Factors that affect learning outcomes in online learning

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ABSTRACT

Online learning is an alternative to learning during a pandemic. This learning is done by utilizing technology and information. Constraints in online learning are taken into consideration so that the expected competencies are achieved. These constraints are also referred to as factors. This study aims to determine the factors contributing to learning achievement during online learning during the pandemic. This research was conducted at SMAN 1 Kalibawang and SMA N 2 Ngaglik, with 90 respondents as the subject of the research trial taken randomly. The instrument used is a questionnaire and the results of math test scores. This research uses the Partial Least Squares-Structural Equation Model (PLS-SEM). The purpose of PLS-SEM is to confirm how well the variables that have been measured can represent the formed factors. The steps taken in conducting analysis using PLS-SEM include: (1) designing an analytical model by making path diagrams; (2) identifying the model; (3) estimating parameters; (4) drawing conclusions. Parameter estimation is divided into two parts: the outer model (measurement model) and the inner model (structural model). The results showed that learning media when online learning had a significant effect on learning achievement. The effect given is 83.3% which has a high effect.

INTRODUCTION

The Covid-19 pandemic has changed the order of people's lives, not only attacking the country of Indonesia but also hitting the world. Almost all countries in the world are affected by this pandemic. The impact of the pandemic can lead to essential sectors, non-essential sectors, and critical sectors. The education sector has also suffered a fatal impact. All levels of education, both formal and non-formal, conduct distance learning. Activities that are usually carried out in classrooms in the school environment have now changed to learning from home or online. Distance learning is also known as online learning or online learning. Online learning is learning that utilizes technology and information with digital platforms such as Microsoft Teams, Google Classroom, Canvas, and Blackboard (Pokhrel & Chhetri, 2021).

Online learning has a significant impact on education (Chaturvedi et al., 2021). The use of technology is one of the factors that affect online learning (Liu et al., 2010). Characteristics of students, the environment, student learning outcomes, and infrastructure are factors taken into account in online learning (Tallent-Runnels et al., 2006). The limited ability of the community becomes an obstacle in conducting online learning.

Learning from home is certainly different from learning activities at school. Learning devices supported by learning media can make it easier for students to understand the material. The use of learning media will affect learning outcomes (Matnuh & Triani, 2014), so that the teacher becomes one of the important factors in learning. The results show that the teacher's background

does not affect online learning (Mailizar et al., 2020). When online learning, teachers are required to be more creative in delivering subject matter. Learning strategies are the factors that need to be considered in online learning. Choosing the right strategy will make it easier for teachers to support an effective and efficient learning process.

Online learning is done using gadgets, either in the form of smartphones, laptops, computers, or tablets. The use of online media is considered as the right strategy for replacing classroom learning. The facilities owned are one of the supporters of online learning (Kornpitack & Sawmong, 2022). The application of online learning can run smoothly and stably when assisted by an internet network connection that will be accessed on gadgets. Lack of internet connection and skills in using media are obstacles in online learning. Learning media has a function as a learning resource and can be a means of intermediary in the delivery of information. Therefore, learning media has an important role in the online learning system.

Online learning also affects students' interest in learning. Minimum interaction between students and teachers makes students less interested in online learning (Li & Che, 2022; Wang et al., 2022). The results showed that students' perceptions of social presence showed a positive and significant relationship (Picciano, 2002; Chaker et al., 2022). The presence of students in the class will affect their learning experience. They can discuss with each other, in addition to exchanging experiences.

During the pandemic, all educational institutions in Indonesia must package learning in such a way that they can achieve competency according to the standards. The concept of online learning is changing to online learning. This is where the teacher has a crucial role to achieve educational goals. In the implementation of online learning, many factors will affect learning achievement. This achievement is closely related to student learning outcomes, both in terms of spiritual attitudes, social attitudes, knowledge, and skills. These four competencies must be achieved as learning outcomes. This is a challenge in itself for teachers. If the factors that influence learning outcomes during online learning are well identified, it is hoped that they will contribute, especially to teachers, to design learning concepts appropriately.

Online learning is learning that is carried out remotely, without face to face, taking into account aspects of technology and the learning environment so that learning remains meaningful. Technology is a phenomenon of total system development which is understood as evolution through time and the strength of the object from one stage to another (Helena & Jose, 2013). Appropriate use of technology can make it easier to convey information. Communication becomes more effective and efficient with the development of technology. In the era of the industrial revolution 4.0, technology has a very important role in learning. In this regard, teachers must be able to create interesting, quality, and targeted learning media. In addition, learning strategies are needed to design appropriate learning concepts, especially during a pandemic.

The family environment is also one of the factors considered in the implementation of online learning. The role of parents affects online learning. Learning that originally only depended on the teacher, now the role of parents is an important factor in the success of online learning. Parents should be able to accompany their children during learning at home. Obstacles faced by parents during online learning include: understanding the material, difficulties in growing children's interest in learning, not having enough time to accompany children in learning, being impatient in accompanying children, difficulties in operating gadgets, and internet service coverage (Wardani & Ayriza, 2020).

Based on the aforementioned description, several factors will affect learning achievement during online learning, including the internet network, learning media, learning strategies, and the family environment. These four factors were further investigated to find out how big their contribution to learning achievement was. If the factors in online learning are known for certain, then educational institutions can design learning strategies so that learning objectives can be achieved. This study aims to determine the factors that contribute to learning achievement during online learning during the pandemic.

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METHOD

The subjects of this research trial were students of class X-S 2 and X-S 3 at SMA N 1 Kalibawang and X-S 1 and X-S 2 SMA N 2 Ngaglik as many as 90 respondents. Data collection was taken randomly in both schools. The instrument is made in the form of a questionnaire. The questionnaire was tested using a Likert scale with five answer options, namely strongly disagree, disagree, undecided, agree, and strongly agree. Online learning is measured by four aspects, such as internet networking, learning media, learning strategies, and the family environment. Each aspect developed is measured by several indicators. Each indicator is developed into several questions. The number of items is 20. The minimum number of items to measure each indicator is three (Watkins, 2018; Robinson, 2018). All items in the questionnaire are positive statements. In the first aspect, internet networking, the indicators include internet network stability (three items) and data packet usage (three items). The second aspect, learning media, related to the use of learning media (four items). The third aspect, learning strategies, indicators are the use of learning methods/models (three items) and the implementation of learning evaluations (three items). The fourth aspect, the family environment, is an indicator of parental involvement in online learning (four items).

Questionnaire items for the first aspect (internet network) are summed up with "A". The questionnaire item for the second (learning media) is symbolized by "B". The questionnaire item for the third indicator (learning strategy) is symbolized by "C", while for the fourth indicator (family environment) it is symbolized by "D". For the distribution of the questionnaire via the google form link. Table 1 is a grid of questionnaires.

Table 1. Questionnaire Grid

Variable	Aspect	Indicators	Questionnaire Items
Online Learning	Internet Network	Internet network stability	A1, A2, A3,
		Data packet usage	A4, A5, A6
	Learning Media	The use of learning media	B1, B2, B3, B4
	Learning strategies	Learning methods/models	C1, C2, C3
		The implementation of learning evaluations	C4, C5, C6
	Family environment	Parental involvement in online learning	D1, D2, D3, D4

The questionnaire instrument that has been made needs to be tested for content validity by expert judgment. Content validity is used to provide information relevant to the conclusions to be made regarding the item score (Thorndike, 1961). Content validity uses Aiken, with expert judgment of three raters. Questionnaire items can be used if the validity value is greater than 0.6. After the instrument is declared valid, the instrument is given to class X students.

Furthermore, perform an analysis with Partial Least Squares based on the Structural Equation Model or better known as PLS-SEM. The advantage of PLS-SEM is that it does not require certain distribution assumptions to estimate the parameters (source). Thus, it can be said that PLS-SEM is nonparametric. PLS-SEM in this study uses unidimensional, online learning. In this study, the direction of the indicators is reflective, with the consideration that the construct is explained by the indicators.

The steps taken in analysis with PLS-SEM include: (1) designing an analysis model by making a path diagram; (2) identifying the model; (3) estimating parameters; (4) drawing conclusions. Parameter estimation is divided into two parts, namely the outer model (measurement model) and the inner model (structural model). The outer model is carried out to determine the relationship between the measured variable and the latent variable, while the inner model contains steps to examine the relationship between one latent variable and another latent variable. The outer model was carried out by confirmatory factor analysis. The purpose of this analysis is to determine factors that influence online learning and the amount of this contribution.

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FINDINGS AND DISCUSSION

This study uses two aspects with four indicators, namely aspects of technology (internet network and infrastructure) and aspects of the learning environment (teachers and families). Each indicator contains several questions. The total number of items made is 20. There are two validity tests carried out in this study, namely content validity, and construct-related validity. The first step is to do content validity. Content validity is carried out to see the accuracy of the content domain with the questionnaire items. This validity is carried out by 3 expert judgments. The results of content validity can be seen in Table 2.

Table 2. Content Validity Results

No Item	rater1	rater2	rater3	S1	S2	S3	S	V
1	4	3	4	3	2	3	8	0.666667
2	4	3	4	3	2	3	8	0.666667
3	4	3	4	3	2	3	8	0.666667
4	4	3	4	3	2	3	8	0.666667
5	5	4	4	4	3	3	10	0.833333
6	5	4	4	4	3	3	10	0.833333
7	5	4	4	4	3	3	10	0.833333
8	5	4	4	4	3	3	10	0.833333
9	5	4	4	4	3	3	10	0.833333
10	5	4	4	4	3	3	10	0.833333
11	5	3	4	4	2	3	9	0.75
12	5	4	4	4	3	3	10	0.833333
13	5	4	4	4	3	3	10	0.833333
14	5	4	4	4	3	3	10	0.833333
15	5	4	4	4	3	3	10	0.833333
16	5	4	4	4	3	3	10	0.833333
17	5	4	4	4	3	3	10	0.833333
18	5	4	4	4	3	3	10	0.833333
19	5	4	4	4	3	3	10	0.833333
20	5	4	4	4	3	3	10	0.833333

In Table 2, it can be seen that point no. 1-4 of the Aiken index are worth 0.667 and item no. 11 is 0.75, it can be said that the validity is moderate because it is in the range of 0.4-0.8 (Retnawati, 2016). Items no 5-10 and no 12-20 have an Aiken index of 0.833. The value is above 0.8 so it can be said that the validity is high. Based on the evidence of content validity, it can be said that the instrument has been proven valid. After the instrument is said to be valid, it will be distributed to research respondents.

In determining how much the factor contributes to learning achievement during online learning during a pandemic, PLS-SEM analysis is used. Several steps must be taken to determine this, namely determining the outer model (measurement model) and inner model (structural model). Determination of the construction model must be done before doing the outer and inner models. The reflective construction model is used in this study. This consideration is based on the fact that the construct that is formed can be explained by its indicators. Online learning is a multidimensional construct because it is explained by four indicators, namely the internet network, learning media, learning strategies, and the family environment.

Outer Model

The outer model (measurement model) was conducted to assess the validity and reliability. The outer model with reflective indicators is evaluated through convergent validity and discriminant validity. As for the indicators, it is done with composite reliability and Cronbach alpha (Nokels et al., 2010). The first step is to analyze with CFA. This analysis is carried out in two stages, namely the first-order construct (the latent construct of the dimensions formed by the indicators) and the second-order construct (the construct formed by the construct of items).

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The constructed model is using the first-order and second-order constructs. Both analyzes were conducted to determine to construct validity. This validity is carried out to be able to prove the suitability of theoretical and empirical analysis of student responses, so construct validity is expected to be able to interpret the measurement results according to the definition used. The design of the construct reflective model and its analysis is shown in Figure 1.
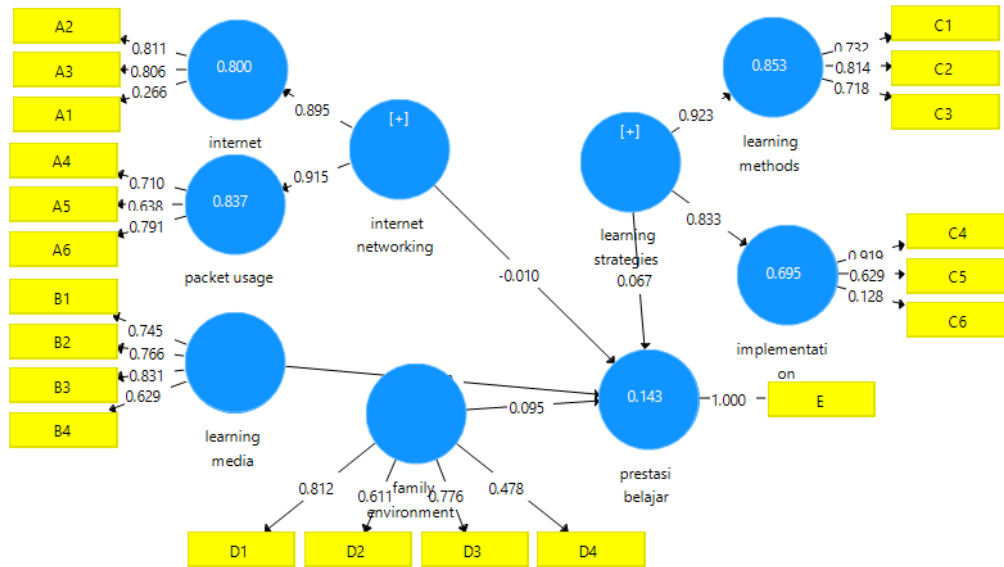

Figure 1. Design and Analysis of Constructs

Figure 1 shows the results of the construct analysis. The first measurement is done by looking at the dimensions of the construct through its four aspects. The items on each indicator are said to be fulfilled if the loading factor value is at least 0.5. But otherwise, it is necessary to consider whether the item is excluded or remains included in the model. First, internet network. One item has a loading factor value of less than the standard, A1 with a loading factor of 0.266. Second, in learning media, all items can be included in the model because the resulting loading factor value is more than 0.5. Third, learning strategies. There is only one item that has a loading factor below 0.5, C6 with a loading factor of 0.128. Fourth, family environment, one item has a factor loading less than the standard, D4 which has a loading factor of 0.478. Thus, it can be said that three items have a loading factor of less than 0.5.

Items that have a loading factor of less than 0.5 need to be considered for inclusion or exclusion from the model. These considerations are based on the value of composite reliability. If the new model can increase the composite reliability value, then the item needs to be removed from the model. The recommended minimum composite reliability is 0.7 (Hair et al., 2017). The results of the comparison of composite reliability values before the item are issued and after the item is removed can be seen in Table 3.

Table 3. Comparison of Composite Reliability Values

Composite Reliability	Early Model	New Model
Internet network	0.782	0.815
Internet stability	0.686	0.804
Package usage	0.758	0.758
Family environment	0.770	0.781
Learning media	0.833	0.833
Learning achievement	1.000	1.000
Learning strategies	0.754	0.804
Learning methods	0.800	0.800
Implementation	0.617	0.758

Composite reliability generated in both the initial model and the new model meets the minimum standard criteria, which is above 0.7. Table 3 shows that when items on indicators are removed from the model, it can increase the value of composite reliability. With these considerations, items that have a loading factor of less than 0.5 are removed from the model so that they will get a new model with a composite reliability value as shown in Table 3. The number of items removed from the model is three, A1, C6, and D4. Then, a re-analysis will be carried out by removing the three items. The results of the analysis is shown in Figure 2.

The results of the analysis in Figure 2 show that all items have a loading factor value above 0.5. It means all items are included in the model. The number of items entered is seventeen. The internet network factor can be explained by internet networking stability and packet usage, 80.4% and 75.8%. Media can be explained by items B1, B2, B3, and B4 more than 62%. Learning strategies can be explained by learning methods and implementation, 80%, and 75.8%. Meanwhile, the learning environment can be explained by D1, D2, and D3 each of which is above 60%. Thus, it can be said that these items meet convergent validity.
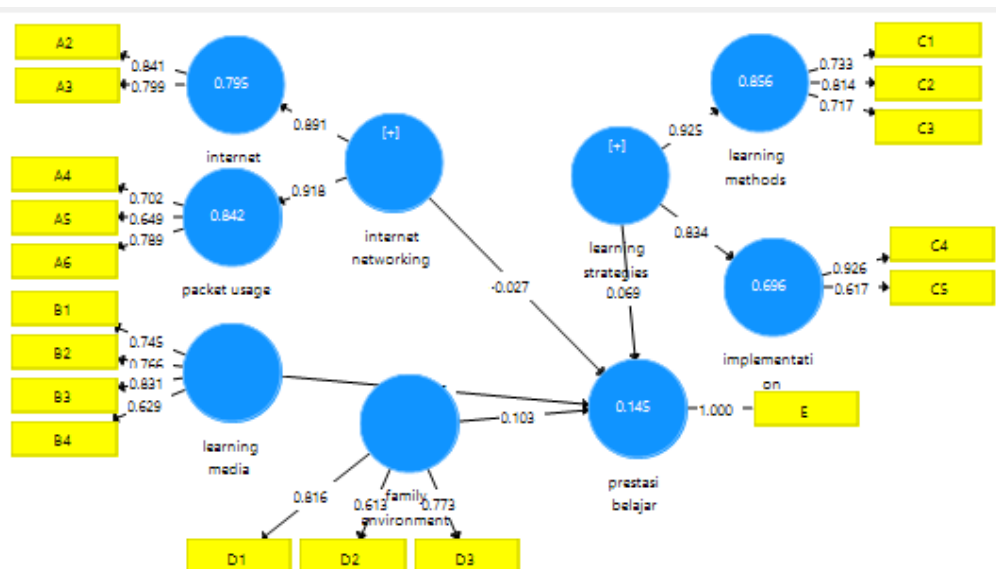

Figure 2. Second Iteration PLS-SEM Analysis

Table 4. Calculation of Outer Loading for Discriminant Validity

	Internet Network	Family Environment	Learning Media	Learning Achievement	Learning Strategies
A2	**0.680**	0.251	0.607	0.116	0.102
A3	**0.711**	0.226	0.323	0.175	0.344
A4	**0.893**	0.141	0.472	0.331	0.123
A5	**0.564**	0.055	0.263	0.031	0.190
A6	**0.545**	0.261	0.496	0.106	0.412
B1	0.596	0.230	**0.745**	0.193	0.359
B2	0.538	0.210	**0.766**	0.206	0.313
B3	0.390	0.232	**0.831**	0.394	0.324
B4	0.379	0.237	**0.629**	0.168	0.327
C1	0.282	0.282	0.304	0.054	**0.692**
C2	0.241	0.130	0.210	0.192	**0.728**
C3	0.152	0.109	0.357	0.284	**0.800**
C4	0.115	0.241	0.222	0.080	**0.652**
C5	0.246	0.463	0.335	0.185	**0.512**
D1	0.168	**0.816**	0.235	0.186	0.321
D2	0.237	**0.613**	0.244	0.115	0.099
D3	0.190	**0.773**	0.196	0.162	0.234
E	0.297	0.213	0.358	1.000	0.308

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Furthermore, the discriminant validity test was carried out. This validity serves to measure the correlation between indicators. This test is shown by comparing the square root of the AVE for each item with the correlation value between constructs in the model. In addition, the discriminant validity test can also be seen from the cross-loading aspect. If the outer loading value of each item is greater than all the outer loading values of items to other constructs, then the model has good discriminant validity. The calculation of outer loading can be seen in Table 4. In Table 3 it can be seen that if each item has met the requirements of discriminant validity, then the item can be said to be valid.

Inner Model

The inner model or structural model is used to see the relationship between the construct, R-square, and the significance of the research model. The initial step taken before determining the inner model is to test the collinearity of online learning variables with learning achievement. Online learning is influenced by four aspects, the internet network, family environment, learning media, and learning strategies. This aspect will be tested for collinearity with learning achievement. The test was carried out with AVE (Average Variance Extracted). AVE calculation can be seen in Table 5. Several AVE's are worth because of less than 0.5, internet networking, and learning strategies. This value is still acceptable as long as the composite reliability value is more than 0.6 (Alarcon & Sánchez, 2015). Because these aspects have composite reliability more than 0.6, these aspects can be said to be valid and reliable.

Table 5. Calculation of Variance Inflation Factor (VIF)

	AVE
family environment	0.547
implementation	0.619
internet networking	0.471
internet stability	0.673
learning media	0.557
learning achievement	0.572

Table 6. The Relationship Between Factors Influencing Learning Achievement in Online Learning

	Original Sample (O)	Sample Mean (M)	STDEV	T Statistics	P Values
family environment -> learning achievement	0.103	0.125	0.123	0.841	0.401
internet networking -> internet stability	0.891	0.893	0.021	42.017	0.000
internet networking -> packet usage	0.918	0.919	0.020	46.239	0.000
internet networking -> learning achievement	-0.027	-0.035	0.139	0.192	0.848
learning media -> learning achievement	0.317	0.345	0.132	2.406	0.016
learning strategies -> implementation	0.834	0.842	0.035	23.687	0.000
learning strategies -> learning methods	0.925	0.924	0.025	36.781	0.000
learning strategies -> learning achievement	0.069	0.058	0.101	0.679	0.498

The relationship between factors that affect learning achievement when online learning can be seen in Table 6. The influence of the internet network on learning achievement is 16.2%. The family environment has an influence of 7.3% on learning achievement. Meanwhile, learning me-

dia and learning strategies contributed to the influence of learning achievement by 14.9% and 18.1%. These four aspects make a small contribution to learning achievement. Even the effect is not up to 20%. Of the four aspects that give the greatest influence is the learning strategy. Meanwhile, the least contribution to learning achievement is the family environment.

Statistical test can be used to see the effect of online learning with a significance level of 5%. In Table 6, the results of the t-test on the internet network, family environment, and learning strategies are 0.192, 0.841, and 0.679. This value is less than 1.96, so it can be concluded that each aspect, the internet network, family environment, and learning strategies, has no significant relationship to learning achievement, while the learning media produces a value of 2.406. The value is more than 1.96, so it can be concluded that learning media has a significant relationship to learning achievement.

Implementation and learning methods are indicators that measure learning strategies. Coefficient of determination resulting 0.696 and 0.856. This value can be seen in Table 7. Implementation's reliability is classified as moderate, but the reliability of learning methods is high. Internet stability affects internet networking by 79.5%, while package usage has influenced by 84.2%, so both have a strong correlation. Learning methods can describe variance by 85.6%.

Table 7. Coefficient of Determination

	R Square	R Square Adjusted
implementation	0.696	0.693
internet stability	0.795	0.792
learning methods	0.856	0.854
internet package usage	0.842	0.840
learning performance	0.145	0.104

CONCLUSION

Based on the results of the study it can be concluded that (1) Seven items can measure online learning. (2) Internet networking and usage packages are proven to affect internet networking. (3) Learning methods and implementation are proven to be able to measure learning strategies. (4) There is only one factor that has a significant influence on learning achievement, namely learning media. The others, namely the internet network, learning media, and family environment, did not significantly affect learning achievement during online learning.

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