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The Indonesian version of the Short Grit Scale (Indonesian Grit-S): Psychometric Properties Based on the Multidimensional Rasch Model

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Abstract

"Grit" refers to persistence in trying and consistent interest in achieving long-term goals. The Short Grit Scale (Grit-S) is one of the measures used to assess grit. Given that previous research on the Grit-S scale was reported with a CFA approach, this study aims to examine the psychometric properties of the Indonesian Grit-S using Rasch model analysis. Rasch model shows a more detailed analysis than CFA by explaining item difficulty, item fit statistics, reliability, and wright map. Participants in the study were 480 students (male: 86 and female: 394) with an age range of 17-25 years (mean age: 20.05, SD age: 1.32). The sampling method used was non-probability sampling with a convenience sampling technique. The research analysis results show that the Indonesian Grit-S has a good reliability. In addition, all Indonesian Grit-S scale items fit using the Rasch model. Overall, the results showed that the Indonesian Grit-S scale has valid and reliable psychometric properties and can be used to measure grit.

Keywords: Adaptation Scale, Grit-S, Psychometric Properties, Rasch model

Abstrak

Grit merupakan sifat tekun dalam berusaha dan memiliki minat yang konsisten untuk mencapai tujuan jangka panjang. Salah satu skala yang digunakan untuk mengukur grit adalah Short Grit Scale (Grit-S). Mengingat penelitian sebelumnya tentang skala Grit-S dilaporkan dengan pendekatan CFA, oleh karena itu penelitian ini bertujuan untuk menguji properti psikometri dari Grit-S versi Bahasa Indonesia dengan menggunakan analisis Rasch model. Rasch model menunjukkan analisis yang lebih rinci daripada CFA dengan menjelaskan item difficulty, statistik kecocokan item, reliabilitas, wright map. Partisipan dalam penelitian sebanyak 480 mahasiswa (laki-laki: 86 dan perempuan: 394) dengan rentang usia 17 – 25 tahun (mean usia: 20.05, SD usia: 1.32). Metode pengambilan sampel yang digunakan adalah non-probability sampling dengan teknik convinience sampling. Hasil analisis penelitian menunjukkan bahwa skala Grit-S versi Bahasa Indoneisa memiliki reliabilitas yang baik. Selain itu, semua item skala Grit-S versi Bahasa Indoneisa menggunakan Rasch model. Secara keseluruhan, hasil penelitian menunjukkan bahwa skala Grit-S versi Bahasa Indonesia memiliki properti psikometri yang baik dan dapat digunakan untuk mengukur grit.

Kata kunci: *Adaptasi Skala, Grit-S, Properti Psikometri, Rasch model*

Introduction

Contemporary advances in technology and global culture have led to significant changes in the lifestyles of individuals, along with increased demands for success in life (Singh & Chukkali, 2021). Cognitive intelligence is considered the most influential predictor of life achievement (Gottfredson, 1997; Hartigan & Wigdor, 1989). However, to achieve success, non-cognitive skills are also needed to face life's challenges. Researchers also recognize the importance of non-cognitive skills in character development (Farrington et al., 2012; Jones et al., 2015; Kautz et al., 2014). Grit is a non-cognitive skill that individuals must possess to achieve success (Singh & Chukkali, 2021). Grit is a stronger predictor of individual success than cognitive ability and can explain why individuals with similar abilities but different performances achieve success (Credé et al., 2017).

The study of grit is of specific interest to scientific study, especially psychology (Duckworth & Quinn, 2009), where it has been examined since the early twentieth century. The grit construct was first introduced by (Duckworth et al., 2007) and is defined as perseverance in striving for and having a consistent interest in achieving long-term goals. This includes working hard to face challenges and maintaining effort and interest over the long term despite failures, difficulties, and erratic progress (Duckworth et al., 2007). The renewed interest in empirical studies of character in general and the nature of perseverance in particular came with the relatively recent focus on positive psychology (Peterson & Seligman, 2004). Abilities such as perseverance, passion, and integration toward a goal seem to be important in achieving something desirable outside what can be obtained through talent or intelligence (Schmidt et al., 2019).

Grit is important in education (Wu et al., 2022; Xu et al., 2020). Research studies have shown that grit directly affects students' academic achievement (Harpaz et al., 2024). Grit is important in predicting academic success (Clark & Malecki, 2019). Individuals with high grit remain focused on completing their tasks or achievements (Singh & Chukkali, 2021). This is in line with the research results by (Hodge et al., 2018), which found that individuals with high grit showed higher engagement, leading to greater academic achievement. Apart from that, individuals with higher grit will be more persistent in learning and will not give up easily if they experience failure, and if they experience failure, they will be more motivated to strive to achieve better academic achievements (Reed & Jeremiah, 2017).

Duckworth et al. (2007) introduced the construct of grit as having two dimensions: perseverance of effort and consistency of interest. To achieve a certain level of mastery, diligent practice is required, and early failures must be tolerated. This process can take months or even years. In line with their definition of grit, (Duckworth et al., 2007) developed a measuring tool that can be used to measure the construct. They first developed a two-dimensional grit scale with 12 items called the Original Grit Scale (Grit-O) with a five-point Likert scale response format (1 = not at all like me to 5 = very much like me). The Grit-O scale validity test results showed that the model did not have a good fit, with a root mean square of error approximation (RMSEA) value of 0.11 and a comparative fit index (CFI) value of 0.83, against model fit criteria of RMSEA value < 0.06 and CFI > 0.90 (Hu & Bentler, 1999). Therefore, Duckworth et al., (2007) suggested that improvements be made.

Duckworth and Quinn (2009) reviewed the model fit of the Grit-O scale in a validation study. As a result, they deleted four items on the Grit-O scale: two items in the consistency of interest dimension and two items in the perseverance of effort dimension. This new Grit Scale was named the Short Grit Scale (Grit-S). The Grit-S consists of two dimensions—perseverance of effort and consistency of interest. The scale has eight items in total, four for each dimension. The Grit-S uses the same five-point Likert scale response format as the original Grit-O (1 = not at all like me to 5 = very much like me). Duckworth and Quinn (2009) tested the validity of the Grit-S with various studies and showed that the two-dimensional model had statistically better results than the initial Grit-O. Therefore, they recommended that the Grit-S be used to measure perseverance and passion for achieving long-term goals.

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To date, research on the adaptation of Grit-S has been conducted in several countries, for example Japanese version (Nishikawa et al., 2015), Polish version (Wyszyńska et al., 2017), German version (Schmidt et al., 2019), Malaysian version (Tan et al., 2019) Ma, Portuguese version (Frontini et al., 2022), and Chinese version (Du et al., 2024). The results of these studies used factor analysis with confirmatory factor analysis. The results showed that Grit-S has two dimensions and supports the original research. For the Indonesian version of the Grit-S scale, research was previously conducted by Priyohadi et al., (2019) with confirmatory factor analysis (CFA) approach and provided evidence of fit construct validity. However, given that CFA analysis provides limited information, other methodologies can be used to explore information that has not been the focus of CFA. This research provides novelty by using the Rasch model analysis approach.

The Rasch model has the advantage of scale linearity and specific objectivity, where item and person parameters can be separated and do not influence each other (Rasch, 1966). The Rasch model showed a more detailed analysis than CFA by reporting item fit statistics, reliability, and wright map (Natanael et al., 2024). It is argued here that the Indonesian Grit-S, having been well adapted from the original language and validated, will be highly useful for future research on grit in the context of Indonesia, which has ethnic and cultural diversity, and its relationship with other psychological variables. The analysis results in this study are expected to add to the findings of previous studies related to item parameters using the Rasch model perspective.

Methods

Participants

The participants in this study were undergraduate students at several universities in Indonesia. The study participants were 480 students (male: 86, female: 394) aged 17 to 25 years (mean age: 20.05, SD age: 1.32). The number of participants in this study met the minimum requirement for using Rasch analysis, which was 200 participants (Bintang & Suprananto, 2024; Linacre, 1994; Wright, 1977). The sampling method used in this study was non-probability sampling with convenience sampling. The data were collected using an online questionnaire, a Google form, which was disseminated through social media. Participation was voluntary, and no incentives or compensation were given.

Instrument: Indonesian version of the Short Grit Scale (Indonesian Grit-S)

The Grit Scale was developed to measure perseverance and passion for achieving long-term goals. (Duckworth et al., 2007) developed the Original Grit Scale (Grit-O), which consists of 12 items with two dimensions: perseverance of effort and consistency of interest. Duckworth and Quinn (2009) Subsequently, the Grit-O was modified by removing four items: two from the perseverance of effort dimension and two from the consistency of interest dimension. This modified version is called the Short Grit Scale (Grit-S). Hence, the Grit-S consists of two dimensions with eight items in total (four items on each dimension). The Grit-S uses a five-point Likert scale response format (1 = not at all like me to 5 = very much like me). In this study, the Grit-S adaptation process into Indonesian followed the adaptation guidelines described in the Guidelines for the Process of the Cross-Cultural Adaptation of Self-Report Measures (Beaton et al., 2000). The adaptation process was conducted through five stages: translation, synthesis translation, back translation, expert committee, and test of the pre-final version.

During the first stage, translation, the researcher translated the original Grit-S into Indonesian. This translation process involved the Center for Language Studies of Syarif Hidayatullah State Islamic University Jakarta, Indonesia. During the second stage, synthesis, the researcher considered cultural factors when choosing the translation results. The third stage, back translation, involved the process of retranslation to determine whether there was a difference in meaning when the Indonesian Grit-S was translated back into the original language. During the fourth expert committee stage, after proofreading the translation and considering the results of the retranslation, the researcher discussed the results with the content expert. The fifth stage tested the pre-final version, which involved testing the Indonesian Grit-

S on several respondents to determine whether the items in the Indonesian Grit-S could be understood. The final scale produced was called the "Indonesian Grit-S". For more details, the outline of the Indonesian Grit-S scale items can be seen in Table 1, while the item wording can be seen in Table 2.

Table 1. Blueprint Indonesian Grit-S

Dimension	Item		Total
	Favourable	Unfavourable	
Consistency of interest	-	1 2 3 4	4
Perseverance of effort	5 6 7 8	-	4
Number of item			**8**

Sources: Personal data (2025).

Table 2. Indonesian Grit-S items in Original and Indonesian version

No	Original Item	Indonesian Version
1.	I often set a goal but later choose to pursue a different one	*Saya seringkali menetapkan tujuan untuk dicapai, tetapi kemudian memilih untuk mencapai tujuan yang lain*
2.	New ideas and projects sometimes distract me from previous ones	*Ide dan proyek yang baru terkadang mengalihkan perhatian saya dari ide dan proyek sebelumnya*
3.	I have been obsessed with a certain idea or project for a short time but later lost interest	*Saya terobsesi dengan ide atau proyek tertentu dalam waktu singkat, tetapi kemudian kehilangan minat untuk mencapainya*
4.	I have difficulty maintaining my focus on projects that take more than a few months to complete	*Saya mengalami kesulitan dalam mempertahankan fokus pada proyek yang memerlukan waktu beberapa bulan untuk diselesaikan*
5.	I finish whatever I begin	*Saya menyelesaikan proyek yang telah saya mulai*
6.	Setbacks don't discourage me	*Kegagalan tidak akan membuat saya putus asa*
7.	I am a hard worker	*Saya seorang pekerja keras*
8.	I am diligent	*Saya adalah orang yang ulet*

Sources: Personal data (2025).

Data Analysis

Multidimensional Rasch Model

The probabilistic model proposed by Rasch (1960) revolutionized psychometrics (Mair, 2018). It has the advantage of linearity. Additivity and specific objectivity (Embretson & Reise, 2000; Rasch, 1966). This means that a person's ability and the item difficulty can be measured and calibrated on the same interval scale; hence, when calibrating items, the scores do not depend on the ability level distribution. Conversely, when estimating a person's ability, the ability distribution does not depend on item difficulty distribution (Hayat et al., 2020). In other words, objectivity is obtained by comparing two or more objects with the same attribute in the sense that they should not affect each other (Rasch, 1966).

The Rasch model models polytomy data by involving response categories using the Likert scale, called the partial credit model (PCM; De Ayala, 2009; Masters, 1982). The Indonesian Grit-S has a multidimensional factor structure with two dimensions: consistency of interest and perseverance of effort. The analysis in this study used the multidimensional Rasch model approach (Shih et al., 2013) because correlations between dimensions can be determined (Rahayu et al., 2022). The multidimensional Rasch model is a generalization of the simple Rasch model (Rasch, 1960) and the Rasch polytomy model (e.g. Masters, 1982). Hence, the model used was the multidimensional partial credit model (MPCM) approach.

The analysis used the ACER Conquest 5.13 program with the marginal maximum likelihood (ML) estimation method for item parameter calibration and the Monte Carlo-based approach with 3000 nodes for person parameters. This type of analysis was conducted to obtain information about the item fit. Testing fit items in the Rasch model means examining the infit mean square (MNSQ) and outfit MNSQ

values (Linacre, 2018). The acceptable infit and outfit values were between 0.6 and 1.4, which indicated that the Indonesian Grit-S with Likert scale items had a suitable measurement model (Wright & Linacre, 1994). Values outside this criterion indicate a lack of compatibility between the items and the model (DiStefano et al., 2019). The Rasch analysis also produced information about the person separation reliability for each dimension of the Indonesian Grit-S in the form of plausible values (PVs). These results estimate how items can distinguish a person's abilities, and a reliability value of > 0.70 is considered acceptable (Fauth et al., 2019; Tennant & Conaghan, 2007).

Results and Discussion

Results

Descriptive Statistics

Before conducting a CFA analysis, the assumption of normality is checked by examining the mean value, standard deviation (SD), and skewness of the response distribution of each item. If this assumption is met, the data is assumed to be a continuous variable. The normality assumption is fulfilled when the skewness value ranges from -1 to 1 or even -2 to 2 (Ahmed et al., 2022; Muthén & Kaplan, 1985). Based on the results in Table 3, the Indonesian Grit-S met the normality assumption and CFA analysis could be conducted.

Table 3. Descriptive Statistics for Indonesia Grit-S

No.	Dimension	Item	Mean	SD	Skewness
1.	Consistency of interest	item1	2.846	0.821	-0.027
		item2	2.763	0.849	0.001
		item3	2.817	0.963	-0.049
		item4	2.754	0.887	0.087
2.	Perseverance of effort	item5	3.844	0.698	-0.405
		item6	4.160	0.790	-0.597
		item7	3.960	0.794	-0.355
		item8	3.694	0.791	-0.083

Sources: Personal data (2025).

Factor Structure: Dimensionality

First, the factor structure of the Indonesian Grit-S was examined using Mplus 8.4 software with the ML estimation method. The results confirmed that the two-factor structure of the scale was in line with the original structure of the Grit-S (see Duckworth & Quinn, 2009): Chi-square = 26,761, df = 19, p = 0.1103, CFI = 0.991, TLI = 0.987, SRMR = 0.032, and RMSEA = 0.029 (90% CI = 0.000, 0.053). Based on the results of this model, the Indonesian Grit-S shows that the model fits the data. In addition, all items in the scale are valid such that they had a positive loading factor value in the range of 0.423 –0.876 with a p-value < 0.01. For more details, please see Table 4.

Table 4. Loading factor Indonesian Grit-S

No.	Dimension	Item	Factor Loading	Standard Error	z-value	p-value
1.	Consistency of Interest	item1	0.514	0.042	12.295	0.000
		item2	0.615	0.038	16.200	0.000
		item3	0.745	0.034	21.870	0.000
		item4	0.686	0.035	19.490	0.000
2.	Perseverance of Effort	item5	0.423	0.043	9.733	0.000
		item6	0.579	0.036	16.077	0.000
		item7	0.876	0.029	30.465	0.000
		item8	0.695	0.032	21.848	0.000

Sources: Personal data (2025).

Item Difficulty Levels, Fit Statistics, and Step Parameters

The calibration of items on the Indonesian Grit-S scale was conducted using the MPCM approach. Table 5 shows the calibration results of the scale, including the item difficulty levels, fit statistics, and step parameters. The item difficulty levels were in the range of -0.728 to 1.034 logits. This means that the easiest item to approve was item 6 (Kegagalan tidak akan membuat saya putus asa), while the hardest item to approve was item 5 (Saya menyelesaikan proyek yang telah saya mulai). In addition, all the items fit with the MPCM Rasch model, meaning that no items were misfit; this was because all the items had an infit and outfit MNSQ values within the recommended criteria of 0.6 to 1.4 logit. None of the items showed irregular step parameters because all the step parameter thresholds were sorted from lowest to highest value, although there was an empty threshold for Item 5. However, based on the evidence, it was concluded that the items on the Indonesian Grit-S function well.

Table 5. Item parameter and fit statistics of Indonesian Grit-S

Dimension	Item	Measure	Infit MNSQ	Outfit MNSQ	Step 1	Step 2	Step 3	Step 4
Consistency of Interest	Item 2	0.119	1.00	1.01	-3.631	-1.184	0.784	4.031
	Item 4	0.037	0.97	0.97	-3.512	-0.902	0.663	3.751
	Item 3	-0.026	0.95	0.95	-3.058	-0.866	0.260	3.664
	Item 1	-0.130	1.10	1.10	-3.651	-1.262	1.055	3.858
Perseverance of Effort	Item 5	1.034	1.17	1.16	NA	-2.609	-0.555	3.164
	Item 8	0.059	0.97	0.97	-3.721	-1.536	1.378	3.879
	Item 7	-0.365	0.83	0.84	-2.948	-1.565	1.049	3.464
	Item 6	-0.728	1.04	1.04	-2.509	-1.587	1.009	3.087

Sources: Personal data (2025).

Correlation Between Dimensions: MPCM Results

Table 6 shows the correlation matrix for the two dimensions of the Indonesian Grit-S using the MPCM approach. The correlation estimates considered the suitability of the data to the two-dimensional Indonesian Grit-S model. The results of the MPCM analysis showed that the correlation between the dimension of Indonesian Grit-S had a positive direction with a value of 0.578. The correlation pattern is generally consistent with grit theory, i.e., the dimensions are statistically significantly and positively correlated.

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Table 6. Correlation between dimensions: MPCM

Dimension	Consistency of Interest	Perseverance of Effort
Consistency of Interest	1	0.578
Perseverance of Effort	0.578	1

Sources: Personal data (2025).

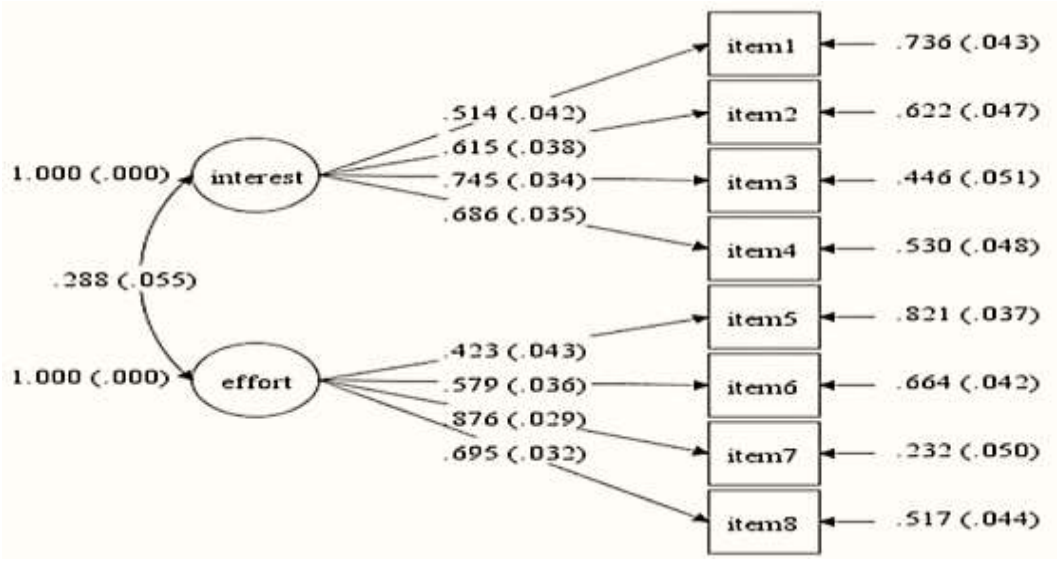
Wright Map

A Wright map shows the location of a person's measurements and the calibration of items on the same scale. In the Rasch model, the average difficulty level of an item is 0.00 (Bond & Fox, 2015). In the MPCM Rasch model, item and person parameters are calibrated to be on the same metric so that in one dimension, all the approximate parameters of the model can be compared at the same scale (Liu et al., 2008). Because the Indonesian Grit-S structure has two dimensions, the resulting Wright map describes the ability level of each dimension and one distribution of item parameters (see Figure 2).

Based on the Wright map, the average person's abilities varied in each dimension. This shows that the Indonesian Grit-S factor structure is indeed multidimensional. In addition, the analysis results show that the "consistency of interest" dimension seemed more challenging for most respondents, while the "perseverance of effort" dimension seemed easy for most respondents to complete.

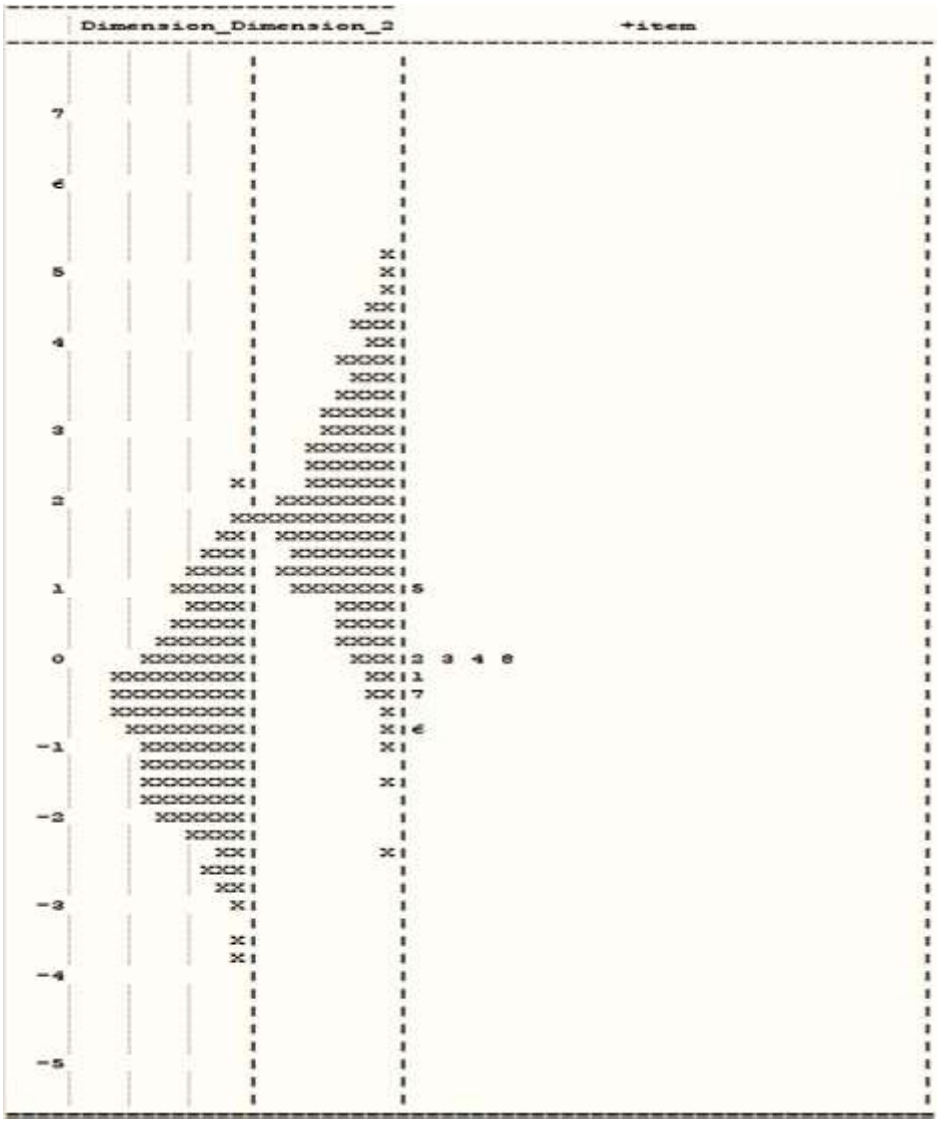
Reliability

The Rasch model has a reliability coefficient developed by Wright and Masters (1982) and has a different concept from classical test theory (e.g., Cronbach's alpha). EAP/PV reliability was used to indicate the internal consistency of all dimensions of the Indonesian Grit-S. It showed that the reliability value of the first dimension, consistency of interest, was 0.742, while the reliability of the second dimension, perseverance of effort, was 0.738. From these results, it was concluded that all the dimensional reliability coefficients of the Indonesian Grit-S were excellent because they met standard criteria, namely > 0.70 (Fauth et al., 2019; Geldenhuys & Bosch, 2020; Tennant & Conaghan, 2007).



Sources: Personal data (2025).

Figure 1. Path diagram, model fit Indonesian Grit-S



Sources: Personal data (2025).

Figure 2. Wright map Indonesian Grit-S

Discussion

The construct of "grit" was developed to assess perseverance and passion for long-term goals. This study contributes to the literature by evaluating a newly developed version of the Grit-S, the Indonesian Version of the Grit-S. This study used the Rasch model to validate the psychometric properties of this new scale, which is multidimensional. Before the Rasch analysis was conducted, CFA analysis was used to confirm the factor structure of the Indonesian Grit-S. The CFA results show that the Indonesian Grit-S supports the theorized two dimensions of grit: Chi-square = 26.761; df = 19; CFI = 0.991; TLI = 0.987; SRMR = 0.032; and RMSEA = 0.029 (90% C.I. = 0.000, 0.053). This evidence confirms the original factor structure of the Grit-S (Duckworth & Quinn, 2009) and supports the use of Rasch MPCM data. The results of this study are supported by research in different cultural contexts (Du et al., 2024; Frontini et al., 2022; Nishikawa et al., 2015; Schmidt et al., 2019; Wyszyńska et al., 2017).

From a methodological perspective, this study provides an example of applying Rasch-based analysis models suitable for analyzing multidimensional data. Although the primary assumption of the Rasch model is unidimensionality (Reckase, 2009), in this study, the Rasch multidimensional model (the MPCM) was used (Adams et al., 1997). This model was considered more accurate than Rasch's unidimensional model for assessing the measurement properties of the Indonesian Grit-S. This also followed the suggestion from a previous study of Grit-S that suggested the need for sophisticated methods

(Priyohadi et al., 2019). Multidimensional models can calibrate all dimensions simultaneously and improve measurement accuracy by considering the correlations between dimensions (Yan & Mok, 2012). The Rasch multidimensional analysis results supported the Indonesian Grit-S correlation pattern, which showed a significant positive correlation. These results are supported by previous studies conducted by (Duckworth & Quinn, 2009), as well as (Tan et al., 2019) and (Du et al., 2024).

In terms of item suitability, all Indonesian Grit-S items followed the Rasch model, where the infit and outfit MNSQ values were in the range of 0.6 to 1.4 logits (Wright & Linacre, 1994). This was also supported by the results of the CFA analysis, where all items of the Indonesian Grit-S were valid, with a positive factor loading value in the range of 0.423 to 0.876 and a significance value of $p < 0.01$. Regarding item difficulty, for the consistency of interest dimension, item difficulty ranges from -0.130 to 0.119 logits. The easiest item to agree with is item number 1 (Saya seringkali menetapkan tujuan untuk dicapai, tetapi kemudian memilih untuk mencapai tujuan yang lain) with an item difficulty level of -0.130. While the most difficult item to agree with is item 2 (Ide dan proyek yang baru terkadang mengalihkan perhatian saya dari ide dan proyek sebelumnya) with a difficulty level of 0.119 logits. For the perseverance of effort dimension, item difficulty ranges from -0.728 to 1.034 logits. The easiest item to agree on is item number 6 (Kegagalan tidak akan membuat saya putus asa), with an item difficulty level of -0.728 logit. The most difficult item to agree with is item 5 (Saya menyelesaikan proyek yang telah saya mulai) with a difficulty level of 1.034 logit.

All the response categories functioned well regarding item category functioning because the thresholds were sequential and presented in an orderly. However, Item 5 returned an empty category of responses. This means that the item was too tricky to disapprove, and it was difficult to achieve a zero response because the item wording was highly positive. The Indonesian Grit-S has an optimal internal consistency value for each dimension. The EAP/PV reliabilities were 0.742 for the consistency of interest dimension and 0.738 for the perseverance of effort dimension. We thus concluded that the Indonesian Grit-S has sufficient internal consistency (Fauth et al., 2019; Geldenhuys & Bosch, 2020; Tennant & Conaghan, 2007).

A limitation of this study is that the sample consisted only of undergraduate students. Hence, the theoretical scope and generalization of grit in this study are relatively narrow, even though grit has been studied in various age groups and from the early stages of cognitive development. Based on this limitation, the findings regarding the psychometric characteristics of the Indonesian Grit-S only apply to samples with the same characteristics as examined here. Therefore, further studies are needed with other age groups and sample characteristics. In addition, this study did not conduct a measurement invariance test to determine whether the items applied equally to men and women.

Conclusion

This research is the first study to test the psychometric properties of the Indonesian version of the Grit-S Scale with the Rasch model. The results showed that the Indonesian Grit-S is multidimensional and supports the factor structure of the original Grit-S development. In addition, the Indonesian Grit-S has good psychometric properties, and all items fit the Rasch model and are reliable. The Indonesian Grit-S can be recommended for use in research assessing the grit of Indonesian students. In addition, these findings should be confirmed using other samples, such as employees, to verify that a wider sample character can support the multidimensional model.

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Conflict of Interest

The authors declare that there are no conflicts of interest to the authorship of this paper.

Authors Contribution

All authors contributed to the manuscript. N: writing original draft, Methodology, Software and analysis, Data Collection, Review, and editing. RSB: writing original draft, Methodology, Software and analysis, Data Collection, Review. KZ: writing original draft, Data Collection, Review. DM: writing original draft, Data Collection, Review.

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