Preliminary Development and Validation of Teacher's Grit Scale

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Abstract. Grit is an essential quality for teachers as they strive to meet the demands of providing high-quality education. To effectively assess teacher grit, there is an urgent need for a reliable measurement tool, as grit is a key indicator of teaching quality. We developed a grit scale for teachers based on fundamental dimension of grit, namely *consistency of interest* and *perseverance of effort*. The research aims to inially develop the scale to ensure that meets high psychometric standards. The total subjects participated in this study were 192 elementary school teachers. The validity and reliability of the scale were evaluated through the results of psychometric tests, specifically in terms of construct validity assessed via Confirmatory Factor Analysis (CFA) and *Cronbach's Alpha internal consistency*. Based on the CFA test results, the Elementary School Teacher Grit Scale had an excellent *model fit* (CFI = 0.977; TLI = 0.963; RMSEA = 0.057; SRMR = 0.036) as well as good reliability with a total *Cronbach's Alpha* reliability value of 0.832 (with *Cronbach's α* values on Interest Consistency = 0.711 and Perseverance in Effort = 0.738). In conclusion, the eight-item teacher grit scale is appropriate for measuring grit among elementary school teachers.

Keywords: Grit, Teachers, Primary education, Confirmatory factor analysis, validity, reliability

1 Introduction

Education is a means to advance all areas of human life in Indonesia, both in the economic, social, technological, security, skills, noble character, welfare, culture and national glory [1]. Every individual has the right to education because this can be a determining factor in the success of a country [2]. Not only as a source of knowledge, education also provides learning about good and right things [3]. Channeling knowledge and learning to every individual in the world of education is the task of a teacher. Teachers play an important role in helping students achieve their learning goals. A teacher not only teaches concepts and theories, but also helps students understand and apply them in everyday life. Teachers also help students develop the skills and abilities they will need to succeed in the future. In addition, teachers are also role models for students, in accordance with the saying "Guru iku digugu lan ditiru" [4]. Based on this, the role of

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a teacher is very important in the world of education. The more competent and qualified teachers there are, the higher the guarantee of educational excellence. A teacher's competence includes the ability, strength, and potential of teaching that is adequate to carry out its functions properly. Teachers serve as the main element in the implementation of education reform and are fundamental agents of change [5].

Teachers have a crucial role in education, even the success of a country can be determined by the quality of its teachers [3]. Not only teaching knowledge, teachers also act as teachers, educators, facilitators, mentors, learning resources, demonstrators, trainers, managers, advice givers, innovators, motivators, and elevators [6]. Based on this, perseverance and enthusiasm to achieve long-term goals are needed in a teacher. Teachers must be able to face challenges and obstacles in education. This ability is called *grit. Grit* helps teachers to maintain interest so that teachers always work hard in the face of challenges and obstacles to achieve long-term goals. *Grit* consists of two aspects: *consistency of interest* and *perseverance of effort*. Through this combination of *consistency of interest* and *perseverance of effort*, teachers can certainly improve their competence or abilities amid difficulties, challenges, obstacles and changes in the world of education. There are several factors that can influence *grit*, namely *interest*, practice, *purpose*, *hope*, *parenting*, *the playing fields*, and *culture* of *grit* [7].

Grit can predict individual success, including teachers [7], yet valid and reliable measurement tools to measure *grit* in teachers in Indonesia are still limited. Many of the currently available *grit* measurement tools are more focused on students or the general population, and none have been specifically developed to evaluate *grit* in teachers. In fact, measuring *grit* in teachers has its own uniqueness, considering that teachers are an important component to determine the success of an education because teachers are the spearheads who are directly related to students as subjects and objects of learning [8], and the challenges and dynamics of teacher work are certainly different from other professions.

Measuring instruments in research have a crucial role in determining the quality of research, because the validity of the data obtained is highly dependent on the quality of the measuring instruments used, as well as data collection procedures. Good quality, valid, and reliable measuring instruments will produce accurate data in accordance with the reality in the field. Conversely, measuring instruments with low quality will produce invalid data, resulting in wrong conclusions. This measuring instrument has a very important role in a study because it is used to collect data that will be processed and analyzed to produce research conclusions. If the making of the measuring instrument is incorrect and incorrect, it can cause the research data to be inaccurate. Based on this, a good measuring instrument must be able to produce accurate and consistent data.

There is not much research on grit measuring instruments in Indonesia. The results of research conducted by Tamba and Wicaksono [9] explain that the development of grit measurement tools in Indonesia is still very minimal. Research using the grit construct is still only limited to correlational and descriptive research. Meanwhile, grit research focuses on the western region. In Indonesia there is no research that reports the psychometric properties of the grit measuring instrument.

Developing a teacher-specific *grit* measurement tool is necessary for several reasons. First, it can help in the teacher selection and recruitment process, ensuring that prospective teachers have the perseverance and passion needed to face the challenges of education. Second, the tool can be used in professional development programs, helping teachers understand their level of *grit* and

how they can improve it. Third, by having a valid measurement tool, researchers can evaluate and develop more effective interventions to improve *grit* among teachers. Therefore, this study aims to develop a valid and reliable measurement tool specifically to measure *grit* in teachers. Through this measurement tool, it is hoped that later phenomena related to *grit* in teachers can be measured validly so that it can provide research results that describe related phenomena well.

In this study, the researcher aims to test the validity and reliability of the teacher grit measuring instrument. The things tested in this study are the discrimination power of the items with unidimensional reliability, the construct validity of the measuring instrument will be tested with *Confirmatory Factor Analysis (CFA)* and the reliability will be tested for internal consistency with the *Cronbach-Alpha* value.

2 Research Method

2.1 Procedure

The research procedure began with designing a teacher grit measurement instrument based on the grit concept proposed by Duckworth (2016). The researcher identified indicators based on Duckworth's two dimensions of grit: consistency of interest and perseverance. Once the indicators for each dimension were established, the next step was to compile the items for the teacher grit measurement instrument.

After completing the preparation of the grit scale, data collection was conducted. This involved administering questionnaires both online through Google Forms and offline using paper and pencil formats, tailored to the specific needs of the field and the regulations in place at the school where the research was conducted.

The collected data were then analyzed to assess both construct validity and reliability. Construct validity was tested using Confirmatory Factor Analysis (CFA) to ensure that the items in the instrument accurately reflect the latent construct being measured. Reliability was evaluated by calculating Cronbach's alpha coefficient. Both analyses were performed using JASP software. Confirmatory Factor Analysis (CFA) is a widely used method for testing the construct validity of measurement instruments. When conducting CFA, several factors must be considered to ensure that the instrument demonstrates good construct validity. Key considerations include the factor loading values of each item and the overall model fit. Common fit indices evaluated in CFA include the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Normed Fit Index (NFI), and Root Mean Square Error of Approximation (RMSEA). The determination of model fit is based on whether these fit indices meet their respective cutoff criteria.

2.2 Sample

This study collected data from 192 participants, all of whom are elementary school teachers in Indonesia. Among these participants, there were 44 male teachers (23%) and 148 female teachers (77%). Most of the participants were in the early adulthood age range of 21 to 40 years,

comprising 141 teachers (73%). This was followed by 50 teachers (26%) in the middle adulthood age range of 40 to 60 years, and one teacher (1%) in the late adulthood age range of over 60 years. Regarding educational qualifications, the majority of participants held an undergraduate degree (S1), accounting for 177 teachers (92%). The remaining participants included those with a master's degree (S2) at 5%, high school or equivalent (SMA) at 1%, and a diploma (D3) at 1%. Additionally, two teachers (1%) did not provide information about their education level.

3 Results and Discussion

3.1 Preparation of Grit Measurement Tool

In preparing the scale, the first step is to identify the indicators of grit that can be measured according to its dimensions: consistency of interest and perseverance. Below, we present the grit indicator items for each dimension, along with the corresponding items organized according to these indicators.

Table 1. Dimensions and Indicators of the Teacher's Grit Scale

No	Dimension	Indicator	Favorable / Unfavorable	Code	Item
1.	Consistency of Interest	*Maintaining interest in the long term.*	Favorable	C1	*During my time as a teacher, I never thought about resigning from my job.*
			Favorable	C2	*I am happy to be a teacher because I can educate students.*
			Favorable	C3	*Differences of opinion with other teachers do not deter me from using teaching methods that I believe are effective.*
			Unfavorable	C4	*In my opinion, teaching is a boring task.*
			Unfavorable	C5	*Every year, my interest in teaching is decreasing.*
			Unfavorable	C6	*I will change my teaching method if the old one proves difficult to implement.*
		Maintaining focus on long-term goals	Favorable	C7	*I am enthusiastic about developing my skills as a teacher by participating in activities such as workshops, seminars, and others.*
			Favorable	C8	*The additional tasks assigned to me did not distract me from my primary responsibility as a teacher.*

			Unfavorable	C9	*I prefer to use a variety of teaching methods rather than focusing on one method that I have mastered.*
			Unfavorable	C10	*I am not interested in participating in further teaching skills development training programs.*
2.	Perseverance of Effort	*Persevering in the face of challenges*	Unfavorable	P11	*I am not enthusiastic about continuing teaching and learning activities when the classroom atmosphere is not conducive.*
			Unfavorable	P12	*I am not enthusiastic about the constant changes to the curriculum.*
			Unfavorable	P13	*When I fail to help students understand the material, I feel discouraged.*
			Unfavorable	P14	*I am impatient with the misbehavior of students.*
			Unfavorable	P15	*I feel tired when dealing with students who are slow to grasp the material.*
		Work hard	Favorable	P16	*I am willing to spend extra time teaching students who are slow learners.*
			Favorable	P17	*I try to understand the strengths and weaknesses of each student I teach.*
			Favorable	P18	*I prepare teaching materials before starting class.*
			Favorable	P19	*When school facilities are lacking, I will do my best to make use of what is available so that I can teach effectively.*
			Unfavorable	P20	*I forgot to provide feedback on the students' assignments.*

3.2 Validity and Reliability of Teacher Grit Measures

3.2.1 Construct Validity (Part I)

In this study, Confirmatory Factor Analysis (CFA) was conducted using a two-factor model, reflecting the two dimensions of grit proposed by Duckworth: consistency of interest and persistence of effort. The following section presents the validity testing of the teacher grit scale using CFA (first part).

3.2.2 Factor Loading

Based on the CFA test whose results can be seen in Table 2. below, of the 20 items of the teacher grit scale, not all items have a *factor loading* value ≥ 0.5 which means the ideal value of an item in construct validity [15]. There are eight items that have a *factor loading* value <0.5. So this shows that the number of items that are valid and can be used to measure the variables to be measured is 12 items.

Table 2. CFA Results: *Factor Loading*

Dimensions	Aitem	Factor Loading
Consistency Of Interest	C1	0,383
	C2	0,456
	C3	0,723
	C4	0,603
	C5	0,495
	C6	0,508
	C7	0,577
	C8	0,366
	C9	0,516
	C10	0,429
Perseverance Of Effort	P11	0,409
	P12	0,601
	P13	0,274
	P14	0,534
	P15	0,600
	P16	0,707
	P17	0,644
	P18	0,639
	P19	0,645
	P20	0,481

3.2.3 Model Fit

Based on Table 3. below, it is known that the fit index has a *Comparative Fit Index* (CFI) value = 0.648. This value is still far from the fit value category, which is ≥ 0.90 [16]. The RMSEA and SRMR values of the teacher grit scale can be seen in Table 7. below which shows a value that is still high, namely 0.121. While a good RMSEA value has a value equal to or smaller than 0.08 [16]. The SRMR value of the scale also cannot be said to be good, which is 0.093. A scale with a good SRMR value has an SRMR value <0.05 [16].

Table 3. Model Fit (Two-factor Model)

Index	Value
Comparative Fit Index (CFI)	0,648
Tucker-Lewis Index (TLI)	0,604
Bentler-Bonett Non-Normed Fit Index (NNFI)	0,604
Bentler-Bonett Normed Fit Index (NFI)	0,582
Parsimony Normed Fit Index (PNFI)	0,517
Bollen's Relative Fit Index (RFI)	0,530
Bollen's Incremental Fit Index (IFI)	0,653
Relative Noncentrality Index (RNI)	0,648

Table 4. Other Fit Measures

Metric	Value
Root mean square error of approximation (RMSEA)	0,121
RMSEA 90% CI lower bound	0,112
RMSEA 90% CI upper bound	0,131
RMSEA p-value	$5{,}407 \times 10^{-14}$
Standardized root mean square residual (SRMR)	0,093
Hoelter's critical N (α = .05)	60,408
Hoelter's critical N (α = .01)	64,664
Goodness of fit index (GFI)	0,964
McDonald fit index (MFI)	0,288
Expected cross validation index (ECVI)	4,008

3.2.4 Reliability

Based on the results of the reliability test with the internal consistency approach, the alpha value α = 0.871 was obtained. *Construct reliability* uses the assumption that a good alpha coefficient is ideally worth ≥ 0.7 [15]. This shows that the teacher grit measuring instrument has a good reliability value. Scale reliability can be seen in the table below.

Table 5. Cronbach's α

Estimate	Cronbach's α
Consistency of Interest	0,753
Perseverance	0,804
Total	0,871

3.3 Construct Validity (Part II)

After conducting the CFA on the 20 items of the teacher grit scale, several items were found to have factor loading values below 0.5, which is considered inadequate. Furthermore, the overall

fit of the scale model was unsatisfactory. To address the issue of items with poor factor loading values, the researchers decided to remove some of these items from the the model, retaining only those with acceptable factor loading values. After ensuring that all remaining items had factor loading values equal to or above 0.5, the next step was to improve the model fit of the measurement instrument, which was still unsatisfactory. The researchers identified items with high modification indices and found that the pairs C3-P16 and C9-P11 were of particular interest. Subsequently, the researcher conducted a residual covariance analysis on these two pairs of items.

The final version of the teacher grit scale consists of eight items, with four items representing each dimension.

3.3.1 Chi-Square

Based on the chi-square test in table 6 below, it is known that the chi-square value is significant with a value of $p = 0.049$ ($p < 0.05$). According to Hooper et al. [16], a fit model has an insignificant chi-square value. However, the chi-square value of the measuring instrument model is susceptible to sample size. The model tends not to fit if the sample used is large [16] Therefore, other alternatives are also needed in measuring model fit [16].

Table 6. Chi-Square

Model	Square X	df	p
Baseline model	498,528	28	
Factor model	27,678	17	.049

3.3.2 Factor Loading

Based on the CFA test whose results can be seen in Table 8 below, all 8 items of the teacher grit scale have *factor loading* values ≥ 0.5. This indicates that these eight teacher scale items are valid and can be used to measure the variables to be measured.

Table 7. *Factor Loading* Results

Dimensions	Aitem	Factor Loading	Summary
Consistency of Interest	C3	0,650	Good
	C4	0,681	Good
	C5	0,543	Good
	C9	0,627	Good
Perseverance Of Effort	P11	0,543	Good
	P14	0,742	Good
	P15	0,812	Good
	P16	0,533	Good

3.3.3 Model Fitn

Based on Table 9, it is known that the fit index has a *Comparative Fit Index* (CFI) value = 0.977 and a *Tucker-Lewis Index* (TLI) value = 0.963. This value is included in the fit value category, which is ≥ 0.95 on CFI and TLI [16]. Based on Table 10 below, it is also known that the scale RMSEA value has shown a good value, which is 0.057. A good RMSEA value has a value equal to or smaller than 0.08 [17]. And this scale also has a good SRMR value, which is 0.036. A good SRMR value is below 0.08 [17].

Table 8. Model Fit (Two-factor Model)

Index	Value	Cut off criteria **[16], [18], [19]**	Description
Comparative Fit Index (CFI)	0.977	≥ 0.95	Fit
Tucker-Lewis Index (TLI)	0.963	≥ 0.95	Fit
Bentler-Bonett Non-Normed Fit Index (NNFI)	0.963	≥ 0.95	Fit
Bentler-Bonett Normed Fit Index (NFI)	0.944	≥ 0.9	Fit
Parsimony Normed Fit Index (PNFI)	0.573	≥ 0,5	Fit
Bollen's Relative Fit Index (RFI)	0.909	≥ 0.90	Fit
Bollen's Incremental Fit Index (IFI)	0.978	≥ 0.95	Fit
Relative Noncentrality Index (RNI)	0.977	≥ 0.95	Fit

Table 9. Other Fit Measures

Metric	**Value**
Root mean square error of approximation (**RMSEA**)	0,057
RMSEA 90% CI lower bound	0,004
RMSEA 90% CI upper bound	0,095
RMSEA p-value	0,345
Standardized root mean square residual (**SRMR**)	0,036
Hoelter's critical N (α = .05)	192,366
Hoelter's critical N (α = .01)	232,749
Goodness of fit index (GFI)	0,998
McDonald fit index (MFI)	0,973
Expected cross validation index (ECVI)	0,425

3.3.4 Reliability

Based on the results of the reliability test with the internal consistency approach, the alpha value α = 0.832 was obtained. *Construct reliability* uses the assumption that a good alpha coefficient is ideally worth ≥ 0.7 [15]. This shows that the teacher grit measuring instrument has a good reliability value. Scale reliability can be seen in the table 11.below.

Table 10. Cronbach's α

Estimate	**Cronbach's α**
Consistency of interest	0,711
Perseverance	0,738
Total	0,832

3.4 Grit Measurement Tool After Testing

After a series of testing of the teacher grit scale was carried out from 20 items leaving 8 good items to use. The following is the latest *blueprint* consisting of 8 items:

Table 12. Grit Measure Tool After Validity and Reliability Testing

No.	Aspect	**Indicator**	**Aitem**
1.	*Consistency of Interest)*	*Maintaining interest in the long term.*	*Even though it is considered to have a low salary compared to other professions, I still want to be a teacher.*
			In my opinion, teaching is a tedious task.
			Every year, my interest in teaching is decreasing.
		Maintain focus on long-term goals.	*I find it difficult to focus on teaching when I have other problems outside of work, such as family issues or other problems.*
2.	*Perseverance of Effort*	*Persevering in the face of challenges .*	*I am not enthusiastic about continuing teaching and learning activities when the classroom atmosphere is not conducive.*
			I am impatient with students who misbehave.
			I feel tired when dealing with students who are slow to grasp the material.
		Work Harder	*I am willing to spend extra time teaching students who are slow learners.*

4 Conclusion

After compiling the measuring instrument items based on Duckworth's (2016) framework, the researcher tested the validity and reliability of the instrument to ensure its consistency and appropriateness for measuring grit. The trial involved 192 teachers in Indonesia, with scales distributed both online and offline. Construct validity was assessed using Confirmatory Factor Analysis (CFA), conducted in two phases. In the first phase, 12 out of 20 items demonstrated adequate factor loading values (≥ 0.5). In the second phase, 12 items were discarded, leaving a total of 8 items in the Elementary School Teacher Grit Scale. The CFA results indicated a good model fit (CFI = 0.977; TLI = 0.963; RMSEA = 0.057; SRMR = 0.036). Additionally, the reliability of the scale was confirmed with a Cronbach's Alpha value of 0.832, indicating that the final eight-item teacher grit measuring instrument is valid and reliable for use.

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