the H0 hypothesis is rejected and the H1 hypothesis is accepted which means there is a difference between the pretest and posttest on agility. And it can be seen from the increase in the z-count value between the control group and the treatment group there is a difference, namely the control group has a result of 8.605 and the treatment group got a result of 8.614, in this data shows that the treatment group got better results. It can be concluded that the implementation of TPACK-based blended learning in PJOK learning for class XI students of SMA Negeri 1 Ploso has an effect on learning outcomes.

Motivation to learn

Table 3. Results of the Wilcoxon Test of Learning Motivation

Variables	Pair	z_{hitung}	z_{tabel}	Sig. (*2-tailed*)	Status
Control	Pretest – Posttest	8,688	0,9750	0,000	Different
Treatment	Pretest – Posttest	8,646	0,9750	0,000	Different

Based on Table 3, the analysis concludes that statistically significant differences can be seen from the z-count and Sig. (2-tailed) values. The z-count in the group showed 8.688 with a probability value of 0.000. The calculation results obtained z-count > z-table = 8.688 > 0.9750 and Sig. (2-tailed) < 0.05, therefore, hypothesis H0 is rejected and hypothesis H1 is accepted, indicating a difference between the pretest and posttest learning outcomes of the control group. Meanwhile, in the treatment group, the z-count showed 8.646 with a probability value of 0.000. The calculation results obtained t-count > t-table = 8.646 > 0.9750 and Sig. (2-tailed) < 0.05, therefore, hypothesis H0 is rejected and hypothesis H1 is accepted, indicating a difference between the pretest and posttest. The Wilcoxon test results showed that the treatment group was smaller than the control group. It can be concluded that the implementation of TPACK-based blended learning in Physical Education learning for class XI students at SMA Negeri 1 Ploso has little influence on learning motivation.

Uji Kruskal Wallis

To find out the differences between the control group and the treatment group, where both groups also underwent a pretest and posttest, a further data analysis was carried out which had previously been tested with Wilcoxon, then using SPSS 22 application data processing in the Kruskal Wallis test, namely comparing groups of data that were related or connected to each other. The results of SPSS data processing are presented in table form, which is then explained in the form of data from the calculation results for each variable using the Kruskal Wallis test.

Table 4. Krskal Wallis

Group	*Pretest*		*Posttest*	
	Control (Sig)	Treatment (Sig)	Control (Sig)	Treatment (Sig)
Learning outcomes	55,92	43,08	39,64	59,36
Motivation to learn	50,51	50,49	48,38	52,62
Asymp. Sig	0,997		0,463	

Status	p > 0,05	p > 0,05

Table 4 shows a Sig. value > 0.05, indicating no significant difference in the average of learning outcomes and learning motivation. This means that the difference between the two control groups and the treatment group is not significant, but there is still a relatively small difference when viewed from the mean difference in both variables in the posttest table, the result of the sig. value. The learning outcomes of the control group are 39.64 while in the treatment group it is higher at 59.36. In the learning motivation variable, the Sig. value > 0.05 shows no significant difference in the average of learning motivation. This means that the average difference between the two control groups and the treatment group is not significant, but there is still a relatively small difference when viewed from the mean difference, especially in the posttest table, the result of the sig. value. The control group is 48.38 while in the treatment group it is higher at 52.62. It can be concluded that in the Kruskal Wallis test, the two variables do not have a significant difference in the average of learning outcomes. However, the difference is seen in the mean difference column which shows an increasing difference between the control group and the treatment group.

4. Discussion

Discussion of the Results of Implementing the TPACK-Based Blended Learning Model on Improving Learning Outcomes

Based on the results of the treatment in the experimental group and the data that has been taken, the data is then processed using the SPSS 22 application, from the results of data processing it can be concluded that the results of the statistical test have a calculated value of Sig. <0.05, so it can be interpreted that there is no effect. However, at the level of calculation of the mean or average, the results have increased between the control group and the treatment group, therefore there is a difference in the results of the increase in the treatment group as seen from the mean or average when the implementation of the TPACK-based blended learning model with the learning outcomes of the physical education subject.

Discussion of the Results of the Implementation of the TPACK-Based Blended Learning Model to Increase Learning Motivation

The results of the implementation of TPACK-based blended learning in the experimental and control groups of data that have been taken are continued with data processing using the SPSS 22 application, from the results of data processing it can be concluded that the results of the statistical test have a calculated value of Sig. <0.05, then it can be interpreted that there is no effect. However, at the level of calculation of the mean or average, the results have increased between the control group and the treatment group, therefore there is a difference in the results of the increase in the treatment group as seen from the mean or average when the implementation of the TPACK-based blended learning model with learning motivation in PJOK subjects.

Discussion of the Recapitulation of the Results of the Application of the Blended Learning Model to Improve Learning Outcomes and Student Learning Motivation in Physical Education Learning

Overall, based on the calculation results after being given treatment in the form of games for four meetings over four weeks, in the experimental group there was an increase in the average or mean value. So in this case, it can be concluded that there is an effect of the application of the TPACK-based blended learning model on improving student learning

outcomes and motivation in physical education learning. The results of research on the role of the TPACK-based blended learning model can indeed improve student learning outcomes in physical education learning.

Sjukur (2012) stated in his research results related to the motivation and learning outcomes of vocational high school students who were given blended learning treatment, where the results of the study showed significant differences. Meanwhile, Hamallik (2010, p. 179) factors that influence motivation are age, physical condition, intelligence strength, models, and the environment. In this study, learning outcomes and increased motivation are influenced by teachers, learning models, and the school environment, so this can help students be motivated in carrying out the learning process to participate in physical education and health lessons at school. In this study, these theories work to improve student learning outcomes in physical education.

Khairuddin, Ahmad (2019), the results of the implementation of learning using blended learning made students enthusiastic in participating in Islamic Religious Education learning, in addition, the paradigm of the learning process was no longer focused on the teacher but more centered on a new paradigm that is centered on students. From the results of the research in the journal, it was proven that motivation increased with the treatment of learning using blended learning and the result was an increase in student enthusiasm when conducting Islamic Religious Education learning using the blended learning method.

Furthermore, the TPACK learning model implemented in a learning process also has a positive impact, as explained by Angeli (2008) in her journal, explaining that there was an increase in student learning outcomes in the second assignment assessment for the application of TPACK-based learning. With TPACK, students found a modern learning environment in accordance with the current technological developments. The results of this journal explain that students experienced an increase in learning outcomes when given learning treatment using the TPACK model.

The expert explanations above show that learning strategies, methods, and models can motivate students in the learning process and also achieve student learning outcomes. In this study, students directly experienced learning activities using a blended learning model based on TPACK, thus allowing students to directly experience learning activities and experience a new learning activity, and it is hoped that this learning model will help improve their learning outcomes.

The decline in student learning outcomes can occur due to various factors, internal factors, namely factors originating from each individual student themselves, as well as external factors, namely factors originating from outside the student (the student's own environment). The factors originating from the student (internal) are: a) Attitude factors, b) Laziness factors, c) Time factors, d) Making assignments easier, e) Students' learning methods at home, f) Too relaxed, these are factors originating from the student themselves, so that student learning outcomes have recently decreased. The external factors are factors that are outside the student or individual (the student's own environment), including: a) Family or parental environment, b) School environment, c) Community environment.

From the description above, it can be concluded that what is meant by student learning outcomes is the changes that occur in students after participating in a learning process, learning outcomes are feedback given by students (Juniarti, Bahari, & Riva'ie, 2015). In this study, there were differences in research results that were apparent from the mean or average value, from the factors causing the decline in learning outcomes, this could also be experienced by respondents. In addition, the learning process that took place in the four classes that had been divided into control groups and treatment groups and in the 4 classes

were accompanied by different teachers and both had their own characteristics when teaching. Such as the pattern of dividing material between more theory or practice.

5. Conclusions

The results of the study on the implementation of TPACK-based blended learning on student learning outcomes and motivation in PJOK learning for grade XI high school students, the study went smoothly using the flipped classroom blended learning model where there was online learning that had been scheduled before offline learning took place. However, during the implementation there were also students who did not participate in online learning because there were additional tutoring classes that clashed with the schedule and there were also those who were allowed due to illness. In the implementation of TPACK-based learning also took place in the classroom before practical learning using learning PPT displayed on the projector screen. After calculations were carried out on the student learning outcome variables, there was an increase seen in the average results of the sig. learning outcomes of the control group were 39.64 while in the treatment group it was higher at 59.36. In the learning motivation variable, the sig. value of the control group was 48.38 while in the treatment group it was higher at 52.62.

This research can provide students with valuable experience, enabling them to develop their skills in physical education. Furthermore, this research will increase students' motivation to participate in physical education lessons, especially when using TPACK-based blended learning. Furthermore, this research can serve as a reference for teachers, demonstrating that limited facilities and infrastructure do not hinder students' learning and movement. Teachers are expected to be more creative in developing and creating learning models and learning environments to encourage students to be more motivated and active in physical education lessons.

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