The Effect of Project Based Learning Assisted by Mobile Learning Applications and Learning Motivation on the Competence and Performance of Teachers

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Abstract: One learning model that can be used to improve teachers' quality, pedagogic competence, and personality is the Project Based Learning (PjBL) learning model. The development in research carried out the Project Based Learning (PjBL) learning model in collaboration with applying the mobile learning model. The use of project-based learning using mobile applications focuses on optimizing teacher performance. The results of this study are: (1) There is an influence of the PjBL strategy assisted by the Mobile Learning Application on the pedagogical competence of teachers. It shows by the significant p-value <0.05; (2) There is an effect of the PjBL strategy assisted by mobile learning on teacher performance which is shown by the significant p-value <0.05; (3) Shown by the average value of the pedagogic competence of teachers for students who have high and low learning motivation with a significant difference of p-value <0.05; (4) The average value shows teacher performance for students who have high against students with low learning motivation with a significant difference with the p-value <0.05; (5) Shows the significant value, p-value <0.05. Moreover, it also shows the average pedagogical competence of teachers who apply the PjBL strategy assisted by mobile learning to students who have high learning motivation reaches the value of 6.2500. Meanwhile, the average score of students who use the PjBL strategy and have high motivation earns 4.2341; (6) The significant value shows it, p-value <0.05, and the average performance of teachers who have high learning motivation is 64.0787.

Keywords: project based learning assisted by mobile learning application, learning motivation, teacher's competence and performance.

1. Introduction

The ability of teachers to improve teacher performance in learning activities, by using the mobile learning model, children become independent in looking for references to teaching material assignments (Walden, 2020)(Balacheff and Kaput, 1996). Improved teacher performance increases with active learning material. As the results of research conducted byWu et al. (2012) found that most of the studies on mobile learning are very effective in learning systems (Ash *et al.*, 2019). Boundless learning is now seen as an aspiration(Hamid *et al.*, 2019), "Habit-mind" (Wong and Looi, 2011), or a set of metacognitive abilities (Flanagan and Ogata, 2018) or "schema setting and habitual strategy" in psychological terms Safiah (2020) which positions that learning is not only at school but can continue for life in everyday life.

Mobile technology has the potential to mediate mobile learning, which is by creating a connected learning experience (Wong and Looi, 2011)(Caena, 2014). While research on cognition and learning over the past decade has emphasized the importance of linking classroom learning and learning in the field, the dominant characteristics of school learning still have a strong focus on individual cognition, purely toolless mental activity, and too much general-context learning.(Darling-Hammond, 2010). One of the mobile technology used as a medium for mobile learning is smartphones(Wong and Looi, 2011)(Hamid *et al.*, 2019).

The advantage of mobile learning is that it supports the performance of teachers to optimize their teaching experience and their concern for abstract and concrete experiences. (Krull and Duart, 2017). Mobile learning is a positive impact of technological developments that change the paradigm in education, learning develops already outside the context of traditional learning in general(Dee and Wyckoff, 2015). Learning can be used on a mobile basis, without any limitations(Looi *et al.*, 2010). Students can use various mobile media to support the learning process(Bauer *et al.*, 2020). Teachers can use various tools such as cluod computing to store the material being studied and can continue it again at home to explain the analysis.(Barden and Bygroves, 2018)(Uther, 2019).

The use of project-based learning using mobile applications focuses on optimizing teacher performance. Mobile learning is shaped like cloud computing (cloud computing) is a technology that makes the internet a center for data management and applications, where computer users are given access rights (login)(Georgieva *et al.*, 2005). Public cloud use is almost the same as shared hosting, where on 1 (one) server there are many users.

Seeing the positive impact of this technology, the trend of learning in Indonesia has also suffered (Kowi and Widyanigsih, 2017). A number of Android-based educational applications have started to appear that can help teachers improve their performance, ranging from independent learning applications to online tutoring applications(Setiawan and Asrowi, 2018). The large number of students who have smartphones supports information technology-based learning models, especially mobile learning.

Mobile learning models are used to describe situations where they can learn whenever they want in various scenarios and that they can switch from one scenario to another easily and quickly using one or more mobile per student ("one-to-one") as mediator (Balacheff and Kaput, 1996)(Looi *et al.*, 2010). Students to study anytime, anywhere, and provide them with various ways of learning throughout the day(Jafari and Kosasih, 2014). Seamless learning is also used to describe lifelong learning in multiple environments across time and locations without barriers through the use of technology as a mediating tool(Looi *et al.*, 2010).

One solution to increasing the low performance of teachers is by implementing Project Based Learning (PjBL) based on mobile learning (Kokotsaki *et al.*, 2016)(Kong *et al.*, 2013). To implement this learning, an application will be developed that supports the implementation of mobile learning (Nakada *et al.*, 2018)(Krull and Duart, 2017). The application developed has two main subsystems, namely "improving teacher performance". Based on this background, it can be seen that there are values and benefits of mobile services in supporting the development of teacher performance with well-designed applications and systems.

2. Method

2.1. Design Research Design

This study used a quasi-experimental design.(Maciejewski, 2020). This type of research aims to examine the effect of PjBL strategies assisted by mobile learning applications and teaching motivation on teacher competence and performance(White and Sabarwal, 2014). The design of this study was a 2 x 2 factorial non-equivalent control group design, this study did not use random assignments but used the experimental class and the control class that had been determined in Setyosari & Widijoto (2007)Denny & Pajnkihar (2017). The research design is described in Table 1.

Table 1. Design Research Design

Moderator Variables	Learning strategies	
Teaching motivation	PPA Assisted by mobile learning applications	PPA (2)
High teaching motivation (1)	X1Y1	X2Y1
Low teaching motivation (2)	X1Y2	X2Y2

X1 Y1 : teachers who have high teaching motivation in the classroom who use the PjBL strategy Assistedby mobile learning applications (Experiment Class)

X2 Y1 : teachers who have high teaching motivation in the classroom using the PjBL (Control Class)
strategy

X1Y2 : teachers who have low teaching motivation in the classroom using the PjBL strategy assisted
by mobile learning applications (Experiment Class)

X2 Y2 : teachers who have low teaching motivation in the classroom use the PjBL (Control Class) strategy.

2.1. Research subject

Research on teachers from various educational study programs, including physics, chemistry and mathematics study programs at Madrasah Iftidqiyah Nahdatul Watan 1 semester 1 of the 2020/2021 school year.

Table 2. Table of Research Subjects

PjBL learning strategy	Teaching motivation moderator variable	Total number of teachers	Total number
PjBL assisted by mobile learning applications	High Low	17:15	32
PjBL	High Low	16:14	30
Total Research Subjects			62

2.2. Instrument Testing

2.2.1. Testing Instrument Validity

Instrument validation is measured by the instrument used. High instrument validity has a high degree of accuracy as well. And conversely, low instrument validity has a low level of accuracy as well. The formula used to measure the validity of an instrument is the product moment correlation as follows:

$$\frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[(N\sum X^2 - \sum X^2)(N\sum Y^2 - \sum Y^2)]}}$$

Information:
rxy : the x and y correlation coefficients
X : score of each item
Y : total score
N : Number of subjects / teachers studied

The criterion to see whether or not it is valid is compared to the product moment r table price with a significance level of 5% an item is said to be valid if the calculated price> r table. In testing the level of validity of the items from the multiple choice test given in order to find out the teacher's initial understanding of the subject matter of teacher competency 1, a trial was given to a group of teachers with a total of 30 teachers who were not research subject.

a. Teacher Competency Validity Test

Initially, the item validity test was given 15 multiple choice questions, and after being validated based on the validity and reliability of the items, 25 questions were valid and feasible to be applied at the next level. The results of the calculation of the validity test of each item are as shown in the following table.

Table 2. Results of Testing the Validity of Teacher Competency Instruments

Item	rhitung	r table	Ket	Item	rhitung	r table	Ket
KPTS 1	0.436	0.3061	Valid	KPTS 16	0.313	0.3061	Valid
KPTS 2	0.292	0.3061	Invalid	KPTS 17	0.392	0.3061	Valid
KPTS 3	0.356	0.3061	Valid	KPTS 18	0.492	0.3061	Valid
KPTS 4	0.368	0.3061	Valid	KPTS 19	0.438	0.3061	Valid
KPTS 5	0.094	0.3061	Invalid	KPTS 20	0.208	0.3061	Invalid
KPTS 6	0.681	0.3061	Valid	KPTS 21	0.369	0.3061	Valid
KPTS 7	0.371	0.3061	Valid	KPTS 22	0.362	0.3061	Valid
KPTS 8	0.347	0.3061	Valid	KPTS 23	0.34	0.3061	Valid
KPTS 9	0.422	0.3061	Valid	KPTS 24	0.645	0.3061	Valid
KPTS 10	0.413	0.3061	Valid	KPTS 25	0.419	0.3061	Valid
KPTS 11	0.434	0.3061	Valid	KPTS 26	0.392	0.3061	Valid
KPTS 12	0.340	0.3061	Valid	KPTS 27	0.492	0.3061	Valid
KPTS 13	0.383	0.3061	Valid	KPTS 28	0.438	0.3061	Valid
KPTS 14	0.303	0.3061	Invalid	KPTS 29	0.205	0.3061	Invalid
KPTS 15	0.430	0.3061	Valid	KPTS 30	0.369	0.3061	Valid

From the results of the analysis, the item score can be obtained with the total score. This value is then compared with the rtable value. The rtabel is sought at 5% significance with a 2-sided test and n = 30, then the r table is obtained0.3061. If the r value of the analysis results is less than (<) r table, it can be concluded that these items are not significantly correlated with the total score (declared invalid) and must be removed or corrected. The validity of the instrument is determined through the corrected-item-total correlation column.

Score less than rtabel (0.3061) then the item is categorized as invalid. Based on the results of the validity test of the teacher competency test instrument in table 3.1 above, it is known that from 30 items, there are 25 valid items and 5 invalid items, namely items to KPTS 2, 5, 14, 20, 29 thus based on the results of the validity test. then the 25 items can be used to continue in the pretest and posttest questions.

Table 3. Results of the Validity of Teacher Competency Instruments

Item	rhitung	r table	Ket	Item	rhitung	r table	Ket
KPTS 1	0.378	0.3061	Valid	KPTS 14	0.384	0.3061	Valid
KPTS 2	0.343	0.3061	Valid	KPTS 15	0.490	0.3061	Valid
KPTS 3	0.430	0.3061	Valid	KPTS 16	0.422	0.3061	Valid
KPTS 4	0.701	0.3061	Valid	KPTS 17	0.390	0.3061	Valid
KPTS 5	0.472	0.3061	Valid	KPTS 18	0.429	0.3061	Valid
KPTS 6	0.366	0.3061	Valid	KPTS 19	0.369	0.3061	Valid
KPTS 7	0.383	0.3061	Valid	KPTS 20	0.651	0.3061	Valid
KPTS 8	0.427	0.3061	Valid	KPTS 21	0.510	0.3061	Valid
KPTS 9	0.416	0.3061	Valid	KPTS 22	0.384	0.3061	Valid
KPTS 10	0.318	0.3061	Valid	KPTS 23	0.490	0.3061	Valid
KPTS 11	0.323	0.3061	Valid	KPTS 24	0.422	0.3061	Valid
KPTS 12	0.422	0.3061	Valid	KPTS 25	0.390	0.3061	Valid
KPTS 13	0.346	0.3061	Valid				

The results of the Pearson validity test on the learning outcomes questionnaire obtained that the rcount value of each item met the requirements, namely>0.3061 so that the item is valid and can be continued. The results of the reliability test with Cronbach Alpha met the requirements, namely> 0.600 so that the variables used were reliable.

b. Test the Validity of Teacher Motivation

The validity test of teacher motivation items consisted of 16 questionnaire items, and after being validated based on the validity and reliability of the items, it was found that all items or 16 items were valid and feasible to be applied at the next level. The results of the calculation of the validity test of each item are as shown in the following table.

Table 4. Results of Testing the Validity of Teacher Motivation

Item	rhitung	r table	Ket	Item	rhitung	r table	Ket
MTVS 1	0814	0.3061	Valid	MTVS 9	0.788	0.3061	Valid
MTVS 2	0.727	0.3061	Valid	MTVS 10	0.776	0.3061	Valid
MTVS 3	0831	0.3061	Valid	MTVS 11	0.721	0.3061	Valid
MTVS 4	0.765	0.3061	Valid	MTVS 12	0.802	0.3061	Valid
MTVS 5	0.781	0.3061	Valid	MTVS 13	0.747	0.3061	Valid
MTVS 6	0.771	0.3061	Valid	MTVS 14	0.728	0.3061	Valid
MTVS 7	0.774	0.3061	Valid	MTVS 15	0.716	0.3061	Valid
MTVS 8	0.798	0.3061	Valid	MTVS 16	0.795	0.3061	Valid

The results of the validity test with Pearson's correlation to the motivation questionnaire obtained that the rcount value of each item met the requirements, namely> 0.3061 so that the item was valid and could be continued.

c. Teacher Performance Validity Test

The validity test of the teacher performance items consisted of 18 questionnaire items, and after being validated based on the validity and reliability of the items, it was found that all items or 18 items were valid and feasible to be applied at the next level. The results of the calculation of the validity test of each item are as shown in the following table.

Table 5. Results of Performance Validity Testing

Item	rhitung	r table	Ket	Item	rhitung	r table	Ket
KNJR 1	0.700	0.3061	Valid	KNJR 10	0.674	0.3061	Valid

KNJR 2	0.475	0.3061	Valid	KNJR 11	0.528	0.3061	Valid
KNJR 3	0.769	0.3061	Valid	KNJR 12	0.754	0.3061	Valid
KNJR 4	0.513	0.3061	Valid	KNJR 13	0.711	0.3061	Valid
KNJR 5	0.693	0.3061	Valid	KNJR 14	0.605	0.3061	Valid
KNJR 6	0.667	0.3061	Valid	KNJR 15	0.455	0.3061	Valid
KNJR 7	0.632	0.3061	Valid	KNJR 16	0.798	0.3061	Valid
KNJR 8	0.776	0.3061	Valid	KNJR 17	0.526	0.3061	Valid
KNJR 9	0.765	0.3061	Valid	KNJR 18	0730	0.3061	Valid

The results of the validity test with Pearson's correlation to the Teacher Performance questionnaire showed that the value of each item fulfilled the requirements, namely> 0.361 so that the item was valid and could be continued. The results of the reliability test with Cronbach Alpha obtained that the Cronbach Alpha value meets the requirements, namely> 0.600 so that the variables used are reliable.

2.2.2. Instrument reliability test

Reliability shows that an instrument can be trusted as a means of collecting data because the instrument is good. The formula used to find the reliability of the research instrument is:

$$r11 = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \sigma b^2}{\sigma 1^2}\right)$$

(Arikunto, 2006: 170)

Information:
r11 : instrument reliability
k : number of instrument items
∑***σ***b^2 : the number of variants of the question item
σ12 : total number of variants

Variants of question items can be searched using the formula:

$$\sigma b^2 = \frac{\sum X^2 - \frac{(\sum x^2)}{N}}{N}$$

Information:
σb^2 : Variants of instrument items
∑x : total score of the question items
N : Number of respondents

If the price of r11 is consulted with the r table with a significance level of 5%, it is greater, it means that the instrument is reliable. r11> r table, the instrument in this study is reliable. Following are the results of the test instrument reliability testing.

a. Teacher competency reliability test

Table 6. Teacher Competency Reliability Test Results

Reliability Statistics	
Cronbach Alpha	N of Items
0866	25

Based on the calculation results in table 3.5 above, it is known that the initial teacher competence with 30 item items obtained a Cronbach Alpha value of 0.860 and after invalid items were discarded, the remaining 25 items were valid with a Cronbach alpha value of 0.866. The instrument is included in the reliable category because it has a Cronbach Alpha value above 0.600.

b. Teacher Motivation Reliability Test

Table 7. Results of Teacher Motivation Reliability Testing

Reliability Statistics	
Cronbach Alpha	N of Items
0.962	16

Based on the results of the calculation in table 3.5 above, it is known that the teacher motivation test score with 16 item items obtained a Cronbach Alpha value of 0.962. The instrument is included in the reliable category because it has a Cronbach Alpha value above 0.600.

c. Teacher Performance Reliability Test

Table 8. Teacher Performance Reliability Test Results

Reliability Statistics	
Cronbach Alpha	N of Items
0.939	18

Based on the results of the calculation in table 3.5 above, it is known that the teacher performance test score with 18 item items obtained a Cronbach Alpha value of 0.939. The instrument is included in the reliable category because it has a Cronbach Alpha value above 0.600.

2.3. Data collection

In this stage the researcher took several steps. The first thing the researcher did was collecting the initial data on learning outcomes in the experimental class and the control class. This is believed to determine whether the two classes of this group have the same learning outcomes or are close to the same. The second thing the researcher does is to collect data on teaching motivation, along with data collection about the attractiveness of learning outcomes in both classes. From the above steps, the researcher then gave the experimental class treatment by implementing the PjBL strategy assisted by the mobile learning application, while for the treatment control class only applying the PjBL strategy without the assistance of the application.

2.4. Data analysis

2.4.1. Testing Prerequisite Analysis

The analysis requirements test is carried out to detect whether the data obtained meets the requirements for analysis using analysis techniques that are planned in accordance with the research objectives. The basic assumptions that must be met before data analysis using the MANOVA analysis technique are (1) the data distribution is normal, and (2) the data is homogeneous.

a. Normality test

Normality Test Data that has a normal distribution has a normal distribution as well. This normality test is used to determine the distribution of data, whether it is in the form of a normal distribution or not. This normality test using the Kolmogorov-Smirnov test can also be a consideration for normally distributed data if the significance value (p) is more than 0.05.(Andy Field, 2009). In addition, the data will be normally distributed if the skewness and kurtosis values will be between -2 and +2(George and Mallery, 2010).Field (2009)provides an alternative which states "the data can be said to be close to normal distribution if the research sample is more than 30". In other words, normally distributed data can represent the population in the study(Andy Field, 2009). Another normality test that does not only refer to numerical data, can use the QQ-Plot graph, the QQ Test produces a QQ Plot graph that can describe the distribution of data distribution.

b. Homogeneity test

The homogeneity assumption aims to determine whether the variance of the measured score (variance between sample groups) is the same or not "(Andy Field, 2009). The homogeneity test was carried out in a multivariate manner because it involved the dependent variable simultaneously. The homogeneity test used the Box's M test with a significance levelα= 0.05. The decision criterion is that if the resulting significance value is more than 0.05, the variance-covariance matrix in both classes is the same or homogeneous. The homogeneity test of variance is used to determine whether the samples taken are homogeneous or not. The 59 homogeneous test was carried out on the dependent variable. This univariate homogeneity test used the Levene's test. Levene's test using the help of IBM SPSS 22 for Windows. Levene's test was used to test the variance homogeneity between data groups. The criterion for decision making is that if the significance is more than 0.05, the variants of the data group are the same (homogeneous).

2.5. Hypothesis test

Hypothesis testing, used Statistical Analysis: Descriptive, paired sample-test, and MANOVA based on a factorial designTuckman (1999) and refers to Kerlinger & Lee (2000). This technique is useful for analyzing the dependent variable with interval and ratio scales. In this study, the dependent variable was the attractiveness and effectiveness of the learning outcomes. MANOVA analysis technique with a significance level of a = 0.05. The decision criterion is if the sign value> 0.05 then H0 is accepted and if the sign value <0.05 then H0 is rejected.

3. Results

3.1. Variable Description

The following shows the results of descriptions of competency and performance variables based on Learning Method Factors (PjBL treatment assisted by mobile Learning applications and PjBL treatment) and motivation factors (high motivation and low motivation).

Table 9. Competency Description Results

Descriptive Statistics					
	Method	Motivation	Mean	Std. Deviation	N
Competence	PjBL controls	Low	2,5000	1.34450	14
		High	3.1250	1.99583	16
		Total	2.8333	1,72374	30
	PjBL Mobile Experiment	Low	5.1176	2.47271	15
		High	5.4000	2.14716	17
		Total	5,2500	2.27185	32
	Total	Low	40000	2.46403	29
		High	4.1515	2.27927	33
		Total	4.0806	2.34904	62

The results of the competency description based on the learning method factor obtained the average competency score in the PjBL class. Assisted with the Mobile Learning Application of 5,2500 and in the PjBL class of 2.8333. The results of the competency description based on the interaction of learning method factors and motivation factors obtained the average competency value in the PjBL class assisted by mobile learning applications with high motivation of5.4000 and with low motivation of 5.1176. Then the average value of competence in the PjBL class with high motivation is equal to3.1250 and with low motivation 2,5000.

Table 10. Performance Description Results

Descriptive Statistics					
	Method	Motivation	Mean	Std. Deviation	N
Performance	PjBL controls	Low	39.3750	7.20233	14
		High	39,7857	5.70234	16
		Total	39.5667	6.33373	30
	PjBL Mobile Experiment	Low	56.3529	1.96396	15
		High	65.0000	6.30418	17
		Total	60.4062	6.44009	32
	Total	Low	48.1212	13.79976	29
		High	52,8276	10.45753	33
		Total	50.3226	12,26320	62

The results of the performance description based on the learning method factor, the average value of performance in the PjBL class assisted by the mobile learning application is equal to 60.4062 and in the PjBL class of 39.5667. The results of the performance description based on the interaction of learning factors and motivational factors obtained the average value of performance in the PjBL class assisted by mobile learning applications with high motivation of 79.89 and with low motivation of 72.63. Then the average value of performance in the PjBL class with high motivation is 72.30 and with low motivation is 70.64.

3.2. Test Prerequisite Analysis

The following shows the results of the assumption test as a requirement for the MANOVA test, namely the normality test and the homogeneity test of variance. The normality test was carried out by the Shapiro-Wilk test method and the variance homogeneity test was carried out by the Levene test method.

Table 11. Normality Test Results Based on Learning Method Factors

Tests of Normality							
	Method	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.

Competence	PjBL controls	0.219	30	0.101	0.898	30	0.108
	PjBL Mobile Experiment	0.121	32	0.200	0.940	32	0.077
Performance	PjBL controls	0.136	30	0.167	0.979	30	0.791
	PjBL Mobile Experiment	0.156	32	0.145	0.904	32	0.108

The results of the normality assumption test for the competency and performance variables based on the Learning Method Factors obtained a significance value greater than 0.05 (p> 0.05) so that they were normally distributed.

Table 12. Normality Test Results based on Motivation Factors

Motivation		Kolmogorof-Smirnov			Shapiro-Wilk		
		Statistics	Df	Sig.	Statistics	Df	Sig.
Competence	High	.104	34	.200	.981	34	.801
	Low	.122	47	.077	.977	47	.474
Performance	High	.100	34	.200	.970	34	.470
	Low	.105	47	.200	.968	47	.717

The results of the normality assumption test on the competency and performance variables based on the learning method factor obtained a significance value greater than 0.05 (p> 0.05) so that they were normally distributed.

Table 13. Result of Variety Homogeneity Test

	F	df1	df2	Sig.
Competence	1,223	3	60	0.546
Performance	1,433	3	60	0.455

The results of the homogeneity assumption test on the competency and performance variables based on the learning method factor obtained a significance value greater than 0.05 (p> 0.05) so that the results of the variance between groups were homogeneous.

3.3. Hypothesis Test Results

The following shows the MANOVA results on competency and performance variables based on Learning Method Factors (PjBL Assisted Mobile Learning Application treatment and PjBL treatment) and motivation factors (high motivation and low motivation).

Table 14.MANOVA Test Results on Competence

Factor		M	SD	F	Sig.	Ket.
Learning methods	PjBL Assisted with Mobile Learning Applications	5,2500	2.27185	22,041	0.000	Significant
	PjBL	2.8333	1,72374			
Motivation	High	4.1515	2.27927	11,063	0.008	Significant
	Low	40000	2.46403			
Interaction	PjBL Assisted with High Motivation Mobile Learning Application	6.2500	1.34185	7,759	0.009	Significant
	PjBL Assisted with Low Motivation Mobile Learning Application	4.2341	1.4932			
	PjBL High Motivation	4.2342	1.5383			
	PjBL Low Motivation	2.6681	1.2232			

The first hypothesis, it is known that the MANOVA test results based on the Learning Method Factors on teacher competence obtained an F value of 22.041 with a significance of 0.000. These results indicate a significant difference of 0.05) between the PjBL group assisted by the mobile learning application and the PJBL group on the pedagogical competence of teachers.

The third hypothesis, it is known that the results of the MANOVA test based on the motivation factor for Teacher Pedagogic Competence obtained an F test value of 11.063 and a significance of 0.008.These results indicate a significant difference (p <0.05) between the high motivation and low motivation groups on teacher pedagogical competence.
Fifth hypothesis, it is known that the MANOVA test results based on the interaction of Learning Method Factors and motivation factors on Teacher Pedagogic Competence obtained an F test value of 4.177 and a significance of 0.044. The results showed a significant difference (p <0.05) based on the interaction of Learning Method Factors and motivation factors on teacher pedagogical competence.

Table 15.MANOVA Test Results on Performance

Factor		M	SD	F	Sig.	Ket.
Learning methods	PjBL Assisted with Mobile Learning Applications	60.4062	6,400,000	164,742	0.000	Significant
	PjBL	39.5667	6.3337			
Motivation	High	52,8276	10.4575	12,323	0.001	Significant
	Low	48.1212	13,7997			
Interaction	PjBL Assisted with High Motivation Mobile Learning Application	64.0787		8,189	0.006	Significant
	PjBL Assisted with Low Motivation Mobile Learning Application	53.4761				
	PjBL High Motivation	54.3423				
	PjBL Low Motivation	46,5486				

The second hypothesis, it is known that the MANOVA test results based on the Learning Method Factors on teacher performance obtained an F test value of 164,742 and a significance of 0.000. These results indicate a significant difference (p <0.05) between the PjBL Group Assisted by Mobile Learning Applications and the PjBL group on performance. teacher.
The fourth hypothesis, it is known that the MANOVA test results based on the motivation factor for teacher performance obtained an F test value of 12,323 and a significant value of 0.001. These results indicate a significant difference (p <0.05) between the high and low motivation groups on teacher performance.
The sixth hypothesis, it is known that the MANOVA test results based on the interaction of Learning Method Factors and motivation factors on teacher performance obtained an F uii value of 8,189 and a significance of 0.006. These results indicate a significant difference (p <0.05) based on the interaction of Learning Method Factors and motivation factors on teacher performance.

4. Conclusion

Based on the results of research that has been carried out together with data processing and discussion of the results of the study, it can be concluded that several things:

1. It was found that the PjBL strategy assisted by the mobile learning application had an effect on teacher pedagogical competence. This can be seen from the significant value, namely p <0.05 and the average pedagogical competence of teachers who use the PjBL strategy assisted by mobile learning applications is higher than applying the PjBL strategy alone.
2. It was found that the influence of the PjBL strategy assisted by mobile learning on teacher performance. This can be seen from the significant value, namely p <0.05 and the average performance of teachers who use the PjBL strategy assisted by mobile learning applications is higher than implementing the PjBL strategy.
3. It was found that there were differences in the pedagogical competence of teachers in students who had high motivation when compared to students who had low learning motivation. This can be seen from

the average value of the pedagogic competence of teachers for students who have high learning motivation against students who have low learning motivation with a significant difference, namely p <0.05.

4. It was found that there were differences in the performance of teachers who had high learning motivation compared to students who had low learning motivation. This can be seen from the average value of teacher performance for students who have high learning motivation against students who have low learning motivation with a significant difference, namely p <0.05.
5. It was found that there was an interaction between the implementation of the PjBL strategy assisted by mobile learning and high learning motivation on teacher pedagogical competence. This can be seen from the significant value, namely p <0.05 and the average pedagogical competence of teachers who apply the PjBL strategy assisted by mobile learning to students who have high learning motivation of 6.2500 compared to the average score of students who apply the PjBL strategy who has motivation. learning height of 4.2341.
6. It was found that there was an interaction between the implementation of the PjBL strategy assisted by mobile leraning and high learning motivation on teacher performance. This can be seen from the significant value that is p <0.05 and the average performance of teachers who have high learning motivation is 64.0787 compared to students who apply the PjBL strategy and have high learning motivation of 53.4761.

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