The Indonesian version of the Life Orientation Test-Revised (LOT-R): Psychometric properties based on the Rasch model

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Abstract: This study aimed to validate the Indonesian version of the Life Orientation Test-Revised (LOT-R), a scale used to measure optimism. Despite being adapted in over 20 countries, its validation and adaptation reports are unavailable. This study used the rating scale model to evaluate its psychometric characteristics. The instrument was tested on 584 Indonesian high-school students aged 14 to 18 years (mean age: 16.02; SD: 1.39; 54.5% female and 45.5% male). The results indicated that the LOT-R's factor structure was unidimensional, based on the evidence from the Rasch analysis combined with a confirmatory factor analysis. Further, no local item dependence was identified. Based on the item fit statistics, all items fit the model. Nonetheless, their response categories functioned well, and the scale could reliably separate persons based on their optimism level; however, it had limitations regarding item reliability and separation because of the low number of items. Moreover, no differential item functioning was found based on gender and school type. Overall, the results indicated that this 6-item scale, including its psychometric properties, was satisfactorily reliable and valid to measure optimism.

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PUBLIC INTEREST STATEMENT

The research investigates the psychometric properties of the Indonesian translation of the Life Orientation Test-Revised (LOT-R) in a middle school samples. This is done within the framework of Rasch measurement models. This study is the first validity study of these adapted questionnaire. The findings from this study indicated that the items in the Indonesian LOT-R were generally adequate and appropriate for the measurement of dispositional optimism in Indonesian student samples. However, there are limitations to this research, where the importance of these limitations makes it necessary to replicate this study in order to implement methodological improvements in relation to the scale.
in student samples, based on the Rasch analysis measurement standards. Implications and suggestions for future research have also been discussed.

**Subjects:** Quantitative Methods; Factor Analysis, SEM, Multilevel & Longitudinal Modeling; Testing, Measurement and Assessment

**Keywords:** confirmatory factor analysis; Life Orientation Test-Revised; optimism; Rasch model; rating scale model; validation

1. Introduction

Optimism is an individual difference variable that reflects the extent to which people hold generalized favorable expectancies for their future (Carver et al., 2014). Optimists are individuals who expect good things to happen to them, while pessimists are those who presume the contrary (Carver & Scheier, 2014). The concept of optimism has a long history of research, especially in the field of positive psychology (e.g., Scheier & Carver, 1985; Scheier et al., 1994), which has grown in recent decades globally.

Indonesia, the largest archipelago in Southeast Asia, is a nation that encompasses extremely diverse cultural traditions, with over a thousand tribes living across different islands (Muluk et al., 2018). Therefore, Bahasa (an Indonesian language) serves as a unifier of the entire society. Thus far, Indonesia has been a part of optimism studies conducted in 95% of the world’s population (Gallagher et al., 2013). A study found that optimism and its relation to the educational context could be a new Indonesian ideology (Gellert, 2015), where optimism is also considered to be “the future of Indonesian Muslim students” (Muniroh et al., 2020). Furthermore, a descriptive study reported that Indonesian students have a moderate to high level of optimism (Augustiya et al., 2019; Umboh et al., 2020). However, the latest studies have many methodological limitations, especially in terms of the measurement aspects of optimism. Since optimism is a latent construct, measurement tools are essential, as in any social and behavioral research; therefore, their Indonesian versions are valuable to capture the culturally diverse country.

Dispositional optimism is defined as a continuum in which pessimism and optimism are bipolar, meaning that this construct is an attribute with two extreme variables—optimism and pessimism (Carver & Scheier, 2014; Scheier et al., 1994). The Life Orientation Test was developed to measure it (Scheier & Carver, 1985), and after some advancements and revisions on its items, the Life Orientation Test-Revised (LOT-R) was developed (Scheier et al., 1994); thus far, it is one of the most widely used instruments in a broad range of areas in psychology (Chiesi et al., 2013; Gustems-Carnicer et al., 2017; Jovanovic & Gavrilov-Jerkovic, 2013). Many previous studies have assessed its psychometric characteristics across several languages and cultures.

Over the last two decades, the LOT-R has been used and adapted in several languages worldwide, such as Arabic (Aitcheson et al., 2017), Chinese (Lai & Yue, 2000), Dutch (Schotanus-Dijkstra et al., 2019), Finnish (Ylostalo et al., 2003), French (Vautier et al., 2003), German (Glæsmer et al., 2012), Greek (Lyarakos et al., 2010), Italian (Chiesi et al., 2013), Japanese (Sumi, 2004), Jordanian (Khallad, 2010), Korean (S. R. Kim & Lee, 2018), Malay (Abdullah et al., 2017), Norwegian (Schou-Bredal et al., 2017), Portuguese (Bastianello et al., 2014), Serbian (Jovanovic & Gavrilov-Jerkovic, 2013), Spanish in Latin America (Zenger et al., 2013), Spanish in Spain (Cano-Garcia et al., 2015), and Thai (Gooren et al., 2013).

The findings from numerous studies have revealed the necessity of incorporating the cultural differences of various countries when researching optimism (Jovanovic & Gavrilov-Jerkovic, 2013), especially for the ones with a large population and broad geographical areas, such as Indonesia.
The latest researches conducted using the LOT-R in Indonesia found a consistently moderate to high level of optimism among Indonesian students (Augustiya et al., 2019; Umboh et al., 2020). However, these studies provided inadequate evidence for the construct validity or the adaptation procedure, utilized a relatively small sample size (N = 98–100), and also had a methodological limitation since they used only descriptive statistics. Thus far, no study has reported the evidence of the Indonesian LOT-R being psychometrically sound.

From a methodological perspective, the present research used various methods to evaluate the psychometric characteristics and factor structure of the LOT-R, such as an exploratory factor analysis (EFA) (e.g., Lyarakos et al., 2010; Sumi, 2004), a confirmatory factor analysis (CFA) (e.g., Cano-Garcia et al., 2015; Jovanovic & Gavrilov-Jerkovic, 2013), and polytomous item response theory (IRT) (e.g., Chiesi et al., 2013; Steca et al., 2015). The current psychometric practice encourages the use of the Rasch model to provide additional information about item and sample characteristics (DiStefano et al., 2019). This allowed overcoming the classical test theory’s (CTT’s) limitations and provided a different perspective from that of a factor analysis (Ewing et al., 2005). This resulted in person and item parameters being on the same metric of logits for the estimation of ability and item difficulty, permitting a total score use for non-specialists (Saggino et al., 2020). Thus far, no research has been carried out on the evaluation of the LOT-R using the Rasch model. Thus, by using this model, we will be able to provide novel evidence for the measurement quality of the LOT-R, which has previously been analyzed using factor analysis or IRT.

In this study, we aimed to evaluate the psychometric properties of the Indonesian version of the LOT-R, based on a polytomous Rasch measurement model. We examined its capacity to adequately assess optimism in Indonesian high-school students by using this model, in terms of dimensionality assessment, item fit, response category functioning, reliability, and differential item functioning (DIF). We believe that a well-adapted and well-validated Indonesian version of this scale will be beneficial for future research on optimism in the Indonesian context, which is an extremely diverse cultural nation.

1.1. The Rasch measurement model
The Rasch model was developed by George Rasch to analyze dichotomous data (Rasch, 1960). It enables the modeling of specific response probabilities, in terms of more precise items as the logistic functions, derived from the differences between a person’s abilities and item difficulties (Bond & Fox, 2015). Thus, it allows researchers to understand response attitudes as separate parameters that are estimated for persons and items (Andrich & Marais, 2019), where both parameters are calibrated using a general interval through the Rasch analysis. This enables a direct comparison, as well as devises invariant characteristics from the parameters (Tennant & Conaghan, 2007), known as the Rasch model’s specific objectivity, parameter separation, and additive properties (Wright & Masters, 1982).

The Rasch model can be used to analyze polytomous data with the rating scale model (RSM) (Andrich, 1978) and the partial credit model (Masters, 1982). The RSM was considered suitable for this study because of its Likert response format, and the LOT-R has an equal number of response categories for all items, further supporting its use. The application of the RSM includes persons’ abilities, items’ locations, and the thresholds from each category as the parameters in a logit scale (Andrich & Marais, 2019). The threshold value is \( k = 1 \) (number of categories minus one, resulting in four thresholds in the LOT-R). Within the context of the RSM, the person’s location may be interpreted as a trait level, and that of the item may be interpreted as the “difficulty” of endorsing it (Andrich, 1978).

As a part of the Rasch measurement model, three fundamental assumptions must be fulfilled in using RSM, namely, (1) the unidimensionality of the latent trait, (2) parallel item characteristic
curves, and (3) local independence, which means that given a person's parameter, item responses become independent (Mair, 2018). The absence of DIF is also an important aspect of the Rasch analysis (Christensen & Kreiner, 2010).

Moreover, while LOT-R is theoretically unidimensional and has a bipolar construct (e.g., Carver & Scheier, 2014; Chiesi et al., 2013; Steca et al., 2015) that fulfills the unidimensionality requirement of the Rasch measurement (Wright & Masters, 1982), the debate over its dimensionality remains unsolved (Schou-Bredal et al., 2017). Unidimensional measures, as per the Rasch model, are more appropriate for statistical analyses because the differences between participants’ scores are interval-scaled, and the total score is an adequate representation of the construct measured by the scale used (Saggino et al., 2020). Therefore, in this study, we hypothesized a unidimensional model of the Indonesian LOT-R.

2. Methods

2.1. Participants

A total of 584 senior high-school students (318 females and 266 males) from the Special Capital Region of Jakarta, Indonesia, belonging to heterogeneous grades (148 in the 10th grade, 25.3%; 338 in the 11th grade, 57.9%; 98 in the 12th grade, 16.8%), completed the Indonesian LOT-R. A nonprobability sample was drawn from 30 schools, comprising 2 types of high schools (373 from a public high school, 63.9%; and 211 from a private high school, 36.1%), with a quota of 600 respondents (20 students from each school), resulting in a response rate of 97.34%. The mean age of these students was 16.02 years (SD = 1.39). Their participation was voluntary. Informed consent was obtained from all subjects to adhere to the school administration procedures.

2.2. Instrument: the Indonesian version of the LOT-R

The Indonesian version of the LOT-R (Scheier et al., 1994) is a translated adaptation of the original one, an instrument used to measure dispositional optimism. The LOT-R comprises 10 items scored on a 5-point Likert scale, ranging from 0 (strongly disagree) to 4 (strongly agree). Out of the 10 items, 4 are not scored (items 2, 5, 6, and 8), and the remaining 6 comprise 3 positive and negative statements each. The raw score was calculated by adding the optimism item scores and the reversed pessimism item scores, resulting in a single construct (dispositional optimism). Scores ranged from 0 to 24, with higher scores indicating greater optimism, and lower scores indicating lower optimism (pessimism).

In this study, we followed Gudmundsson's (2009) adaptation guideline. In the first phase, the LOT-R was translated to an Indonesian language by an expert of English Literature from the Centre for Language Development, Syarif Hidayatullah State Islamic University, Jakarta, Indonesia. Thus, we obtained a certified translated version of the scale. In the second phase, the authors translated this version back into English to identify any differences in meaning. In the last phase, after correcting the translation by considering the results of the reverse translation, we discussed the results with content experts, namely two lecturers who specialized in Educational Psychology and Counselling and Psychometrics, resulting in the final version of the Indonesian LOT-R.

2.3. Statistical analysis

Since the RSM was adopted for this study, we examined the extent to which the empirical data corresponded to that of the RSM. The Indonesian LOT-R was analyzed to fulfill the unidimensionality assumption, local independence, the Rasch item measure, and fit statistics. It included a graphical representation using the Wright maps, rating scale diagnostics, reliability and separation indices, and a DIF analysis based on gender and school type. WINSTEPS (ver. 3.65) was used to conduct the RSM
analysis using an unconditional maximum likelihood estimator. In addition to the dimensionality assessment, a CFA was performed using Mplus 8.4 and a robust maximum likelihood estimator.

2.3.1. Unidimensionality and local independence
Unidimensionality is an important assumption in the Rasch model’s application because its violation could cause biased parameter estimation (Chou & Wang, 2010). In this research, unidimensionality was tested using the principal component analysis of a standardized residual (PCAR; Smith, 2002) to ensure that the scale met this requirement of the model. Based on the PCAR, a large Rasch dimension, with approximately 40% of the variance explained, provided sufficient unidimensionality (Holster & Lake, 2016); the eigenvalue of the first contrast was not greater than 1.5 as the critical value of the unidimensionality violations (Smith, 2002).

In addition, we used a CFA to examine the factor structure of the scale. We hypothesized a one-factor model fit to the data, fulfilling the unidimensionality requirement of the Rasch model. This was assessed using the four indices of model fit, comprising a comparative fit index (CFI) and a Tucker–Lewis index (TLI), where descriptive index values > 0.90 were indicative of an acceptable model fit, and values > 0.95 reflected a good model fit. Standardized root mean square residual (SRMR) and root mean-square error of approximation (RMSEA) fit index values < 0.08 were indicative of an acceptable model fit, and values < 0.05 reflected a good model fit (Wang & Wang, 2019; Xia & Yang, 2019).

After the unidimensionality assumption was fulfilled, the second assumption tested was local independence that underpins the Rasch model. It implies that once the Rasch factor has been extracted, that is, the main scale, there should be no leftover patterns in the residuals (Tennant & Conaghan, 2007). In this research, the standardized residual correlation was used to test this assumption, with its value for each item pair being > 0.30 in a positive direction, indicating violations of local independence (Saggino et al., 2020).

2.3.2. Item fit and the Wright map
Subsequently, we analyzed the item fit to the Rasch model using the infit and outfit mean-squares (MNSQs). The expected value for the two was 1.0, with acceptable value ranges of 0.5 to 1.5, meaning that those outside the items did not fit to the Rasch model (Linacre, 2018). Furthermore, the point-measure correlation (PT-measure) value had to be observed to understand the compatibility aspect between the model and the data, with negative values indicating that the item was not functioning adequately (Saggino et al., 2020).

2.3.3. Rating scale diagnostics
The rating scale diagnostics using the RSM were employed to evaluate how well each category that formed a group of responses functioned to create scales that could be interpreted (S. Kim & Kyllonen, 2006). In this study, we followed several recommendations to ensure that the response category functioning comprised (1) a minimum of 10 observations for each category, (2) average measures advancing monotonically with the category, and (3) an outfit MNSQ that was less than 2.0, indicating that the response categories were well-functioning (Linacre, 1999).

2.3.4. Reliability and separation indices
Reliability in the Rasch model is different from the CTT, where it is estimated for both persons and items (S. Kim & Kyllonen, 2006). Person reliability and separation indicate internal consistencies and how efficiently a set of items can separate the persons measured. Item reliability and separation indicate how well items are separated by the person taking the test (Wright & Masters, 1982), with reliabilities of > 0.70 considered as acceptable, and a separation of 1.5 being an adequate value (Tennant & Conaghan, 2007). To compare the Indonesian version with
other languages' versions of the LOT-R (e.g., a meta-analysis of coefficient alpha), we also reported Cronbach’s alpha (α), with an acceptable threshold value of 0.70 (Cortina, 1993).

2.3.5. DIF analyses

DIF is potentially problematic in general for measurement tools because it points to items in them that perform differently across sample characteristics (Smith et al., 2016). In this study, we conducted a Rasch-based DIF evaluation for two types of subgroups (female vs. male and public school vs. private school). In this procedure, item location parameters were estimated individually for a reference group and focal groups through logistic regression. Subsequently, the differences in item difficulties across the groups could be tested for significance using the Welch t-statistics and inspecting the size of logit differences (DIF effect size), where a significant value for the two should be greater than 0.40 logits, indicating a DIF (Choi et al., 2006; Smith et al., 2016).

![Figure 1. One-factor CFA model of Indonesian LOT-R.](image)

**Table 1. Standardized residual correlation for all item pairs**

| Item | 1   | 3   | 4   | 7   | 9   | 10  |
|------|-----|-----|-----|-----|-----|-----|
| 1    | 1   |     |     |     |     |     |
| 3    | −0.34 | 1   |     |     |     |     |
| 4    | −0.21 | −0.21 | 1   |     |     |     |
| 7    | −0.22 | −0.11 | −0.22 | 1   |     |     |
| 9    | −0.10 | −0.15 | −0.18 | −0.24 | 1   |     |
| 10   | −0.20 | −0.20 | −0.24 | −0.15 | −0.22 | 1   |

Note: Standardized residual = (observed—expected)/(model standard error).
Table 2. Item measures and fit statistics for the Indonesian LOT-R

| Item | Item wording | Measure | Infit | Outfit | PT-measure |
|------|--------------|---------|-------|--------|------------|
| 9    | Saya jarang mengantungkan harapan pada hal-hal baik yang terjadi pada diri saya | 0.06    | 0.80  | 0.80   | 0.70       |
| 7    | Saya jarang sekali mengharapkan sesuatu terjadi sesuai keinginan saya | 0.05    | 0.90  | 0.87   | 0.68       |
| 1    | Dalam situasi yang tidak menentu, saya biasanya berharap yang terbaik | 0.03    | 1.19  | 1.12   | 0.68       |
| 10   | Secara keseluruhan, saya berharap akan lebih sering mengalami sesuatu yang baik dibandingkan sesuatu yang buruk | 0.01    | 1.05  | 0.99   | 0.68       |
| 4    | Saya selalu optimis tentang masa depan saya | −0.04   | 1.03  | 1.04   | 0.65       |
| 3    | Jika terdapat hal buruk yang akan menimpa saya, maka hal tersebut akan terjadi | −0.11   | 1.04  | 0.99   | 0.62       |

Note: Measure = the estimate of the item difficulty; Infit & outfit = a mean-square statistic; PT-measure = The correlation between the observations and the Rasch measures.

3. Results

3.1. Unidimensionality

The Rasch PCAR showed that the Rasch RSM accounted for 46.1% of the variance (5.1 in eigenvalues unit) in the observations, barely meeting the predefined criteria, with the unexplained variance in the first contrast being 12.8% (1.4 in eigenvalues unit). We concluded that the unidimensionality assumption of the Indonesian LOT-R was fulfilled. Additionally, the CFA result indicated that the unidimensional model, according to the hypothesized model and the scale’s original structure, was confirmed because the values of the indices were above the acceptable threshold ($\chi^2$ (9) = 18.149, $p < 0.050$; RMSEA = 0.042 (90% CI = 0.011–0.069), CFI = 0.985, TLI = 0.976, SRMR = 0.024).

Thus, based on the RMSEA, CFI, TLI, and SRMR, the results indicated that the unidimensional model was satisfactory and provided representations of the underlying structure of our unidimensional construct. All items loaded significantly (ranging from 0.52 to 0.65) in relation to the optimism factors, at a $p < 0.01$ significance level. The complete standardized results of this model can be seen in Figure 1. This finding was also in line with those from the Rasch PCAR that supported the use of the RSM in terms of requiring a unidimensional factor structure.

3.2. Local independence

The local independence assumption test result showed that there were no item pairs with a positive residual correlation (see Table 1). The highest correlation in a negative direction of −0.34 occurred in the pair of items 1 “Dalam situasi yang tidak menentu, saya biasanya berharap yang terbaik” and 3 “Jika terdapat hal buruk yang akan menimpa saya, maka hal tersebut akan terjadi.” Both of the
items contained opposite Indonesian words (baik—good and buruk—bad) and still correlated, even though the score of item 3 (pessimism) was reversed, indicating the contrary of local dependence. Considering that the standardized residual correlation for each item pair was not > 0.30 in a positive direction, it could be concluded that no items experienced local dependence.

3.3. Item measure, fit statistic, and the Wright map
Table 2 presents the item-level statistics from the Indonesian version of the LOT-R, such as the items' difficulty levels (item measure), item fit statistics (infit and outfit MNSQs), and PT-measure. As seen in Table 2, all the LOT-R items showed an outfit with acceptable values (0.5 to 1.5). Thus, there were no misfit items, showing that all Indonesian LOT-R items fit to the Rasch RSM. The item measure fell within a relatively narrow value range (~0.11 to 0.06 logit) because of the low number of items (6 items) and the constraint of the mean item difficulty (equalled zero).

Item 3, “Jika terdapat hal buruk yang akan menimpa saya, maka hal tersebut akan terjadi,” with the lowest measure of ~0.11, was most likely to receive the “strongly agree” response. Meanwhile, the least likely item to receive it was item 9, “Saya jarang mengantungkan harapan pada hal-hal baik yang terjadi pada diri saya,” with its location on the 0.09 logit. In this research, all the PT-measures in the Indonesian version of the LOT-R instrument showed a positive correlation ranging from 0.62 to 0.70. This finding indicated that all the items in this measure functioned well and in the expected (positive) direction.

From the information gained regarding the items' parameter estimation results, the Wright map was used to compare the relation between the respondents' “latent trait” levels and the items' difficulties on the same logit scale. The Wright map utilized for the Indonesian LOT-R is shown in Figure 2.

As observed in Figure 2 above, the respondents' average level of optimism was ~0.30 logit (SD = 1.02), which was below the mean of the item measure (mean = 0; SD = 0.06). The highest value obtained from the respondents was 2.56 logit, while the lowest was ~2.92 logit. Based on Figure 1, the distribution of the person measure far exceeded the item distribution, which was
When compared with item 3, which had the lowest value of −0.11, 65.2% of the respondents had a person measure below −0.11. This showed that Indonesian students' optimism tends to be lower as compared to the attitudes measured in the LOT-R.
### Table 3. Threshold and fit statistics of the response format

| Category           | Threshold | Observed Average | Observed count (%) | Infit  | Outfit |
|--------------------|-----------|------------------|--------------------|--------|--------|
| Strongly Disagree  | None      | −1.03            | 775 (22)           | 1.01   | 1.00   |
| Disagree           | −1.18     | −0.64            | 1113 (32)          | 0.92   | 0.90   |
| Neutral            | −0.09     | −0.28            | 792 (23)           | 0.98   | 0.84   |
| Agree              | 0.63      | 0.39             | 399 (11)           | 0.90   | 0.95   |
| Strongly Agree     | 0.64      | 1.20             | 425 (12)           | 1.13   | 1.08   |

Note: Category = label of the category in data set; Threshold = the relationships between adjacent categories, and correspond to the points where adjacent category probability curves cross; Observed Average = the average of the (person measures—item difficulties) that are modeled to produce the responses observed in the category; Observed count (%) = the count (percentages) of occurrences of this category; Infit & Outfit = a mean-square statistic.

3.4. Rating scale diagnostics

Table 3 shows that the threshold for all response categories monotonically increased, and there was no disordered threshold. The respondents with high levels of optimism were more inclined to endorse the higher categories (“strongly agree” or “agree”), whereas those with low levels of optimism (pessimism) were more likely to endorse the lower ones (“strongly disagree” or “disagree”).

We also found that there was no category with an observed count of < 10, and the infit and outfit statistics for all four response categories were within the acceptable ranges (< 2.0). Thus, the threshold for each response category of the Indonesian LOT-R functioned well. The categories’ response curves are shown in Figure 3.

3.5. Separation index and reliability

In terms of the person and item reliabilities of the Indonesian LOT-R, the former was 0.73, indicating that the instrument could differentiate between low and high optimism levels of a person, where the person separation index was 1.63 in the standard error unit. This could be used to classify persons, and demonstrate an acceptable separation among them. The item reliability was 0.42, with an item separation index of 0.84. These values were very low, indicating a narrow range of item measures, since the LOT-R has six items. Moreover, regarding our sample, the Cronbach’s \( \alpha \) for the Indonesian LOT-R was 0.76, indicating acceptable internal consistency.

3.6. The DIF analysis

The results of the DIF analyses for the Indonesian LOT-R items were found to be satisfactory. On the basis of the Rasch-based DIF analysis, no significant DIFs for any of the items across the two subgroups (gender and school type) were found. This result indicated that the scale functioned similarly in the two gender groups (female vs. male), with the DIF effect size range = 0.00–0.16, and the school types (public vs. private), with a DIF effect size range = 0.00–0.14; this was because the items had non-significant item difficulty differences across the two groups, and there was no DIF effect size greater than 0.40.

4. Discussion

This study has contributed to the literature by being the first to evaluate the psychometric properties of the LOT-R items’ scores by using the Rasch analysis. It has provided a novel analysis method of the scale, compared to the other procedures used. The Indonesian LOT-R has also shown to have good psychometric characteristics.
The unidimensionality and local independence assumptions of the Rasch model were fulfilled; the former assumption was confirmed based on the findings from the Rasch PCAR that was in line with the original factor structure of the LOT-R (Carver & Scheier, 2014) and the results from the IRT (Chiesi et al., 2013; Steca et al., 2015). However, it opposed the study that suggested a two-factor model of optimism (e.g., Gustems-Carnicer et al., 2017), favoring two relatively independent dimensions of optimism and pessimism (Jovanovic & Gavrilov-Jerkovic, 2013). In addition to the statistical evidence for unidimensionality, the findings from the CFA indicated the same conclusion. Despite being considered a “contrasting statistical approach” to the Rasch model (Allison et al., 2015), the combination of the CFA with the Rasch model made it possible to gain more insight regarding a different statistical tradition (Kelly et al., 2007). Moreover, this study found no local dependence, which was also confirmed by the CFA, as the one-factor CFA models were fit, without freeing residual covariance.

The person reliability of the Indonesian LOT-R was 0.73, which was greater than the acceptable value of 0.70 (Tennant & Conaghan, 2007), indicating that this instrument could differentiate between high and low groups (Linacre, 2018). Moreover, we found a person separation index of 1.63, resulting in the previously mentioned acceptable value for group use (Tennant & Conaghan, 2007). However, a low item reliability of 0.42 and a resulting item separation index of 0.84 was found, which was far below the acceptable criteria. This occurred because of the low number of items, which led to a very narrow item difficulty range (Linacre, 2018). However, it should be noted that the reliability does not refer to the measurement instrument itself, but to the consistency of the results obtained (Thompson & Vacha-Haase, 2000); thus, an acceptable person reliability was maintained only for our study samples.

In terms of the very narrow item difficulty range, based on the content of the LOT-R, the optimism continuum covered the optimistic behavior; this included the primary definitions of dispositional optimism on six indicators (Scheier et al., 1994), with no gradation of “very hard” or “very easy” behavior endorsed by the definition. When the Rasch measurement model was used, the mean for item difficulty was set to zero; there was no specific distributional assumption of person ability, which was different from the IRT (Andrich & Marais, 2019), with only the six items of the LOT-R. Furthermore, the item difficulty was distributed around the mean, resulting in a very narrow item difficulty range. However, previous studies showed that a small number of items (six items) could be analyzed using the Rasch model (e.g., Wongpakaran et al., 2020), since its outcome results in information about the psychometric characteristics, as well as the person’s trait level and item measure; both of these would be sample- and item-free, even when the number of items were relatively small. We found the low item reliability to be a limitation of our study.

The application of the Rasch model also provided information on alternative measurement methods that were in line with other findings from the polytomous IRT model, in terms of the Graded Response Model on the LOT-R measurement (Chiesi et al., 2013; Steca et al., 2015). Although these two methods are similar in terms of unidimensionality, the local independence assumption, and the logistic function that was used, they have philosophical differences, as compared to the Rasch measurement model (e.g., Andrich & Marais, 2019). A previous study also tested the IRT-based DIF detection by gender and age (Steca et al., 2015). From the Rasch and IRT perspectives, we also examined the response category functioning that was found to be well-functioned for all items. Our study found no DIF, which strengthened the measurement quality of the LOT-R. Furthermore, we concluded the same findings for both the studies, that is, the Rasch analysis provided a deeper understanding of the LOT-R and optimism construct at the item level (Chiesi et al., 2013; Steca et al., 2015).

Even though the Rasch model has been used widely to validate measures in psychological research (Andrich & Marais, 2019; Boone & Noltemeyer, 2017), our study is the first to use the
Rasch measurement in the LOT-R that can be adapted to many languages. These findings demonstrated that the psychometric characteristics of the Indonesian LOT-R are an important addition for the Indonesian researchers. In line with a previous research, and from a practical perspective, the findings from the Rasch analysis allow psychologists and non-specialists to confidently interpret sum scores as good indicators of individuals' optimism (e.g., Saggino et al., 2020). This is also in line with the original scoring method proposed by the LOT-R developers (see Scheier et al., 1994). The availability of a Rasch-based, validated Indonesian LOT-R is expected to initiate future research on optimism in Indonesia across disciplines.

Simultaneously, there are additional limitations to this research. First, since the samples comprised only high-school students, the theoretical scope and generalization of optimism in this study is very narrow; this is because optimism, as well as LOT-R in particular, has been studied since the beginning of its development in various age groups. On the basis of these drawbacks, we recognize that our findings regarding the psychometric characteristics of LOT-R will be applicable only to the same sample characteristics. Meanwhile, further study is required for other age characteristics.

Second, even though this research used an adequate number of samples, they only originated from the capital cities of Indonesia, and different cultures or people from the country’s remote areas were not considered. Therefore, our findings can provide measurement tools to expand this study area for capturing more diverse samples in Indonesia. Third, we used nonprobability sampling that may not provide an accurate representation of the population in these study areas. Finally, the importance of these limitations makes it necessary to replicate this study in a population with different characteristics in order to contrast the resulting conclusions and implement methodological improvements in relation to the scale.

5. Conclusions
In summary, this is the first study that translated and examined the psychometric properties of an Indonesian version of the LOT-R, and analyzed it using the Rasch analysis. The results of this study indicated that the Indonesian translation of the scale represented a psychometrically sound instrument for the assessment of optimism in Indonesian students, and fit the unidimensional model of optimism, based on the Rasch model’s measurement standards.

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Ethics approval
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The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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