Blended Mathematics Learning in Elementary Schools: A Factor Analysis

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Abstrak

Although a great deal of study has been done on blended learning, less has been done to examine the execution component. The goal of this study is to develop a fit model and investigate the factors influencing the implementation of mixed learning in arithmetic. Stacey and Gerbic provide an effective implementation of mixed learning that takes into account four important factors: the condition of the foundation, teachers, students, and academic reflections. The method of inquiry that is employed is a quantitative overview approach. Testing utilizing arbitrary group evaluating adding up to 165 educators of grade schools in Bogor City, West Java, Indonesia, beginning from January to July 2020. The techniques used for data analysis are structural equation modeling (SEM) and descriptive analysis. The two phases of this model's evaluation are the measurement model and the structural measurement. The outcomes demonstrated that the most crucial element in improving the blended learning implementation was the teacher's state. The student's condition was the second most important factor, followed by pedagogical considerations and the state of the institution. This examination means quite a bit to use as a kind of perspective for the public authority and partners of every establishment in the progress of reinforcing the variables of executing numerical mixed learning. The novelty of the research is an improvement on Stacey and Gerbic's theory of blended learning implementation factors.

Keywords: Blended Learning Mathematics, Elementary School, Factor Analysis

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INTRODUCTION

The utilization of data and correspondence innovation is a far out in time proficiency. The improvement of innovation and correspondence is right now exceptionally fast, this significantly affects changes in the field of data and other related everyday issues. Changes that will and are occurring, particularly those prompted by the potential and capacities of data and correspondence innovation, empower individuals to cooperate with one another and address their issues for data nearly unbounded.

Educational establishments utilize the latest developments in digital technology to involve their pupils in diverse teaching and learning approaches. One such model is mixed learning, which is defined as a pattern that incorporates technology into the process of delivering education with the aim of addressing some of the drawbacks associated with traditional face-to-face instruction (Porter et al., 2014). Students can study whenever they choose, from anywhere, with the help of blended learning.

Blended and learning are two words forming blended learning. According to Friesen (2012) In 1999, a foundation named Interactive Learning Centers (which offered software training courses and computer skills certificates in Atlanta) introduced blended learning as a teaching methodology. Later, the organization changed its name to EPIC Learning. Güzer & Caner classify the years between 1999 and 2002 as the initial attempts to implement blended learning, the years between 2003 and 2006 as the definition era, and the years between 2007 and 2009 as the popular period. (Güzer & Caner, 2014).

Moreover, Graham (2006) argues that the constraints of time and place in face-to-face instruction may be overcome by using blended learning. Thus, an eclectic paradigm based on minimizing the drawbacks of both face-to-face and virtual learning environments and combining the benefits of both might be referred to as blended learning. (Finn, A., & Bucceri, nd; Graham, 2006; Harding, A., Kaczynski, D., & Wood (2005). , (Harding, A., Kaczynski, D., & Wood, 2005) 2005; Whitelock, D., & Jelfs (2003), 2003; (Williams, N. A., Bland, W., & Christie, 2008).

Meanwhile, Allen, I. E. & Seaman (2013) say that the combination of face-to-face and virtual learning settings is how just a small number of people identify blended learning. Another opinion from Lim and Lim, D. H., & Morris (2009), a small number of others specifically emphasize pedagogy on the implementation of blended learning. Numerous advantages of blended learning, including expanding learning possibilities, providing worthwhile learning experiences, easing resource access for learners, and motivating learners, have been documented in the literature. Blended learning, which was initially only carried out in higher education, is now being widely applied in schools to elementary schools. The loose definition of blended learning makes several schools take part in the implementation of blended learning.

There are several models that can be used for blended learning, so that Prescott et al. (2017) argue that programs can be modified by users to meet their pedagogical objectives and the needs of physical environments through blended learning. According to Christensen, C. M., Horn, M. B., & Staker (2013), Station rotation, lab rotation, flipped classrooms, and adhering to a sustainable hybrid innovation pattern are a few examples of blended learning strategies.

In today's elementary school learning, Prescott et al. (2017) states that station rotation is a common form in which blended learning is applied. Evans (2012) argues that this form is considered appropriate for the school-element because it is built on traditional classrooms that have an activity center model. In this blended learning model, Powell et al. (2015) Describe how students rotate to the station in small groups in the classroom, with at least one digital component. In elementary schools, lab rotation is also used, with kids visiting the computer lab. Using the station rotation and lab rotation methods, some teachers' classes or small groups from different schools adopt an eclectic approach to blended learning.

According to Stacey & Gerbic (2008), there are four key components to a successful blended learning implementation: the institution's state, the instructors' and students' qualifications, and pedagogical considerations. The first factor is the condition of the institution. The institutional conditions referred to by Tabor (2007) include technological resources that are sufficient, academic members who are driven, organizational preparedness, effective student feedback systems, and good communication.

According to Sharpe et al. (2006) The blended learning model, which is not yet fully defined to incorporate in-person instruction and active learning and foster a commitment to the idea, allows teachers to interpret it however they see fit.

Institutions should implement blended learning as a scientific and innovative redesign process. (Sharpe, R., Benfield, G., Roberts, G., & Francis, 2006). Another opinion Littlejohn and Pegler (2007) emphasized that blended learning should rebuild the course rather than just adding technology.

The next important factor is that teachers, according to Vaughan (2007), need for teachers to have continuous professional growth with enough time to practice lawfully. Garrison, R., & Vaughan (2007) argue, sustainable pedagogical and technical support through teacher association with mixed practices can be a model that supports teacher innovation. Other things that need to be considered according to Vaughan (2007), from the teacher are worries about losing control, the prevalent fear of the effects of online learning and the poor value of student input. One last thing to consider is the effect of teacher workload. Littlejohn, A., & Pegler (2007) identify costs in terms of institutional and teacher investment and recommend building digital resources that can be shared and reused in an effort to ensure that blended learning is sustainable.

The condition of students is also an important factor, according to Tabor (2007), It is important to take into account how mature and prepared the students are to balance their needs for independent study with their education. There will be fewer in-person classes, which means less work for students. Instead, they must take greater ownership of their education and focus on time management. According to Sharpe et al. (2006), clear and regular communication is necessary to assist students in comprehending the blended learning process.

Strong integration between the two contexts is important, as stated by Garrison, R., & Kanuka (2004). The integration needs have been operationalized in a four-phase face-to-face model by Garrison, R., and Vaughan (2007). The order of events leading up to, during, following, and before the subsequent in-person meeting is described, along with recommendations for different technological solutions that best utilize the advantages of both settings. In one study, Stacey & Gerbic (2008) (2006) discovered that students did not notice new online environments and that encouraging students, teachers' reminders, and conversations about the benefits of adding online discussions were ineffective in connecting online discussions to classrooms and courses.

Including teachers who can offer feedback on the caliber of online discussions into in-person lectures and activities that get students ready for their online activities is a more efficacious approach than blended learning. The instructor's focus on the new virtual environment in the classroom validates this course component and highlights how crucial it is to understand.

By using the Publish or Perish application and the help of the VoSViewer application, researchers can see the network that accompanies blended learning specifically for articles indexed by Scopus. The output of the VoSViewer application using the resulting saved RIS/RefManager data is shown in the following visualization:

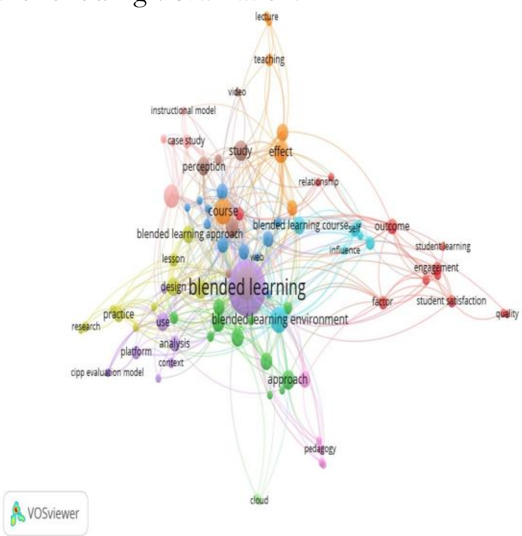

Figure 1. Network Visualization of Blended learning

From Figure 1, that the network of variables appears less than the previous visual overlay. In this figure, the research clusters are distinguished by certain colors. Of the 86 (eighty-six) items that are divided into 11 (eleven) clusters, which are differentiated according to their color. The implementation items are not immediately obvious, even if the item approach, blended learning model, challenge, cost, development, edmondo, medical student, motivation, program, and undergraduate student are all in the second cluster (green).

Clusters represented by color can be used as a state of the art in this study. This network also shows that blended learning research is dominated by research at the higher education level, at the primary school level it is still rare (in the picture not shown). Research on the blended learning factor appears in lowercase letters, this can provide researchers an opportunity as a novelty of research. In order to clarify the novelty picture that can be built, it can be shown by zooming VosViewer as follows:

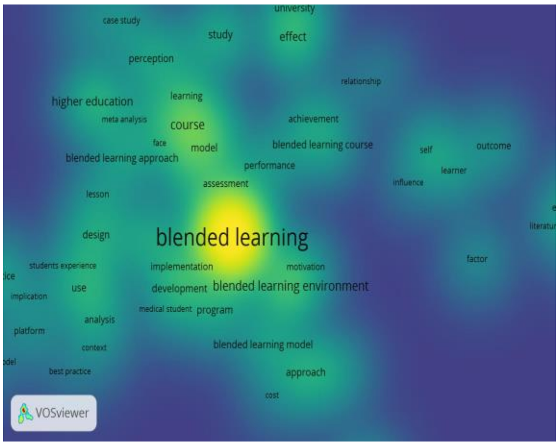

Figure 2. Zoom Density Visualization Implementation

In the results of Figure 2, it appears that the implementation of the item is a bit blue with a small font size, this indicates that research on the implementation of blended learning has not been done much. Elementary school and mathematical items also do not appear, so it can be concluded that research on blended learning mathematics has not been done much at the elementary school level and can be considered as novelty in this research.

Bower et al. (2015) use a cross-case analysis approach to examine how blended learning is being implemented. This involves reviewing all seven of the previously mentioned data sources and eliminating themes pertaining to marker factors (pre-lesson design), process factors (lesson implementation), and product (effect design and implementation). The seven data are (1) The pre-observation teacher recorded a summary of cases that were previously handled. (2) In order to ascertain the rationale for the creation of teacher insights into the integrated synchronous learning strategy, teacher interviews were carried out prior to observation. (3) adjusting blended learning by using video and selecting lesson recordings, (4) researchers conducted lesson observations, (5) replies to a post-observation student survey, (6) post-observation group student interviews, and (7) post-observation teacher interviews. The implementation of blended learning on the other hand, according to Sharpe et al. (2006) must include institutional practices to carry out periodic evaluations and publish the results. This is considered important so that the implementation of blended learning is carried out properly and the publication of the results can have an impact on the expansion of the use of the blended learning method in other institutions.

To optimize blended learning implementation, multivariate analysis approaches like Structure Equation Modelling (SEM) are required to determine the dimensions and sub-dimensional components in the learning model above. (According to Ghozali (2014), the SEM model is a second-generation multivariate analytic method that enables researchers to investigate both recursive and non-recursive interactions between complex variables to give a thorough explanation of the model as a whole. (Haryono, 2017) asserts that the SEM approach is better than route analysis or multiple regression since it can examine data in a comprehensive manner.

METHODS

Research Design

This study uses a quantitative approach with survey methods related to measuring the level of implementation of blended learning mathematics in elementary schools (Madrasah Ibtidaiyah) in Bogor City. The research was conducted from January to July 2020 at Madrasah Ibtidaiyah, Bogor City, West Java Province, involving 165 teachers. The sample determination uses the Cohen (1992) approach which considers the statistical power and effect size when determining the sample size. The maximum number of arrows leading to the concept and the degree of significance are taken into account by the guide when determining the sample size. Proportional cluster random sampling was the method utilized for sampling. This is in accordance with the opinion of Taylor and Madow Taylor & Madow (1968) that cluster random sampling is good for research with large areas.

Furthermore, the data and facts from the collected questionnaires were tested using the Structural Equation Model (SEM) data analysis technique. At least according to Latan (2013), Model specification, model identification, model estimate, model evaluation, and model modification or specification are the five steps that the SEM analysis stages must go through.

Model Evaluation in SEM

This model has two steps to its evaluation: the measuring model, also known as the outer model, and the structural measurement, also known as the evaluation model. Assessing both the formative and reflective measuring models constitutes the evaluation of the outer model.

The following criteria are used to evaluate reflective measurements: (1) discriminant validity; (2) internal consistency, also known as construct reliability; (3) average variance extracted; and (4) individual item dependability. The first three measurements are categorized into convergent validity, which is used to measure the correlation between constructs and latent variables (Haryono, 2017). The evaluation's standardized loading factor value shows how each item's reliability was evaluated. An indicator is considered perfect when its loading factor value is ≥ 0.7, indicating that it can measure the construction it forms. Actually, loading factor values ≥ 0.5 are still considered appropriate in empirical study experiences (Haryono, 2017).

Cronbarch Alpha and Composite Reliability (CR) scores show the internal consistency reliability. Since CR does not take each indicator's frequency as given, Cronbarch Alpha tends to underestimate construct reliability when compared to CR, which is why Composite Reliability (CR) has been shown to be superior to Cronbarch Alpha in SEM for measuring internal consistency dependability (Haryono, 2017). It is appropriate to interpret CR as Cronbarch Alpha ≥ 0.7.

The Average Variance Extracted (AVE) value is an additional metric for convergent validity. In order to demonstrate strong convergent validity, Ghozali (2008) advises using AVE as a criterion for evaluating convergent validity of at least 0.5. The AVE value is obtained by calculating the loading factor squared divided by the error.

When assessing a formative measurement model, the notions of construct validity and reliability are meaningless since they are not pertinent to assessing the measurement's quality (Haryono, 2017). Using a logical theoretical foundation and the advice of specialists is crucial. Haryono (2017) asserts that evaluating the formative model's quality involves considering at least five important factors, specifically: (1) content specification: in this instance, the researcher frequently has to clarify and attest to the accurate construct specifications; (2) specification indicators: this calls for precision. Finding and characterizing these indicators, talking about them with specialists, and confirming them with a pre-test, (3) Indicators of reliability: This indicator pertains to the significance of indicators in formulating a construct. By examining the indicator signals in line with the hypothesis and ensuring that the weight indicator is at least 0.2 or significant, it is possible to determine this from the indicator's reliability value; (4) collinearity indicators, which use the Variance Inflated Factor (VIF) number to determine whether or not there is a multicollinearity issue. If the multicollinearity issue is indicated by a VIF rating greater than 10; and 5) external validity, the inclusion of every indicator in the model is ensured.

The structural model (outer model) evaluation comes next. Examining the importance of the link between constructs and variables is the first step. This is evident from the path coefficient, which has to match the theory that has been proposed. The t-test or Critical Ratio (CR) produced by the bootstrapping procedure show the significant value.

Assessment Criteria in PLS-SEM

In PLS-SEM, the latent variable connection model has three different forms of measurement, namely: (1) inner model that, using the theory's content as a basis, describes the relationship between latent variables, (2) The link between latent variables and indicators, or manifest variables, is specified by the outer model, and (3) weight relation, namely the estimated value of the latent variable (Haryono, 2017).

In order to allow for the removal of location parameters (constants) from the model without affecting the generalization value, the PLS relationship model implies that latent variables and indicators on the zero means scale and unit variance (standardized values) (Haryono, 2017). According to Ghozali (2014), since PLS does not generate a specific distribution for parameter estimation, the parameter technique to assess the parameter's significance is not required.

Hypothesis Testing

Hypothesis testing conducted in this study uses the rules of significance testing with the help of the

Smart PLS application. According to Haryono (2017) the criteria for testing the hypothesis on each construct can be seen from the t-value ≥ 1.96 (some round to 2) or by looking at the p-value, if the p-value is ≤ 0.05. If both criteria are met, the hypothesis is accepted. The hypothesis according to the model specifications is stated as follows:

H1 : the teacher condition factor has a positive and significant effect on the condition of the institution in implementing mathematics blended learning

H2 : the student condition factor has a positive and significant effect on the condition of the institution in implementing mathematics blended learning

H3 : Pedagogic considerations have a positive and significant effect on the condition of the institution in implementing mathematics blended learning

H4 : the institutional condition factor has a positive and significant effect on the implementation of mathematics blended learning

H5 : the teacher condition factor has a positive and significant effect on the implementation of mathematics blended learning

H6 : the student condition factor has a positive and significant effect on the implementation of mathematics blended learning

H7 : pedagogic considerations have a positive and significant effect on the implementation of mathematics blended learning

RESULTS AND DISCUSSION

Factor Analysis Assumptions

Before doing the factor analysis test, the researcher will examine each of the 113 female and 52 male teachers' factor analysis hypotheses individually. The KMO and Bartlett's Test result contains the following findings from the correlation test conducted between the independent variables:

Table 1. Results of KMO and Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0,896
Bartlett's Test of Sphericity	Approx. Chi-Square	21493,6
	df	3003
	Sig.	0

For the correlation between the desired variables, the KMO and Bartlett's Test values were greater than 0.5. <0.05 was the research significance. The KMO value from the aforementioned results is 0.896, indicating that it is higher than 0.5. In the meantime, the results of Bartlett's Test of Sphericity yield a significance of zero thousand. It is possible to conclude that the variables and samples employed permit additional investigation based on the findings from Table 1.

Furthermore, we may view the Anti-Image Matrices table in the form of MSA (Measure of Sampling Adequacy) to see the correlation between the independent variables. The range of MSA values is 0 to 1, with the following conditions: 1) MSA = 1, the variable can be predicted by other variables without error; 2) MSA> 0.5, the variable is feasible and can still be predicted and analyzed further; and 3) MSA <0.5, the variable cannot be predicted, cannot be further analyzed, or cannot be excluded from different variables. All of the data are appropriate for additional factor analysis testing if the MSA data processing score is greater than 0.5.

Confirmatory Factor Analysis

Analysis of the Structural Equation Model (SEM) in this study uses a two-stage technique (Two Step Approarch). In the first stage, the variables were measured using the CFA (Confirmatory Factor Analysis) technique. The CFA model can be accepted if the suitability of the model data is good validity and reliability (Wijanto, 2008).

In the institutional condition variable (KL) the variable dropped is KL4. The indicators that persist from the reduction factor and the results of loading factors which are the constructs for the fit model are KL1, KL10, KL11, KL12, KL14, KL15, KL17, KL2, KL3, KL5, KL7, KL8, KL9 (dimension 1) and KL13. KL16 and KL6 (2nd dimension).

Variable Teacher Condition (KG) based on the results of the Pattern Matrix is divided into 2 (two) dimensions. Indicators dropped due to reduction factor and loading factor result are KG3 and KG7. Indicators that remain a construct in the fit model are KG1, KG10, KG13, KG14, KG15, KG16, KG19, KG2, KG20, KG4, KG5, KG6, KG8, KG9 (dimension 1) and KG11, KG12, KG 17, KG18 , KG21, KG22 (2nd dimension).

The Student Condition Variable (KS) based on the results of the component matrix only consists of one dimension. All indicators of the Student Condition Variable (KS) persist from the results of the reduction factor and loading factor which are the constructs of the fit model. The result of the component matrix variable for the implementation of Blended Learning (IB) only becomes 1 (one) dimension. All of the variable indicators persist from the results of the reduction factor and loading factor which is the construct for the fit model.

Indicators of institutional conditions, teacher conditions, student conditions, pedagogical considerations, and blended learning implementation are determined to be adequate constructs of variables based on the dimensions of the data processing indicators.

SEM Full Model Structure Testing

In the second stage, the fitted CFA model is combined into a single hybrid model or full model that needs to be evaluated and examined. According to Haryono (2017), a model is considered fit if it passes the GoF test for overall model fit and assesses the structural model to provide a complete model that is suitable.

Convergent validity is a feature of the measurement model, which in covariance-based SEM is referred to as confirmatory factor analysis (CFA) and in SEM-PLS as the outer model. According to Hair JF, Black WC, and Rabin BJ (2010), there are two requirements that must be met for the outer model (measurement model) to satisfy the convergent validity requirements for a reflective construct: (1) the loading must be greater than 0.7, and (2) the p value must be significant (<0.05).

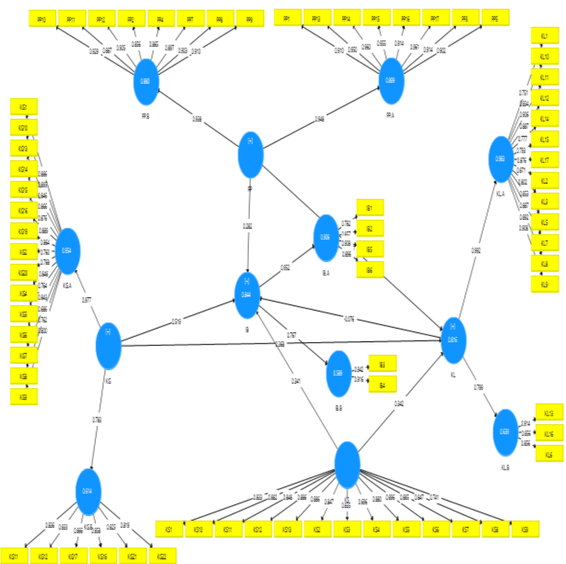

Figure 3. Structure Model 1 based on Loading Factor

Based on the picture, the Loading Factor (LF) value of KG7 and KS4 ≤ 0.7. These indicators are removed from the analysis process and the validity test is repeated.

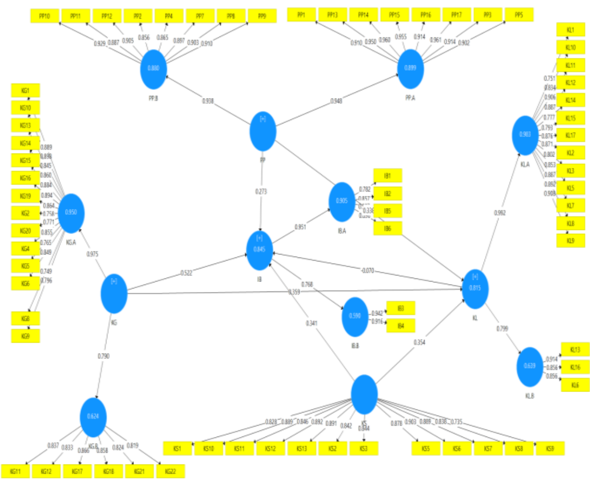

Figure 4. Structure Model 2 based on Loading Factor

Based on testing the validity of loading factors at stage 2 (Figure 4), Because all loading values are known to be greater than 0.7, they have satisfied the validity requirements as determined by the loading value. The measurement model will next be assessed by examining the findings of construct reliability and indicator validity (also known as convergent and discriminant validity).

Construct Validity Testing

The Loading Factor (LF) value of the indicator ≥ 0.7 indicates the validity of the indicator (Hair JF, Black WC, Rabin BJ, 2010). Indicators with a value of less than 0.7 are no longer present in Figure 4, according to the output of the Calculate PLS Algorithm command.

Construct Reliability Testing

Cronbach's Alpha value for each construct must be ≥ 0.7. In the figure, the value of Cronbach's Alpha for each construct is greater than 0.7, indicating that the indicators are consistent in measuring the construct. Composite Reliability and Cronbach's Alpha value are used to evaluate the value of construct reliability.

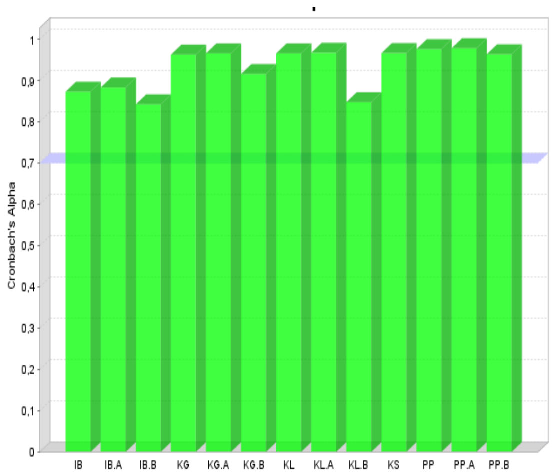

Figure 5. Diagram of Cronbach's Alpha Construct

Furthermore, reliability testing is carried out based on the Composite Reliability (CR) value.

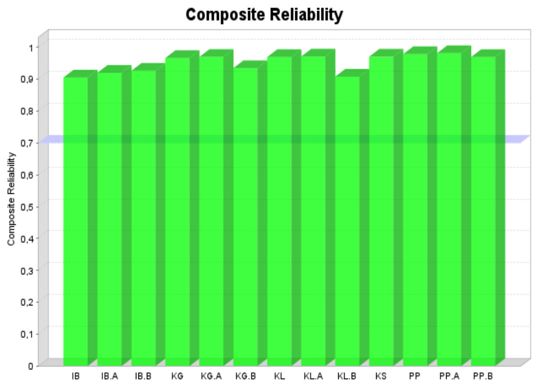

Figure 6. Composite Reliability (CR) diagram

A Composite Reliability (CR) rating of greater than 0.7 is advised. Since all of the CR values are known to be more than 0.7, the reliability standards based on CR have been satisfied. Convergent validity-based construct reliability checks can be performed by examining the Average Variance Extracted (AVE) value in the manner described below:

Table 2. Average Variance Extracted (AVE) Construct

Construct	IB	IB.A	IB.B	KG	KG.A	KG.B	KL	KL.A	KL.B	KS	PP	PP.A	PP.B
AVE Value	0,62	0,74	0,86	0,6	0,7	0,71	0,67	0,72	0,77	0,74	0,74	0,87	0,8

A value of AVE greater than 0.5 is advised. Since all of the AVE values are known to be greater than 0.5, they have satisfied the AVE-based validity criterion. After cross-loading and comparing the AVE root value with the correlation across constructs, the examination of discriminant validity is the next construct reliability test. The correlation coefficient value of each indicator in the construct block in the other columns is less than the correlation coefficient value of each indicator for each construct in the cross-loading output results. Therefore, it may be said that every indicator in the block serves as a constructor for that particular construct. The next examination compares the AVE root value with the correlation between constructs as shown in the following table:

Table 3. Comparison of AVE with AVE roots

	IB	IB.A	IB.B	KG	KG.A	KG.B	KL	KL.A	KL.B	KS	PP	PP.A	PP.B
AVE	0,62	0,74	0,86	0,6	0,7	0,71	0,67	0,72	0,77	0,74	0,74	0,87	0,8
AVE roots	0,79	0,86	0,93	0,77	0,84	0,84	0,82	0,85	0,88	0,86	0,86	0,93	0,89

Table 4. *Latent Variabel Correlation*

	IB	IB.A	IB.B	KG	KG.A	KG.B	KL	KL.A	KL.B	KS	PP	PP.A	PP.B
IB	1.000												
IB.A	0,660	1.000											
IB.B	0,533	0,371	1.000										
KG	0,583	0,572	0,410	1.000									
KG.A	0,573	0,596	0,332	0,677	1.000								
KG.B	0,446	0,344	0,507	0,549	0,440	1.000							
KL	0,563	0,579	0,341	0,541	0,547	0,372	1.000						
KL.A	0,557	0,572	0,339	0,530	0,538	0,357	0,689	1.000					
KL.B	0,453	0,470	0,267	0,462	0,457	0,348	0,555	0,497	1.000				
KS	0,531	0,548	0,318	0,415	0,436	0,241	0,538	0,543	0,382	1.000			
PP	0,519	0,528	0,328	0,428	0,441	0,275	0,538	0,535	0,422	0,422	1.000		
PP.A	0,488	0,483	0,336	0,408	0,417	0,267	0,499	0,503	0,363	0,381	0,658	1.000	
PP.B	0,491	0,514	0,280	0,401	0,414	0,251	0,515	0,506	0,434	0,417	0,651	0,541	1.000

Based on the AVE Roots table and the Latent Variable Correlation table The greatest correlation between the Blended Learning (IB) construct and other constructs is 0.583, which can be explained by the fact that the AVE root for the IB implementation construct is 0.876. These findings show that for the other components, the correlation value is smaller than the root AVE value. This indicates that further criteria for discriminant validity are satisfied. It is also possible to demonstrate that the root value of AVE in other constructs is higher than the correlation of those other constructs.

Structural Model Evaluation

The structural model will be examined at this evaluation stage by examining the importance of the link between the constructs as indicated by the T-statistics (t-value), as displayed in the table below:

Table 5. Path Coefficient and P-Value

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
IB -> IB.A	0,951	0,952	0,006	160,48	0,000
IB -> IB.B	0,768	0,768	0,038	20,128	0,000
KG -> IB	0,522	0,536	0,083	6,274	0,000
KG -> KG.A	0,975	0,975	0,003	293,554	0,000
KG -> KG.B	0,79	0,791	0,035	22,472	0,000
KG -> KL	0,359	0,363	0,033	10,927	0,000
KL -> IB	-0,07	-0,073	0,071	0,99	0,161
KL -> KL.A	0,992	0,992	0,001	802,165	0,000
KL -> KL.B	0,799	0,801	0,04	20,159	0,000
KS -> IB	0,341	0,34	0,077	4,427	0,000
KS -> KL	0,354	0,355	0,038	9,321	0,000
PP -> IB	0,273	0,27	0,085	3,228	0,001
PP -> KL	0,338	0,335	0,043	7,863	0,000
PP -> PP.A	0,948	0,948	0,009	107,547	0,000
PP -> PP.B	0,938	0,938	0,011	85,197	0,000

Based on the results in table 5, the following hypothesis testing can be done:

The path coefficient value (original sample) of 0.359 indicates a positive relationship between teacher conditions and institutional conditions. This relationship is statistically significant, with a T value = 10.927 > 1.96 or P-Values 0.000 <0.05. The results of this research are in line with research by Hopkins et all (1998) stating the important role of institutional conditions in providing a curriculum for teacher development that facilitates the relationship between overall school improvement and modification of classroom learning activities so that it is necessary to improve student learning and achievement. Boyd (2011) observed that the administrative impacts of this institution were constant for first-year teachers across the board for the sample of teachers, and this finding was corroborated by a poll of recently retired teachers. The research results are also strengthened by Burkhauser's (2017) study which found that the ranking of teachers in a school environment depends on the school principal who leads, regardless of school and regional contextual factors.

The route coefficient value (original sample) of 0.354 indicates a strong positive impact of student conditions on institutional conditions, as supported by statistical T values of 9.321 > 1.96 and P-Values 0.000 <0.05. These findings are consistent with Diep's (2017) study on the successful application of blended learning (BL), which demonstrates that the most important variables are student achievement goals, instructor expertise, and the value of student assignments. LMS quality, instructor support, and general student self-sufficiency follow. There are significant ramifications for educational practice and institutional policy from the two BL program modalities, as they also produce disparities in students' perceived achievement goals and demands on LMS functioning and design.

Another quasi-experimental study by Wong et all (2018) shows that there are significant differences in student motivation in using blended learning to learn English through short stories. Other results state that blended learning classes can motivate students to learn. According to Singh (2003) organizational, administrative, academic and student service matters are problems related to the institutional dimension. Organizational readiness, availability of content and infrastructure, and student needs are matters related to planning a blended learning program. Scott Crossley's (2020) study of three constructs related to mathematical identity (self-concept, interests and values) in elementary school students who were given blended learning, shows that mathematical constructs correlate with mathematical success.

The condition of the institution has a beneficial effect by pedagogical concerns; this is evident from the path coefficient value (original sample) of 0.338 and the significant P-Values 0.000 <0.05 and T Statistic = 7.863 > 1.96 values. According to research by Lahwal (2016) and Crawford (2017), the pedagogical dimension will strongly mediate the internal and external dimensions on how the learning environment is perceived, and consequently, on how effective the interactive multimedia learning environment is. These findings are consistent with the findings of this study.

The path coefficient value (original sample) of -0.070 indicates a negative impact of institutional conditions on blended learning implementation; however, this effect is not statistically significant, as indicated by T-statistic values of 0.990 <1.96 or P-Values 0.161 > 0.05. Regarding the relationship between teacher participation and well-being, the impact of the school atmosphere on this construct, and the correlation between teacher stress and self-efficacy, the results of this study align with those of Skaalvik (2017). It has been frequently shown that there is a negative correlation between stress and teacher self-efficacy, and that these variables predict teachers' reactions in different ways on the cognitive, emotional, and behavioural levels. Other research by Wong and friends (2018) shows that the implication of the suitability of blended learning to be implemented in English classes is sufficient monetary, equipment and technical support. According to Benson and Kolsaker's (2015) research of management in two British business schools, blended learning is used in very different ways. Four groups emerged from individual interpretations of the blended learning phenomenon: cautious, techno-centric, pedagogy-centric, and traditionalist. These groups' preferences for the creation and distribution of instructional materials differed greatly.

Blended learning implementation is positively impacted by the teacher's condition, as evidenced by the path coefficient value (original sample) of 0.522 and significant P-Values 0.000 <0.05 and T statistic value = 6.274 ≥ 1.96. The study by Yeop and colleagues (2019) found that Use Expectancy (UE), Social Influence (SI), Facilitating Conditions (FC), and Teacher Efficacy (TE) all contributed to favorable outcomes and implications for efforts. These findings are consistent with the research undertaken in this study. use blended learning to advance instructional strategies. Relevant research results have also been carried out by Matosas-López (2019) concluding that the finished instrument provide unambiguous feedback, reinforces the formative objectives of evaluation in this modality and allows teachers to take certain corrective actions. Research by Elizabeth Anthony (2019) shows that flexibility and understanding are important for teachers in additional blended learning classes. According to him, this is much more important than the blended learning setting itself because students often work independently and, in many cases, have a different context from the teacher.

The adoption of blended learning is positively impacted by student conditions, as evidenced by a path coefficient value (original sample) of 0.341 and a significant value of T Statistic = 4.427 ≥ 1.96 or P-Values 0.000 <0.05. The findings of this study are consistent with a survey conducted by Kintu (2017) using multiple regression analysis, which demonstrated that student characteristics (self-regulation and attitude) and blended learning design features (technology quality, online tools, and in-person support) predict student satisfaction as an outcome. The findings of the study also demonstrate that a number of student traits and backgrounds, as well as design elements, are important indicators of how well students learn in blended learning environments. Fisher and Birdthistle's (2018) study yielded pertinent findings indicating that students' perceptions of blended learning's advantages have a favorable impact on their overall satisfaction. A literature study by Nortvig (2018) states that the dominant factors for the success of blended learning are: 1) The presence of educators in online settings, 2) connections between instructors, students, and the material, 3) created connections between related educational programs and online and offline activities and 4) practice.

Pedagogic considerations possess a favorable impact on the implementation of blended learning, with a path coefficient value (original sample) of 0.273 and significant, with a value of T Statistic = 3,228 ≥ 1.96 or P-Values of 0,000 <0.05. These findings are consistent with Blended Synchronous Learning Environment (BSLE) research by Wang (2018), which was planned from a social, technical, and pedagogical standpoint. The study's findings demonstrate that BSLE can provide online learners with an education that is comparable to that of traditional classroom settings in some respects. Students also adore how convenient and flexible video conferencing is for attending classes. This study also discovered that for BSLE to be applied successfully, clear and fluid audio communication, the redesign of some learning activities, and high-quality audio are necessary.

Our research observation also revealed the effectiveness of blended learning in teaching math integrated with science in schools. Observations revealed a notable enhancement in students' comprehension of mathematical concepts pertaining to science applications, particularly in physics and chemistry, when compared to the outcomes achieved through conventional teaching methods. Students displayed a marked increase in motivation and engagement during learning, exhibiting a deeper ability to connect mathematical theories with real-world applications in science. These findings substantiate the assertion that a blended learning approach can serve as an effective strategy for enhancing both conceptual understanding and the application of mathematics in science contexts within the modern educational landscape.

CONCLUSION

Before the Covid-19 pandemic, many schools did not take the blended learning model seriously, teachers tended to move on their own according to their abilities and limited facilities. Only teachers who have high motivation and good initial ability to master technology use this learning model. The study's findings demonstrate that the institutional condition element has not significantly impacted blended learning adoption. Most of the teachers still use social media tools such as WhatsApp in giving assignments. Teachers need to carry out variance in online learning and institutions (schools) provide facilities in the form of trainings and other things that bridge the accomplishment of successful implementation of blended learning.

The results of this study need to be consulted by the government and stakeholders in each institution to successfully reinforce the components that go into blended learning implementation. Research is carried out as objectively as possible to achieve optimal results. However, there are several limitations. The implementation of blended learning is certainly influenced by many factors, but in this study it was only limited to four variables, namely the condition of the institution, the condition of the teacher, the condition of students, and pedagogical considerations.

This provides limited conclusions about the implementation of blended learning. Thus, it is necessary to carry out more extensive research on the implementation of blended learning with other variables. The study population included only 281 class teachers in Madrasah Ibtidaiyah in Bogor City with a total sample of 165 people. Thus, the generalizability of research results is limited to this population. When compared to studies with more participants and sample, this results in less than optimal accuracy for the research findings.

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