Rasch Model SWLS No Reference

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Psychometric Evaluation Indonesian version of Satisfaction with Life Scale using Rasch model

Abstract

Previous studies on The Satisfaction with Life Scale (SWLS) show inconsistency, primarily related to the justice principle based on gender when using Confirmatory Factor Analysis (CFA). Therefore, this study aims to evaluate the psychometric property of the Indonesian version of SWLS using the Rasch model. This model can be used as an evaluation technique for psychological instruments. The Rasch model showed a more detailed analysis than CFA, explaining person-item fit statistics, rating scale diagnosis, item calibration, and differential item functioning. The total participants after person fit checking were 1,154 university students who completed an online survey consisting of demographic data and a five-item Indonesian version of SWLS. Meanwhile, the Rasch Rating Scale Analysis (RSM) shows that the Indonesian version of SWLS fulfilled unidimensional and local independence assumptions. The items delivered a good item fit index with a five-point rating scale, and there were no gender biases in moderate level and high differential item functioning (DIF). Therefore, the Indonesian version of SWLS is recommended for further research measuring life satisfaction. This research implies that using the Indonesian version of SWLS, especially in Indonesia, can use a five-point rating scale for future research.

Keywords: life satisfaction, satisfaction with life scale, rating scale model, psychometric evaluation, item bias

Introduction

Life satisfaction in individuals was viewed as a subjective appraisal due to different understandings of the concept (Fernández-Portero et al., 2017). For example, a survey conducted by Li et al. (2020) shows a decrease in life satisfaction among 17,865 individuals in China. This showed a negative correlation between life satisfaction and negative emotion in university students. Negative emotions are common in students who are dissatisfied with their life. One of the main reasons for life dissatisfaction among China university students is the Covid-19 pandemic which makes them study at home due to social distancing (Duong, 2021).

Indonesian university students also experience a decrease in life satisfaction. Like China, they also experienced increased negative emotions and stress during the Covid-19 pandemic. A meta-analysis study discussing stress in Indonesians shows that more than 50% of 50,000 students felt stressed during online lectures (Fauziyyah et al., 2021). One of the universities experienced a decrease in the frequency of student attendance at online courses. Most students who explained their reasons felt the online class could have been more varied and effective (Herdiana et al., 2021).

There are various instruments used to measure life satisfaction across countries. The most popular instrument is the Satisfaction with Life Scale (SWLS) (Natanael & Novanto, 2021). Besides being popular, SWLS has advantages in psychometrics with a reliability coefficient of .82 and a value of each loading factor above .60 (Diener et al., 1985), indicating that SWLS is a consistent and valid measure of life satisfaction. However, future research may focus on fulfilling the measuring equivalence of psychological variables. To fulfill the measurement equivalence principle, the items should not be biased. In a simple analogy, the items on the instrument used for research analysis should not have a good

tendency for one of the tested groups. As a test instrument requirement, measurement equivalence is necessary (Raju et al., 2002).

Previous studies of SWLS showed inconsistent findings, especially those related to measurement equivalence. For example, studies in Brazil, Angola, and Norway showed no gender bias in SWLS (Moksnes et al., 2014; Tomás et al., 2015; Zanon et al., 2013). However, gender biases of SWLS were measured in Spain (Atienza et al., 2003). Hence, examining the SWLS, especially related to measurement equivalence in the Indonesian context, is essential.

Literature Review, Rasch Model Theory, and Current Study

Reviewing Life Satisfaction: Indicator, Measurement, Translation, and Validation

Life satisfaction is an individual's self-quality assessment of the expected standard of living (Diener et al., 2003). The intended standard of living is not a comparison of the individual to others. However, a standard of living is set for what has been achieved in a specific period. In principle, life satisfaction indicates five indicators, namely (a) an appraisal of living standards that is close to the term ideal/good, (b) self-confidence in getting a good life, (c) satisfaction with life, (d) satisfaction with the success achieved and (e) a loss of desire to divert attention from the current situation. Life satisfaction increases when the desired conditions are achieved. It correlates with other psychological variables and describes the concepts of happiness and well-being (Ruggeri et al., 2020). For example, in Finland, it significantly positively affects student engagement (Upadyaya & Salmela, 2017). Furthermore, life satisfaction is influenced by various factors such as demographic status comprising of gender, marital status, education level, and income (Ngoo et al., 2021), as well as personality (Xie et al., 2016).

The measurement was initially developed by Neugarten et al. (1961) with instruments known as Life-Satisfaction Index A (LSIA) and Life-Satisfaction Index B (LSIB) 1961, with a total of 32 items. The leading indicators measured by LSIA and LSIB are limited to the individual's view of achieving success. With the introduction of measures a few years later, subsequent studies concentrated on the life satisfaction variable and reduced the number of questions on the instrument to criticize previous results (Casas et al., 2013). The instrument is the Satisfaction with Life Scale, whose basic theory is almost the same as indicators (Diener et al., 1985). SWLS is included in the easy-to-use category and does not take much time to process.

For a decade, SWLS has been translated into different countries, including France (Bacro et al., 2020), Turkey (Telef, 2015), India (Dahiya & Rangnekar, 2020), Brazil (Zanon et al., 2013), and Angola (Moksnes et al., 2014). The measurement invariance in the various groups is also tested for validation using statistical techniques such as confirmatory factor analysis. SWLS in Indonesia was also translated in 2019, but a validation analysis was not conducted using a more detailed statistical analysis (Novanto & Pali, 2019). Based on previous research, the Indonesian version of the SWLS was used to analyze the level of satisfaction of 111 teachers and lecturers in two cities. Therefore, a study is needed to evaluate the psychometric properties of the Indonesian version of SWLS.

Rasch Measurement Model

The Rasch analysis is a measurement model developed by a mathematician named Georg Rasch. Generally, the model analyzes items with dichotomous data (Andrich, 1981; Kreiner, 2013) and shows the possibility of a relationship between the person and the item parameter. For example, Bond and Fox (2015) explained that the person parameter is the individual's ability level, while the item depicts the difficulty level. This means that the Rasch

model focuses on measuring the difficulty level of the questions and the abilities that exist in individuals. In addition, it can also be used to analyze polytomy data widely used to measure attitudes. The method is known as the Rating Scale Model (RSM) or Partial Credit Model (PCM) (Andrich & Marais, 2019). Based on past research, at least 500 samples are required to produce trustworthy and acceptable findings in the Rasch analysis (Mohd Matore et al., 2021).

The use of the Rasch model is based on several reasons, including providing more accurate information on the quality of items and seeing the continuity between item and person parameters (Jong et al., 2015). In addition, RSM for polytomy data from an attitude scale prioritizes the appropriate measurement principle. As a result, the distance in the range of answers is different. The Rasch model can show each item's difficulty level for cognitive tests. In contrast, the attitude scale shows which items are challenging or accessible for individuals to agree with through item calibration (da Rocha et al., 2013).

Current Study

Methodologically, the analytical techniques used by previous studies in the introduction and the participant criteria are the same, but the results obtained are different. Therefore, a different instrument testing was conducted using the Rasch model in the SWLS study. The results obtained vary from the novelty of the research information. It is also strengthened by the purpose of this study, which is to evaluate the psychometric property in SWLS with the Rasch model analysis. The tested SWLS is also the Indonesian version that was translated.

Method

Research Design, Procedure, and Ethical Consideration

This is a quantitative study with a survey design, consisted psychometric evaluation and a psychological instrument (Goodwin & Goodwin, 2013). The data was collected during April 2022 and finished approximately one month of data collection. Permission was granted to use the Indonesian version of the SWLS, and a collaboration study was made to evaluate its psychometric evaluation. The ethics committee of the Scientific Psychology Consortium of Indonesia (Konsorsium Psikologi Ilmiah Nusantara) has approved this proposed study for ethical clearance (EC).

Participants

The initial participants were 1,238 undergraduate students at the Universitas Islam Negeri (UIN) Sunan Gunung Djati Bandung, consisting of 337 males and 901 females, with 27.2% and 72.8%, respectively. The age range of the participants varied from 17 to 27 years old (M = 19.86, SD = 1.22), and they were all unmarried.

Instruments

The Satisfaction With Life Scale (SWLS) instrument was introduced by (Diener et al., 1985). The SWLS is the Indonesian version translated from English by two psychologists with decades of experience (Novanto & Pali, 2019). In the previous study, the Indonesian version consists of five items with seven alternative answers from strongly disagree to agree with a reliability value (α) of .82 (Novanto & Pali, 2019). SWLS is a unidimensional instrument (Lorenzo-Seva et al., 2019).

Statistical Analysis

The data obtained will be analyzed using Winstep 3.65 software for SWLS in the form of a rating scale. The limitation statistics are:

Data Cleaning

Using the Rasch model is to exclude outliers or participants with extreme values in the analysis, marked by the person outfit Mean Square (MNSQ) > two on Winstep (Natanael, 2021).

Assumption of Unidimensionality and Local Independence

Proving the assumption of unidimensionality and local independence (Mair, 2018). The limitation to finding out the unidimensional model is the value of Variance Explained by Measure > 40% (Holster & Lake, 2016). The limit for local independence was met when the residual correlation value between items was < .30. This term is known as the critical value Q3 (Christensen et al., 2017).

Fit Statistics and Reliability

A reasonable limit for item-person reliability in the Rasch measurement is > .80 and > .70 for the person and item reliability (Mohd et al., 2017). The limit value of item-person separation > 3 is also an excellent conformity level in the analysis with the Rasch model (Duncan et al., 2003).

Rating Scale Diagnostics

An increase in logit from one answer choice to another is indicated by an accurate range of values from 1.4 to 5 (Zile-Tamsen, 2017).

Item Fit and Item Calibration

Item reasonable limits were suggested by Boroel et al. (2017), where the instrument tested was at the MNSQ outfit value of .50 -1.50. Categorize the level of difficulty of the test based on the range -.30 to +.30 (Wicaksono et al., 2021)

Differential Item Functioning (DIF)

Rogers and Swaminathan (1990) stated that the limit of an item experiencing bias is based on the group. The difference in DIF between groups can be categorized as low (.20-.40), moderate (.40-.60), and high level (.60-.80).

Results

Data Cleaning

The output of the Winstep software provides information to exclude 84 outliers above the person outfit MNSQ limit. However, the initial number of research participants and outliers was 1,238 and 84 people. For the Rasch model analysis, the total number of research participants was 1,154.

Assumption of Unidimensionality and Local Independence

The Indonesian version of the SWLS analysis results gets a Variance Explained by Measure value of 80.2% > 40%, which implies that the variables tested are unidimensional,

where the limits obtained exceed the value suggested by previous studies. Subsequently, an additional unidimensional model testing using Confirmatory Factor Analysis (CFA) of R Statistics was conducted, and the model was indicated by $\chi 2 = 44{,}749$, $p < .05$; RMSEA = .067 (90% CI = .049 – .087), CFI = .992, TLI = .983, SRMR = .014. The limitation in determining a suitable unidimensional model is CFI > .90 (Hosseinabadi et al., 2018). This indicates that the assumption is fulfilled for the Indonesian version of SWLS with two proofs.

The second assumption is local independence. In principle, it is hoped that the tested items will not have local independence since there is no strong attachment from the residuals between items. The results do not show a relationship beyond the Q3 limit between items in the Indonesian version. Therefore, the Indonesian version of SWLS needs local independence and has fulfilled the two assumptions required for analysis using the Rasch model.

Fit Statistics and Reliability

A summary of the fit statistics and reliability scores can be seen in Table 1. The person and item mean values indicate whether the individual taking the test feels a difficulty (Othman et al., 2015). SWLS is an attitude scale whose interpretation measures the level of the psychological variable measured. For example, this study measures the level of life satisfaction. The person and the mean item values are -1.45 and .00 logit. This indicates that the research participants feel dissatisfied with their lives. Hence, the level of student life satisfaction is low.

The 3.72 value obtained for person standard deviation indicates that the level of life satisfaction of research participants varies. In line with that, the item standard deviation = .76 also shows the spread of different answer patterns. The level of satisfaction and the pattern of answers from research participants are different. The analysis shows the item reliability value of 1, indicating a sufficient level of participants to measure differences in item difficulty

levels. Likewise, the value of person reliability obtained a value of .97, and the items in the analysis can distinguish the level of ability between groups.

The obtained person separation value of 3.86 indicates that the participants are by the population being analyzed. Therefore, the selection of research participants is used appropriately. Item separation is also significant in this discussion since a value of 9.50 has exceeded the excellent limit of> 3, implying that the Indonesian version of SWLS items accurately measures life satisfaction.

The resulting Alpha-Cronbach value is .94 > .80, signifying that SWLS achieves an excellent level of reliability. Therefore, SWLS can be the right and consistent instrument to measure life satisfaction. SWLS is a psychological instrument at an excellent level when categorized based on separation value > three and reliability > .90 (Duncan et al., 2003). It is also important to note that the model fit index using the Rasch model is also attached to the output of the Winstep program. The test results show that the fit model is fulfilled and suitable for analysis with Rasch, as evidenced by the value of Chi-Square ($\chi 2$).

Table 1

Fit Statistics Person and Item.

	Person	Item
N	1154	5
Measure		
Mean	-1.45	.00
Standard Deviation	3.72	1.44
Standard Error	.93	.05
Outfit Mean Square		
Mean	.97	.97
Standard Deviation	.52	.15
Separation	3.86	26.91
Reliability	.94	1
Alpha Cronbach	.94	
Chi-Square (χ^2)	9439.59	
p-value	.00	

Rating Scale Diagnostics

The Indonesian version of the SWLS instrument used seven answer choices from a score of 1 (strongly disagree) to 7 (strongly agree). The results of the rating scale analysis can be seen in table 2. The diagnosis in table 2 shows that the Indonesian version of the SWLS with seven answer choices could not be better for use. This range is known as the Rasch

Andrich Threshold, and the answer choice of "Disagree" has a value of -7.95 logit. The answer choice "Somewhat Disagree" has a threshold value of -5.74 logit, meaning a logit difference of 1.98 between the two answers. This meets the ideal accuracy limit of the answer choice range. The choices from one to the other also meet the limits of the ideal accuracy range of answers. The logit difference between strongly disagree and disagree choice was 7.95 logit. Meanwhile, the logit difference between strongly agree and agree was 11.25, indicating that strongly disagree and agree are not the right choices. This research also looked at the Indonesian version of the SWLS, which included five response alternatives and a rating scale that met the criteria of none, -4.65, -1.93, 1.14, and 5.43 logit.

Table 2

Rating Scale Analysis

Categorization Response	Observed Count	Percentage (%)	Observed Average	Rating Scale Threshold	Standard Error
Seven-category 1234567					
Strongly Disagree	251	4%	-7.95	None	-
Disagree	495	9%	-5.97	-7.62	.09
Somewhat Disagree	1080	19%	-3.99	-5.74	.06
Neither Agree nor Disagree	1763	32%	-1.78	-3.42	.05
Somewhat Agree	1354	24%	.59	-.33	.05
Agree	581	10%	4.56	2.93	.07
Strongly Agree	56	1%	15.53	14.18	.25

Five-category 2234566					
Disagree	746	13%	-4.42	None	-
Somewhat Disagree	1080	19%	-2.18	-4.65	.14
Neither Agree nor Disagree	1763	32%	.17	-1.93	.10
Somewhat Agree	1354	24%	2.55	1.14	.10
Agree	637	11%	4.98	5.43	.21

Item Fit, Item Calibration, and Wright Map

Item fit analysis on the Rasch model is shown through the results of the scale calibration being tested. According to Table 3 of the Logit Value Index (LVI), the order of items that are most difficult to approve are items 5, 1, 4, 3, and 2. These items have the lowest and highest MNSQ outfit value at .88 and 1.28. Therefore, all items meet the criteria for item fit, and the calibration scale obtained is ideal. The LVI value obtained and the MNSQ outfit limit are in the suitable range. The standard error value also strengthens it for each item which is very small at < .50, as evidence of the level of accuracy of the instrument.

The five items were divided into three categories for the Indonesian version of the SWLS. Three items with a negative logit value less than -.30 for items 2, 3, and 4 were included in the category that the participants easily or quickly approved. In contrast, the positive logit value for items 5 and 1 are included in the items that are difficult for research participants to agree with.

Table 3

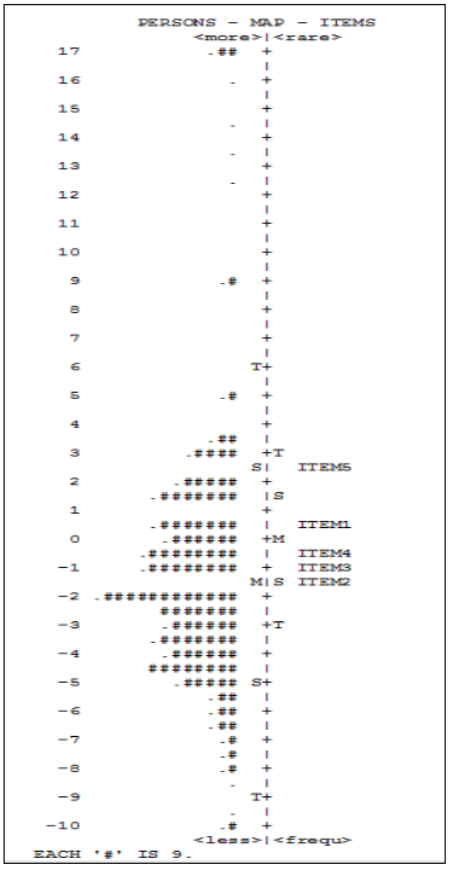
Calibration Item

Category	Item Number	Logit Value Item	Standard Error	Outfit MNSQ	Point Mass. Corr
Difficult	Item 5	2.68	.05	1.28	.85
Medium	Item 1	.29	.05	.95	.84
Easy	Item 4	-.71	.05	.92	.83
	Item 3	-.93	.05	.85	.83
	Item 2	-1.33	.05	.88	.82

This is in line with the picture shown in figure 1. The Wright Map shows that item 5 is the most difficult for research participants to agree on. When associated with the fit statistic above, the pattern generated by the Wright Map shows that the level of item size dominates research participants' ability, characterized by the distribution of the person's ability more under the difficulty of the item. For example, the fit statistic in table 1 shows that the person's means of -1.45 logit is lower than the item mean of .00 logit. Therefore, it can be ascertained that research participants have a lower level of life satisfaction than item difficulty.

Figure 1

Wright Map



DIF Analysis

The final step is to detect bias in the Indonesian version of the SWLS item, as seen in table 4. Rogers and Swaminathan (1990) emphasized the mandatory requirements that should be met in testing item bias: the DIF test on an instrument in various groups of at least 200 participants in the group. The principle of the number of groups is a good reference for correctness in analysis. The Indonesian version of the DIF SWLS analysis results is shown in table 4. Items 5 and 3 from the Indonesian version of the SWLS have detected a gender bias,

indicated by a DIF contrast value of .20 – .40. Item 5 and item 3 experienced DIF at a low level, where the male group responded more to item 5 (favorable to the male group) and vice versa. However, the output item plot of the Winstep program does not show a significant difference between the DIF constraints based on gender. This is because of the same pattern between groups, where the decision on bias is determined in the discussion section.

Table 4

DIF by Gender

Item Number	DIF		DIF Contrast	t	Prob
	Male	Female			
Item 1	.14	.33	.19	1.50	.1301
Item 2	-1.30	-1.33	.02	-.16	.8720
Item 3	-1.08	-.89	.20	1.53	.1269
Item 4	-.64	-.71	.07	-.52	.6029
Item 5	2.88	2.62	.25	-2.11	.0349

Discussion

This research aims to evaluate psychometric properties in the Indonesian version of the SWLS using RSM. Therefore, several topics of discussion are important in terms of psychometric and psychological aspects. There were 84 outliers from 1,238 research participants, and in the end, only 1,154 were eligible, although about 84 outliers were significantly involved in the research discussion. The number of outliers in Rasch's analysis is in line with the research of Natanael (2021), suggesting that conducting research using online questionnaires has significant limitations. Therefore, it is very likely to increase the

number of outliers. Research participants volunteered to help, but it was doubtful that all participants filled in based on their actual conditions.

The Rasch model analysis on the Indonesian version of the SWLS instrument fulfilled two mandatory assumptions of unidimensional and local independence. The Indonesian version of SWLS shows that this psychological variable is unidimensional and has no residual relationship between items (Christensen et al., 2017; Holster & Lake, 2016). Additionally, the CFA analysis also confirmed that SWLS with a unidimensional model is an appropriate analysis. It is characterized by fulfilling model fit criteria that exceed the expected CFI value limits (Hosseinabadi et al., 2018). Furthermore, no measurement error was found in the CFA analysis, which has a similar meaning to local independence, that is, no relationship between residual items.

The analysis results using the Rasch model also show that the level of instrument consistency is very different from previous studies. The Indonesian version of the SWLS was initially distributed to 111 teachers in Toraja and analyzed using the CFA technique. This showed the value of Construct Reliability (CR) to be .828. When using the Rasch model, it has .94. There is a significant difference in reliability values in the analysis using the CFA and Rasch models. This difference strengthens the evidence of previous research, confirming that the reliability value is highly influenced by the number of sample sizes and missing data (Izquierdo & Pedrero, 2014). Tests on 111 teachers resulted in a score of .828, while for 1,154 students, the reliability score was .94. The accuracy of taking research participants can also be a factor that plays an important role in the reliability value of the instrument when associated with the person separation index in Table 1. This accuracy is closely related to the sampling technique used and can make the resulting reliability higher or near perfect.

The Indonesian version of SWLS uses seven ranges of answer choices from Strongly Disagree to Agree. The use of seven ranges of answers is not appropriate for this instrument.

It is supported by the Andrich Rating Threshold value, which increases from one answer choice to another. However, the increase in the threshold on strongly disagree and agree answers in the SWLS with an increase of 1.4- 5 logit between the range of answer choices is suitable for use (Zile-Tamsen, 2017). It is recommended to use a five-point scale from disagree to agree for further research on the Indonesian version of SWLS. The results of the calibration of the scale used also produce an ideal continuum for psychological instruments. Scale calibration shows the difficulty of items from easy to agree to items that are difficult to approve. For example, it was found that Item 5 was perceived as the most difficult, while two was easy to agree with my research participants, who are undergraduate students.

This study also found that two items of the Indonesian version of the SWLS indicated that they were biased by gender, as evidenced by the difference in DIF contrast values > .20. Item 5 measures the desire to change lives, and three focuses on the self-assessment. Additionally, item 5 gave more benefits to the male group. The possibility can be caused by the tendency of men to have a strong desire to change their lives, while the female group has more advantage in item 3, which asks for self-assessment. This finding may indicate that females may be more concerned with their self-assessment compared to male students who are thinking about making changes to their lives. An interesting fact is generated from this study; namely, the Indonesian version of the SWLS data shows the different perspectives of men and women.

On further examination, DIF value contrast to items 3 and 5 are included in the low level. Even though it is detected to have item bias, it is still very feasible to be used for further research. This is because it is simple to be used as a significant benchmark for item bias. The low level of the DIF contrast is the absence of bias. For example, the study's DIF value of .20 indicated an accuracy of 30%. The accuracy of the results reached 95%, which indicates that the occurrence of item bias is actual when the DIF value is> .60 (Rogers &

Swaminathan, 1990). Therefore, it can be interpreted that the five SWLS items do not experience bias based on gender groups, or all SWLS items do not benefit any group or are fair in measurement.

The results showed that the level of student life satisfaction was low, indicated by the person mean value (-1.45 logit) which was lower than the item mean (.00 logit) in table 1. The results of the analysis, in line with a previous survey, showed that people in China experienced a decrease in life satisfaction and an increase in negative emotions (Li et al., 2020). Factors that can make students feel dissatisfied in life may include the social distance in the learning process or online lectures, the feeling of pressure from many assignments, and the lack of social relations, which ultimately causes negative emotions, anxiety, and stress (Rudenko et al., 2020).

The use of the Rasch model analysis for psychometric evaluation testing is also very suitable for the SWLS scale of the polytomy type. Furthermore, it shows the appropriate measurement model from the Chi-square value, the accuracy of the instrument's rating, and the scale calibration results. With one analytical technique, the research results are exposed in detail. Using the Rasch model can also provide more detailed and satisfactory results for statistical analysis.

Limitations

However, there are also limitations of the research, especially in the analysis of person fit, and many research outliers were found. Further studies are expected to obtain the correct sampling technique for research data collection by using an online questionnaire. Many outliers may be experienced in using online questionnaires. The Covid-19 situation might make it difficult to obtain data directly from participants. Moreover, an additional analysis of the unidimensional model CFA can also be used to strengthen the assumption of

unidimensionality. This is based on the Variance Explained by the measured value, which is more complex in testing the unidimensional model because the Rasch analysis cannot directly show the measurement.

Implications for Future Research

The findings summarized here have practical implications for subsequent researchers who use the Indonesian version of SWLS in their research and can use the five-rating scale.

Conclusion

The Indonesian version of the SWLS, based on a statistical fit index, assumptions, and psychometric evaluation using the Rasch Rating Scale Model, is a suitable and reliable psychological instrument to measure student life satisfaction in Indonesia. It is an instrument that does not detect item bias in its use. Therefore, the Indonesian version of SWLS can represent excellent psychometric properties.

Reference

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