A Valid and Reliable Instruments to Measure Learning Motivation of University Students in Elementary Teacher Education

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Abstract
Learning motivation encourages university students to study and carry out certain activities that foster passion and enthusiasm to achieve maximum learning goals and results. To measure learning motivation, valid and reliable measurement tools were needed. The aim of this study was to assess the construct validity and construct reliability of a newly designed university student learning motivation instrument. Using quantitative methods, 282 respondents from 5 randomly selected universities were involved in this research. Using the Lisrel 8.80 program, the data obtained were analyzed using second order confirmatory factor analysis. This variable is measured by four indicators and 20 measuring items and 4 scales, namely: Intrinsic Motivation, Amotivation, Extrinsic-Career Motivation, and Extrinsic-social motivation. The research results show that the university student learning motivation instrument is valid in terms of factor loading, convergent validity and discriminant validity, and meets the construct reliability requirements, so that the university student learning motivation instrument developed is feasible for use.

Keywords: Learning Motivation, Confirmatory Factor Analysis, Elementary Education

Introduction

We often hear the word "motive" in everyday life. It is often common for people to define "motive" as why "someone does something." According to (Bakar, 2014), motivation is a complex part of psychology and human behavior that influences individuals to invest their time and energy in doing a job, how they think and feel about the task, and how long they persist. Suryabrata (2006) explains that motivation is a state within a person's personality that encourages people to carry out certain activities to achieve goals. Motivation is the driving force behind an action and is why someone does something (Nadya & Pustika, 2021). Based on experts, it can be concluded that motivation is a conscious effort to influence someone's behavior so that they are moved to do something to achieve specific results and goals.

Energy changes within a person take the form of real activity in the form of physical activity; because a person has a certain goal for his activity, he has a strong motivation to achieve it with all the effort he can make (Harahap et al., 2021). Human life is influenced by motivation and is closely related to the hope and willingness to learn from within a person to achieve learning goals. Motivation is an important psychological factor in the learning process. Motivation is generated through stimulus situations together with memories to influence students in such a way according to mechanical laws so that it directs, activates and increases student activity in the learning process (Tasiwan et al., 2014).

Learning motivation can be interpreted as the driving force to carry out certain learning activities that come from within oneself and outside the individual to foster enthusiasm for learning (Monika & Adman, 2017). Furthermore, Andriani & Rasto (2019) stated that learning motivation is an absolute requirement for learning and is important in providing passion or enthusiasm for learning. In agreement with this, Sardiman (2007) explains that learning motivation is a psychological factor that is non-intellectual and its specific role is in terms of growing passion, feeling happy and enthusiastic about learning. Motivation to learn appears within a person to carry out learning activities for the best results.

Motivation plays a very important role in the learning process, because motivation can foster enthusiasm within oneself, increase curiosity and be active in learning, so that with motivation students can be encouraged to study more seriously. In learning activities, motivation can be said to be the overall driving force within students, which creates, ensures continuity, and provides direction to learning activities so that learning goals are expected to be achieved (Sardiman, 2007). Motivation plays a vital role in the learning process, because motivation can foster enthusiasm within oneself, increase curiosity and be active in learning, so that with motivation, students can be encouraged to study more seriously (Krismony et al., 2020). Based on several definitions of learning motivation, ,it can be interpreted that learning motivation is a condition within an individual that encourages students to learn and carry out certain activities that foster passion and enthusiasm to achieve maximum learning goals and results.

So far, there have been challenges in measuring variables, especially in assessing the motivation of students majoring in elementary education. Lecturers seek to identify appropriate measuring tools and scales to collect relevant information about student motivation. This problem is significant because lecturers have an essential role in implementing education in higher education, including educational evaluation (Tjabolo & Herwin, 2020). It is essential for lecturers to prepare assessments to measure students' learning motivation. According to Clements & Cord (2013), assessment is an important

component in the learning process. One is that valid and reliable measuring instruments and scales are needed to assess learning motivation.

This research aims to develop an instrument for measuring student learning motivation that meets two psychometric criteria: validity and reliability. The learning motivation instrument developed must be tested for construct validity and reliability. Construct validity refers to the quality of the measuring instrument used to determine whether or not the theoretical construct is used as a basis for operationalization. In short, construct validity assesses how well a researcher can translate the theory into a measuring instrument. Construct validation begins by identifying and limiting the variables to be measured and expressed as a logical construct based on the theory regarding these variables (Retnawati, 2016).

The novelty of this research lies in developing a test instrument that can calculate a whole number of valid and reliable operations. The instrument was tested for construct validity and reliability. Construct validity is used to assess how well the theory used translates into the instruments used. Proving construct validity can be done with factor analysis. Confirmatory Factor Analysis (CFA) is an approach in factor analysis used to test how well the measured variables can represent previously prepared factors or constructs. This test helps measure the model (measurement model) to describe aspects and indicators as a reflection of the latent variable, namely the ability to calculate integer operations by looking at the loading factors of each aspect that forms a construct. CFA is also useful for testing the construct validity and construct reliability of the items that form latent constructs (Elfida et al., 2021).

The CFA used in this research is second-order confirmatory factor analysis, a model whose measurement has two levels. The first level analysis was carried out from the latent construct of the aspects to each indicator, and the second level analysis was carried out from the latent construct to the aspect construct (Petsangsri & Pislae-Ngam, 2020; Sholahuddin et al., 2022). This research aims to test instruments for the ability to calculate a whole number of operations that meet construct validity and reliability. Construct validity includes convergent and discriminant validity. The instrument was tested using Confirmatory Factor Analysis assisted by Lisrel 8.80 software.

Methods

This research uses a quantitative approach to describe a model for measuring student learning motivation using confirmatory factor analysis. This factor analysis method proves and verifies several factors underlying the research variables. The research sample was obtained from 282 university students majoring in primary school teacher education who were randomly selected from 5 specified universities. The adequacy sample influences the internal model suitability analysis factor (Yadama & Pandey, 1995). Therefore it is necessary to consider the use of an adequacy sample. Using several participants more than 100 or five times from several items analyzed can be done to obtain valid data on factors analysis (MacCallum et al., 1999; O'Rourke & Hatcher, 2013).

Data was collected by observation using university student learning motivation instruments and by conducting performance tests with participants. Data was obtained from university students who were observed. The observation sheet used is by the research variable construct, which contains 20 measurement items from four indicator categories. A measurement scale is applied to categorize observation results. The questionnaire scale is 5, 4, 3, 2, and 1. The research data is then summarized and tabulated for further analysis. The data analysis

technique used was confirmatory factor analysis. This study uses LISREL 8.80 software for data analysis. There are latent variables and indicator variables in the confirmatory factor analysis.

Variables studied in this research is learning motivation. Variable of learning motivation is focused on university students in elementary teacher education base. In research, This variable will be measured with four indicators and 20 measurement items. The fourth indicator includes; Intrinsic Motivation, Amotivation, Extrinsic-Career Motivation, and Extrinsic- social motivation. Every indicator is measured with five items. Table 1 below explains the distribution from indicator and item measurements.

Table 1. Measurement Indicators and Items of Learning Motivation

Indicators	Measurement Items	Code
Intrinsic Motivation (A)	Students enjoy studying every subject	A1
	Students enjoy discussing subject content	A2
	Students like to share new things they have learned	A3
	Students enjoy reading study sources and literature	A4
	Students have an interest in learning in class	A5
Amotivation (B)	Students have strong reasons to study	B6
	Students know the benefits of lessons in the future	B7
	Students know the reasons why they have to study	B8
	Students know the benefits of new things learned	B9
	Students take part in a series of learning activities	B10
Extrinsic-Career Motivation (C)	Students know the connection between learning and profession	C11
	Students know the importance of linking learning to the profession	C12
	Students know their chosen concentration options	C13
	Students know the opportunities of the chosen concentration	C14
	Students know their future job options	C15
Social-Extrinsic Motivation (D)	Students prove their success to themselves	D16
	Students prove their success to their families	D17
	Students prove their abilities to other friends	D18
	Students prove their influence on the surrounding environment	D19
	Students prove their positions in the community	D20

Finding

This outline is based on the construct variable motivation to learn students, formulated previously. Construct This covers four indicators: Intrinsic motivation, Amotivation, Extrinsic-career Motivation, and Extrinsic-social Motivation. Analysis results: The fourth indicator is outlined based on the measurement item and the proof for every construct.

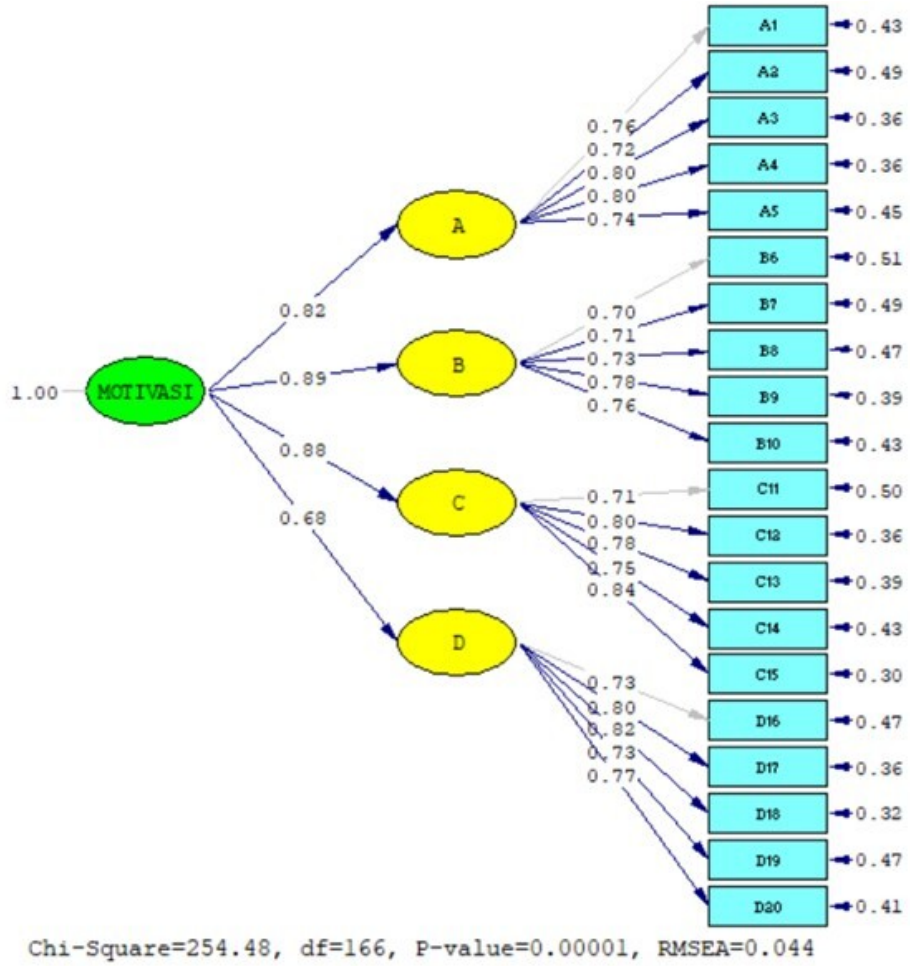

Figure 1. Factor loading's terms of the second-order confirmatory factor analysis.

Tabel 2. Convergent Validity

Indicators	Items	λ	λ^2	$1-\lambda^2$	AVE
A	A1	0.76	0.5776	0.4224	**0.58472**
	A2	0.72	0.5184	0.4816	
	A3	0.8	0.64	0.36	
	A4	0.8	0.64	0.36	
	A5	0.74	0.5476	0.4524	
∑		**3.82**	**2.9236**	**2.0764**	
B	B6	0.7	0.49	0.51	**0.5426**
	B7	0.71	0.5041	0.4959	
	B8	0.73	0.5329	0.4671	
	B9	0.78	0.6084	0.3916	
	B10	0.76	0.5776	0.4224	
∑		**3.68**	**2,713**	**2,287**	
C	C11	0.71	0.5041	0.4959	**0.60412**
	C12	0.8	0.64	0.36	
	C13	0.78	0.6084	0.3916	
	C14	0.75	0.5625	0.4375	
	C15	0.84	0.7056	0.2944	
∑		**3.88**	**3.0206**	**1.9794**	

D	D16	0.73	0.5329	0.4671	**0.59422**
	D17	0.8	0.64	0.36	
	D18	0.82	0.6724	0.3276	
	D19	0.73	0.5329	0.4671	
	D20	0.77	0.5929	0.4071	
∑		**3.85**	**2.9711**	**2.0289**	

Table 3. Discriminant Validity

	A	**B**	**C**	**D**
A	0.765	0.624	0.617	0.542
B	0.624	0.737	0.696	0.512
C	0.617	0.696	0.777	0.514
D	0.542	0.512	0.514	0.771

Table 4. Construct Reliability

Item	**λ**	**λ^2**	**1-λ^2**	**ω**
A1	0.76	0.58	0.42	**0,96**
A2	0.72	0.52	0.48	
A3	0.80	0.64	0.36	
A4	0.80	0.64	0.36	
A5	0.74	0.55	0.45	
B6	0.70	0.49	0.51	
B7	0.71	0.50	0.50	
B8	0.73	0.53	0.47	
B9	0.78	0.61	0.39	
B10	0.76	0.58	0.42	
C11	0.71	0.50	0.50	
C12	0.80	0.64	0.36	
C13	0.78	0.61	0.39	
C14	0.75	0.56	0.44	
C15	0.84	0.71	0.29	
D16	0.73	0.53	0.47	
D17	0.80	0.64	0.36	
D18	0.82	0.67	0.33	
D19	0.73	0.53	0.47	
D20	0.77	0.59	0.41	
∑	**15.23**		**8.37**	

Discussion

Factor Loading

The second-order confirmatory factor analysis determines factor loading (λ) for each indicator and statement of university student learning motivation. In this test, four indicators consist of 20 measurement items. Based on the measurement point of view Figure 1, it can be seen that the factor loading (λ) for each measurement item is more than 0.4. Based on the measurement point of view, the findings of this study indicate that all factor loading on each indicator has a value greater than 0.4 (Prudon, 2015). But, Sujati (2021) claims that a factor

loading of λ0.50 or more is practically significant. So, an item is declared valid for its factors if it has a factor loading ≥0.50.

Based on the results of the second-order confirmatory factor analysis, as shown in Figure 1, it was found that all indicator and item measurements showed factor loadings > 0.5 also. The results of all items and factors are practically significant and suitable for data collection. After the factor loading analysis, all items were declared valid. It shows the Path Diagram, which displays the factor loading results from LISREL 8.80 processing. Each item of measurement is declared significant because the factor loading (λ) is more than 0.50.

Convergent Validity

Convergent validity refers to the extent to which different variables measure similar constructs. In other words, convergent validity ensures that the variable is included in the latent construct to be measured (Wang et al., 2015). Convergent validity is based on the correlation between the responses of different variables in measuring the same construct. Next, the variables must be highly correlated with the latent construct. The size of the factor loading is a fundamental consideration in determining convergent validity (Hair et al., 2019). Sujati (2021) recommends average variance extract (AVE) as a measure of convergent validity because AVE can explain the extent to which items are shared between constructs in a structural equation model (SEM) where an AVE of 0.5 is more acceptable as convergent validity. Hair et al (2019) also recommend average variance extracted (AVE) as a measure of convergent validity because AVE can explain the extent to which items are shared between constructs in structural equation modeling (SEM), where an AVE of 0.5 or more is acceptable as convergent validity.

Scale development in this research involved four factors, namely; Intrinsic Motivation, Amotivation, Extrinsic-Career Motivation, and Extrinsic-social motivation. Based on research data, the results of convergent validity analysis can be described as follows. The research results show that the AVE values for the four factors are 0.58472, 0.5426, 0.60412, and 0.59422. Because all constructs exceed an AVE value of ≥0.50, it is concluded that these factors can measure latent variables. Therefore, these factors can be declared convergently valid.

Discriminant Validity

The discriminant validity test is required to develop instruments involving latent variables. Discriminant validity, which refers to divergent validity means that two concepts must show significant differences conceptually (DeVellis & Thorpe, 2021). The discriminant validity test aims to prove that one construct is very different from others (Voorhees et al., 2016). Discriminant validity expresses how much a construct is differentiated from other constructs in a model (Hair et al., 2019).

Discriminant validity is demonstrated by correlations between latent constructs that are not too high or low factor covariance (Kenny & Kashy, 1992). Discriminant validity confirms that each latent construct is unique. In other words, one latent construct should not be highly correlated with other constructs (Henseler et al., 2015). This is fulfilled when two latent constructs are not correlated theoretically and empirically, as evidenced by scores indicating one construct is higher than the other.

Hair et al (2019) stated that discriminant validity can be built by correlating one construct with others. If the correlation value of the two constructs is smaller than 0.85, discriminant validity exists. Additionally, Fornell & Larcker (1981) argues that discriminant validity exists if a latent variable shows more variance in the related indicator variable than it shares with other constructs in the same model. The results presented in Table 3 inform that the four latent constructs each have a square root of AVE: 0.765, 0.737, 0.777, and 0.771. The square root of the AVE of the four latent constructs is greater than the correlation between the constructs. Conclusively, the four latent constructs have met the criteria for discriminant validity.

Construct Reliability

The final aspect under scrutiny in this research is the reliability of the construct. Findings suggest that the assessment model for students' curiosity demonstrates reliability, boasting a coefficient of 0.96 in Table 4. According to Hinton et al (2014) a reliability index surpassing 0.90 indicates high reliability. This high coefficient suggests internal consistency and uniform variance among measurement items, implying that despite their differences, the items gauge the same construct (Widhiarso, 2009). The construct's reliability indicates the quality of an empirical measure and it can consistently reflect overall measurements even across multiple trials (Nájera Catalán & Gordon, 2020). Consequently, this study's assessment model for curiosity appears capable of consistently evaluating the curiosity construct.

Based construct reliability analysis, the omega ω result is 0.96. Referring to the criteria used, a construct reliability coefficient greater than 0.70 is considered acceptable (Naqsyahbandi & Prodjosantoso, 2023). Table 4 shows the results of construct reliability analysis based on factor loading coefficients. Based on table 4 indicators as a whole. Based on the analysis results, the omega coefficient was 0.96. Referring to the criteria used, namely the construct reliability coefficient value of more than 0.70, it is reasonable to conclude that the university student learning motivation in elementary teacher education instrument is reliable and fit for use.

Conclusion

Based on the results and discussion, four indications were determined: Intrinsic Motivation, Amotivation, Extrinsic-Career Motivation, and Extrinsic-social motivation. Theoretically designed to develop an instrument for learning motivation, it has been proven to be valid in terms of factor loading, convergent validity, discriminant validity and construct reliability. The instrument developed was also declared suitable for data collection to measure learning motivation. We can measure university students' learning motivation in elementary teacher education using this instrument. Another implication in this study is that through this scale, teachers can also monitor the development of students learning motivation.

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