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Validity Test of UCLA Loneliness Scale Version 3 Using the Rasch Model

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Abstract

The UCLA Loneliness Scale Version 3 is one of the main measurement tools in investigating loneliness. This study aimed to test the validity of the UCLA Loneliness Scale Version 3 with the Rasch Model. The validity test was conducted to improve the understanding of the psychometric properties of the scale in the Indonesian population. Participants were 250 adults aged 20–34 (176 men, 74 women). The results showed that the UCLA Loneliness Scale Version 3 is a multidimensional measurement instrument. One item did not meet the criteria of model fit. Considerations for future research are discussed in the article.

Loneliness is an emotional state that individuals experience when they feel isolated or socially disconnected from others. It is not as simple as a lack of interpersonal relationships; loneliness also involves dissatisfaction with the quality of social interactions one has (Majka & Cacioppo, 2013; Russell & Pang, 2020). Loneliness is different from social isolation, as loneliness is a subjective feeling (Taylor et al., 2023). Loneliness currently needs attention due to its high prevalence rate across diverse populations. In a study of patients undergoing treatment, the overall prevalence of loneliness was 20% (Mullen et al., 2019). A systematic review and meta-analysis of 24 studies in 106 countries found that the overall prevalence of loneliness in adolescence was 21.20% (Surkalim et al., 2022). In Indonesia, the prevalence of loneliness in the elderly was found to be around 64% (Susanty et al., 2022). Then, during the COVID-19 pandemic, a study by Rinaldi (2021) found that 86.86% of 236 university students experienced mild to moderate loneliness. This shows that there needs to be studies about loneliness in the Indonesian population.

Research on loneliness is important as it can provide deeper insights into the social and psychological impacts of this condition (Shankar & Kidd, 2022). Understanding influencing factors and consequences of loneliness allows stakeholders to develop more effective intervention strategies. Loneliness can seriously affect mental and physical well-being (Mushtaq et al., 2014; Shankar & Kidd, 2022). Studies have shown a correlation between loneliness and the risk of various diseases and psychological disorders. Loneliness has been associated with various chronic conditions, e.g., lung disease, cardiovascular disease, hypertension, atherosclerosis, stroke, and metabolic disorders (Richard et al., 2017; Yanguas et al., 2018). In addition, loneliness is a major predictor of psychological problems, e.g., depression, distress, and anxiety (Ge et al., 2017; Lee et al., 2019; Santini et al., 2020; Von Känel et al., 2021).

There have been several loneliness scales developed to measure this construct, with the Three-Item Loneliness Scale and the UCLA Loneliness Scale being among the most widely used ones and having good psychometric properties. The Three-Item Loneliness Scale has been shown to be effective in measuring overall loneliness, demonstrating satisfactory reliability and validity in large-scale surveys (Hughes et al., 2004). On the other hand, the UCLA Loneliness Scale, specifically Version 3, is a well-established and widely used instrument. It has consistently demonstrated good reliability, validity, and factor structure in numerous studies (Bottaro et al., 2023; Lin et al., 2022; Russell, 1996). These instruments provide an empirical foundation for loneliness-related research and interventions.

The UCLA Loneliness Scale has been used as the primary measurement tool in loneliness research in various countries, e.g., the United States, China, India, Taiwan (Lee et al., 2019; Lin et al., 2022; Liu et al., 2020; Shankar & Kidd, 2022)



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. The instrument has proven to be reliable and widely used in psychometric and social research literature (Liu et al., 2020; Lin et al., 2022). Although loneliness is a significant phenomenon and the UCLA Loneliness Scale has become a commonly used instrument, it still needs to be tested for validity with a different population from previous studies and with a more robust approach, such as using the Rasch model.

The UCLA Loneliness Scale Version 3 has been tested for validity in the Indonesian population in several studies, one of which is with Confirmatory Factor Analysis (CFA) with adolescent participants in orphanages (Nurdiani, 2013). Seeing the specific research sample, there is a need for a wider sample distribution so that it is not limited to adolescents in orphanages. So this study tests the validity of the UCLA Loneliness Scale with a more varied sample and uses the Rasch model approach, which is still rarely studied in the Indonesian population.

The Rasch model, developed by Georg Rasch, is a statistical approach that allows assessment of the validity and reliability of measurement instruments (Boone, 2016). By applying this model, we can understand the extent to which the instrument is reliable and accurate in measuring loneliness. The UCLA Loneliness Scale Version 3 will be tested using the Rasch Model with several key indicators, such as item fit (Infit and Outfit MNSQ), which measures the fit of the data to the model. Infit or inlier-sensitive fit measures the sensitivity of the response pattern to the item on the respondent. Outfit or outlier-sensitive fit measures the sensitivity of response patterns to items with a certain level of difficulty.

Other indicators in the Rasch Model are unidimensionality test, to ensure the measure measures one psychological construct, and the point measure correlation, to understand the contribution of each item to the overall scale. There is also differential item functioning (DIF) to detect bias in certain items towards certain groups, such as gender or age (Sumintono & Widhiarso, 2015).

According to Sumintono and Widhiarso (2015), the advantage of Rasch modeling over other methods, especially the classical test theory, is the ability to predict missing data based on individual response patterns. This advantage makes the results of the Rasch model statistical analysis more accurate in the research conducted. More importantly, Rasch modeling can produce standard error measurement values for the instruments used, which can increase the accuracy of the calculations. Calibration is carried out in Rasch modeling simultaneously in three ways, i.e., the measurement instrument, respondent (person), and item. An uncalibrated instrument can potentially produce invalid data, leading to the failure of the research activities. Bond and Fox (2014) said using the Rasch model in instrument validation would yield more holistic information about the instrument and better fulfill the measurement definition. This approach can provide further insight into the nature of loneliness measurement and strengthen the empirical basis of the instrument. Therefore, research that tests validity with this model can significantly contribute to the use of the UCLA

Loneliness Scale Version 3 in the Indonesian population.

Methods

Participants

Researchers conducted a validity test of the UCLA Loneliness Scale Version 3 on 250 participants (176 men, 74 women). The participants fulfilled the criteria of this study, which were Indonesian adults aged 20 to 34. The sampling technique used in this study was convenience sampling, which is based on the availability and ease of obtaining respondents. Although this technique offers convenience, it lacks variety in the population because it consists of certain groups only. The majority of participants in this study were male, 70.4 percent, and in the age group of 20–25 years, 85.6 percent. The categorization of subjects who are partly male and at the age of 20–25 years is a weakness of the study because the subjects are less widely spread. This study is a measurement tool validation study with the Rasch model as the main analysis. This study aims to test the validity of measuring instruments with the Rasch model on the UCLA Loneliness Scale Version 3. The validity test was conducted with the aim of significantly contributing to the understanding of the quality and validity of the UCLA Loneliness Scale Version 3 in the context of the Indonesian population.

Procedure

The study began with data collection, then continued with testing the psychometric properties of the scale. Data collection was done through a survey, in which participants filled out the scale. The scale was administered online through a Google Form. Researchers distributed a link to the Google Form through various channels. Before filling out the scale, participants were asked to fill out an online consent form, indicating their willingness to participate in the study. The instrument analyzed in this study was the UCLA Loneliness Scale Version 3, one of the main measuring tools in investigating loneliness.

The data analysis was performed using the Winstep 5.1.4.0 program, which was used to examine the psychometric properties of the UCLA Loneliness Scale Version 3 with the Rasch model. The Rasch model is a statistical approach that allows assessment of the validity and reliability of measurement instruments (Boone, 2016). Besides paying attention to items, the Rasch model also studies respondent aspects and calculates the amount of correlation. By applying this model, researchers can understand the extent to which the instrument is reliable and accurate in measuring loneliness.

Results

Based on data collection, 250 participants were obtained. Table 1 summarizes the demographic information, showing a significant dominance of male participants (70.40%) compared to female participants (29.60%). Most participants were between 20–25 years old (85.60%) with the highest education level of diploma or bachelor's (56.00%).

Table 1
Demographic Data

Variable	N	Percentage (%)
Gender		
Male	176	70.40
Female	74	29.60
Education Level		
Diploma/Bachelor (D-3/S-1)	140	56.00
Senior High School/Vocational/Equivalent (SMA/SMK/MA)	109	43.60
Junior High School/Equivalent (SMP/MTs)	0	0.00
Elementary School/Equivalent (SD/MI)	1	0.40
Age		
20--25 years	214	85.60
26--30 years	30	12.00
Above 30 years	6	2.40

Dimensionality Test

The researchers conducted PCAR (Principal Component Analysis Residual) (“Checking dimensionality in itemr-Response models with principal component analysis on standardized residuals”, n.d.; Smith, 2002) to test the unidimensionality assumption in this study. Unidimensionality is observed when the raw variance explained by measures is 40% (Bond & Fox, 2014). The results (Table 2) show that the raw variance explained by measures was 31.6%. This means that the 19 items measuring loneliness do not meet the unidimensionality criterion, and there may be other dimensions that need to be considered in further analysis.

Test of Local Independence

The results of the analysis (Table 3) show that items 18 and 19 had a raw residual correlation of 0.44 (<0.30), meaning that they did not meet the assumption of local independence. The finding indicates a connection between item 18 and item 19, suggesting the need for editorial changes in these two items.

Item Characteristics

Table 4 showcases characteristics of all items in the UCLA Loneliness Scale Version 3, including Measure, Point Measure Correlation (PT-Measure), and Outfit/Infit MNSQ statistics. There were 19 items analyzed.

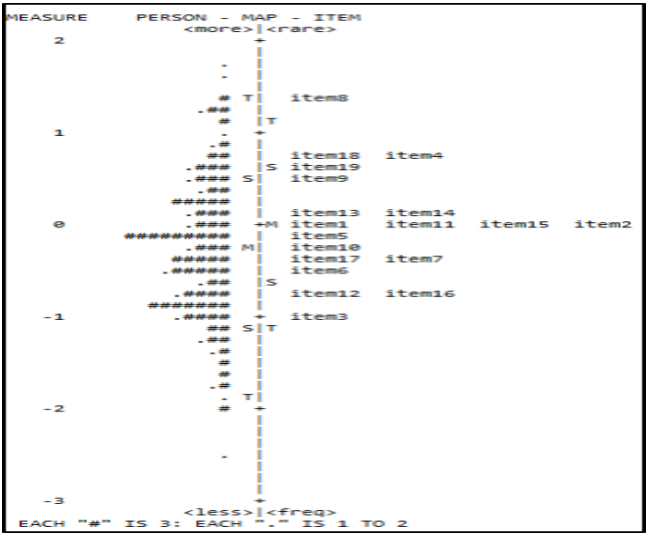
Wright Map

One of the advantages of Rasch modeling is its ability to generate a map that visually illustrates the distribution of item difficulty levels through the Wright Map. On this map, the vertical axis represents the logit scale used to measure both individual ability and item difficulty. The left side shows the distribution of people; the right side shows item difficulty. Based on Figure 1, item 8 is the most difficult to endorse, while item 3 is the easiest. This variation contributes to a balanced measurement.

The average person ability is 0.28 logits (*SD* = 0.80), suggesting a good alignment between item difficulty and

participant ability. Person measures range from 1.77 to -2.2; item difficulties range from 1.35 to -0.96.

Figure 1
Path Analysis of the Third Model



Discussion

This study aimed to test the validity of the UCLA Loneliness Scale Version 3 using the Rasch model, which will provide an understanding of the quality and validity of the instrument in the Indonesian context. This scale measures a construct represented by a multidimensional set of items. The criteria used to test the unidimensionality of the loneliness construct are raw variance explained by measures 40% (Bond & Fox, 2014). In this study, the raw variance explained by measures was 31.6%. This means that 19 items measuring loneliness did not meet the criteria for unidimensionality and there may be other dimensions that need to be considered in further analysis. The results of this study are in line with several studies that found that the UCLA Loneliness Scale Version 3 is

Table 2
Dimensionality Test

No	Description	Eigenvalue	Observed	Expected
1	Total raw variance in observation	27.76	100.00%	100.00%
2	Raw variance explained by measures	8.76	31.60%	31.40%
3	Raw explained by persons	2.87	10.40%	10.30%
4	Raw variance explained by items	5.88	21.20%	21.10%
5	Raw unexplained variance (total)	19.00	68.40%	68.60%
6	Unexplained variance in 1 st contrast	3.85	13.90%	20.30%
7	Unexplained variance in 2 nd contrast	1.82	6.60%	9.60%
8	Unexplained variance in 3 rd contrast	1.33	4.80%	7.00%
9	Unexplained variance in 4 th contrast	1.29	4.70%	6.80%
10	Unexplained variance in 5 th contrast	1.21	4.40%	6.40%

Table 3
Test of Local Independence

	Highest Raw Residual Correlation	Item Pairs
Loneliness	.44	Item 18 and item 19

a multidimensional measurement tool (Ausín et al., 2019; Shevlin et al., 2015).

The subsequent analysis showed that the item pair with the highest raw residual correlation was item 18 and item 19 ($r=0.44$; $r<0.30$), meaning that the assumption of local independence was not met. Local item independence is a key assumption in the Rasch model, which states that items in a test should not be related to one another. Therefore, the wording of these two items may need to be revised. The analysis revealed that item 18 ("How often do you feel that there is someone you can talk to?") is closely related to item 19 ("How often do you feel that there is someone you can meet?"). This means that when a person demonstrates a high ability level on item 18, their estimated ability is also influenced by their response to item 19. This connection suggests that "someone to talk to" is strongly associated with "someone to meet." This finding is consistent with existing literature, which acknowledges that items in loneliness instruments can sometimes be interrelated, reflecting the complexity of the loneliness construct that may involve overlapping aspects (Auné et al., 2019; Gordy et al., 2022).

The loneliness construct analysis provides information about the level of item difficulty (item measure). The item measure provides logit information from each item. The analysis results showed the largest to smallest logit value. A high logit value indicates a high level of difficulty of the question (Sumintono & Widhiarso, 2015). Based on the analysis, it was found that the most difficult item was item 8 ("How often do you feel outgoing and friendly?"), with a logit value of 1.35. Then, the easiest item is item 3 ("How often do you feel alone?"), with a logit value of -0.96. Seeing that the majority of participants were men, item 8 might be considered difficult to answer because those are traits commonly associated with women rather than men. The results regarding item

difficulty are also in line with several previous studies that show variations in the difficulty of loneliness items. Variations in the level of difficulty on loneliness scales can be observed in diverse measurement tools to measure loneliness (Chapot et al., 2015; Hughes et al., 2004). In measurement development, items that have varying levels of difficulty can provide a more comprehensive picture of the experience of loneliness among respondents (Boateng et al., 2018). Then, based on information about item fit, there is an outfit means-square value which is used as a criterion for item fit (Bond & Fox, 2014). The study used Infit and Outfit MNSQ statistics with a value range of .5-1.5 (Boone, 2016) to gauge the item fit. If the item does not meet the value criteria, it means that the item is not good, so further analysis is needed. Based on the calculation results, item 8 did not meet the fit index criteria". Future studies should consider dropping item 8 because it might not only contain information about loneliness but also other constructs as well. Previous studies that did not require item reduction include those conducted in Turkey (Durak & Şenol-Durak, 2010) and India (Suri & Garg, 2020). Based on further analysis using the Point Measure Correlation, it was found that none of the items had a negative Point Measure Correlation value. The calculated correlation values ranged from 0.45 to 0.67. According to the criteria outlined by Boone et al. (2014), acceptable Point Measure Correlation values range between 0.40 and 0.85. Based on these results, it can be concluded that 18 out of 19 loneliness items functioned as expected for the participants. Therefore, these 18 items are suitable for subsequent analyses. Although most of the items fit the Rasch Model, the finding that one item did not meet the fit index criteria differs from previous studies, which reported that all items in the loneliness instrument demonstrated good model fit. The misfit of one item may be attributed to cultural differences that potentially influence how individuals interpret and respond to items in the scale. Additionally, the lack of sample diversity might also have affected the validity test results, as the majority of participants were male, aged between 20–25 years, and represented only a specific demographic group.

Table 4*Distribution of Research Participants Based on Ages*

No	Item	Measure	PT-Measure	InFIT (MNSQ)	OutFIT (MNSQ)	Description
1	Item1	0.01	0.67	0.98	0.99	FIT
2	Item2	-0.04	0.66	0.93	0.93	FIT
3	Item3	-0.96	0.56	1.06	1.05	FIT
4	Item4	0.75	0.43	1.32	1.34	FIT
5	Item5	-0.15	0.32	0.88	0.87	FIT
6	Item6	-0.56	0.67	0.76	0.76	FIT
7	Item7	-0.40	0.39	1.05	1.07	FIT
8	Item8	1.35	0.24	1.46	1.54	MISFIT
9	Item9	0.47	0.36	0.94	0.95	FIT
10	Item10	-0.20	0.62	0.92	0.92	FIT
11	Item11	-0.02	0.48	0.96	0.97	FIT
12	Item12	-0.69	0.61	0.95	0.94	FIT
13	Item13	0.11	0.66	0.92	0.92	FIT
14	Item14	0.10	0.31	1.15	1.16	FIT
15	Item15	-0.05	0.48	0.88	0.88	FIT
16	Item16	-0.69	0.27	1.01	1.05	FIT
17	Item17	-0.35	0.52	0.92	0.92	FIT
18	Item18	0.73	0.39	1.04	1.05	FIT
19	Item19	0.60	0.45	0.91	0.91	FIT

Conclusion

This study aimed to examine the validity of the UCLA Loneliness Scale Version 3 using the Rasch model, which would provide an understanding of the quality and validity of the instrument in the Indonesian context. The findings indicate that the construct of loneliness measured by this instrument is multidimensional. Based on item fit information, one item was found to misfit. Although most of the items aligned with the Rasch model, the presence of a misfitting item contradicts previous findings of full item fit for the loneliness instrument. This discrepancy may be due to specific cultural factors that influence how individuals interpret and respond to the items in this scale. While this study provides important insights regarding the validity of the UCLA Loneliness Scale Version 3, several limitations should be noted. The research sample lacked diversity and represented only a specific subgroup. Additionally, item fit within the Rasch model may vary due to sociocultural factors related to the respondents. The majority of participants in this study were men aged 20-35 years. Future studies are encouraged to use more diverse samples with a more balanced gender distribution and wider age range. Furthermore, it is recommended to explore the validity of the instrument more comprehensively across various social and cultural contexts.

Recommendation

Based on the findings, it is recommended that the UCLA Loneliness Scale Version 3 be used with caution in the Indonesian context, as it demonstrates overall satisfactory psychometric properties but requires refinement. Specifically, one misfitting item should be considered for elimination, and revisions are needed for items that show re-

dundancy or cultural ambiguity. Cultural adaptation of item wording is essential to ensure the scale accurately reflects how loneliness is experienced and expressed in Indonesian society. Further validation studies involving more diverse samples in terms of age, gender, and cultural background are necessary to enhance the scale's generalizability. With these improvements, the UCLA Loneliness Scale Version 3 holds promise as a useful tool for assessing loneliness in both research and applied settings in Indonesia.

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Author's Contributions

Both authors contributed to writing the manuscript, designing the research, collecting and processing the data, as well as conducting the data analysis.

Conflict of Interest

There is no conflict of interest in this study or the publication of the study manuscript.

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