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Validation of a measure of the ARC`s self determination scale in middle school students at Palembang

Tsurayya Syarif Zain[1]*, Siti Dini Fakhriyah[2], Jesyia Meyrinda [3]

*[1]Politeknik Negeri Sriwijaya, Indonesia
[2] UIN Raden Fatah Palembang; Indonesia
[3] UIN Raden Fatah Palembang. Indonesia

[1] tsurayya.syarif.zain@polsri.ac.id ; [2] sitidinifakhriya_uin@radenfatah.ac.id ; [3] Jesyiameyrinda07@gmail.com

*Correspondent Author

KEYWORDS

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ABSTRACT

The Arc's Self-Determination Scale assesses students' beliefs about themselves and self-determination. The study aims to evaluate the validation of the adaptation of the ARC's Self-Determination Scale Indonesian version. The sample in this study was 103 junior high school students. Researchers used purposive sampling, a type of sampling technique, namely non-probability sampling. Sampling was carried out by distributing research questionnaires online using Google Forms. The researcher adapted the Self Determination Instrument developed by Michael L. Wehmeyer (1995), namely The Arc's self-determination scale, which consists of 32 statement items. The aspects measured are autonomy, self-regulation, psychological empowerment, and self-realization. In this study, researchers used Confirmatory Factor Analysis (CFA) using Mplus 8.0 software (Muthen & Muthen, 2017) to test the validity of the measuring instrument. This study concludes that the modified and validated ARC self-determination scale is significantly capable of measuring self-determination, so no items from the modified ARC scale need to be discarded if the calculation uses an accurate score calculation with a bi-factor model.

Introduction

Adolescence is a period of transition to adulthood. The family, school, and social environment are expected to help a person acquire skills to integrate into society. Some skills, such as problem-solving, decision-making, and setting and achieving goals based on interests and talents, develop throughout childhood and adolescence. In this case, adolescents must face situations that can make them grow and develop skills to become adults (Mumbardó-adam, Guàrdia-olmos, & Giné, 2018).

Student motivation and school involvement are associated with positive outcomes (Volk, 2020). However, research shows that academic engagement and motivation decrease as students enter middle and high school (Otis, Grouzet, & Pelletier, 2005). Self-determination is an essential educational outcome for all students (Garrels & Granlund, 2017). Self-determination significantly predicts quality of life, especially in personal development and fulfillment (Lachapelle et al., 2005.; Mcdougall, 2010). Lack of opportunity to develop self-determination is associated with the prevalence of mental disorders (Clark et al., 2004).

Deci and Ryan (2000) define *self-determination* as "the capacity to choose and have those choices, not reinforcement, encouragement, force or pressure that determines one's actions. Meanwhile, self-determination itself is more than just a capacity but a necessity (Deci & Ryan, 2000). Every individual has an innate tendency to determine their destiny, which directs them to be involved in something. Self-determination acts as the primary agent in one's life and makes choices and decisions regarding one's quality of life regardless of environmental influences or disturbances (Michael, 1995.; Wehmeyer, 1992). Self-determination is described in four characteristics; autonomy, self-regulation, psychological empowerment, and self-realization (Wehmeyer & Schwartz, 1997). These characteristics emerge as students develop and acquire a set of self-determined behaviour component elements (Wehmeyer, 1995).

According to self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000), intrinsic motivation is the most desirable and long-lasting motivation. Intrinsic motivation refers to autonomous behaviour in which an individual engages in activities to experience pleasure, achievement, and experience learning new things. When intrinsically motivated individuals choose to engage in an activity for their own self-interest rather than external reasons. In this case, intrinsic motivation is considered the most desirable form of motivation because individuals carry out activities based on an appreciation of the activity rather than the rewards or benefits it brings (Zhang, Solmon, Kosma, Carson, & Gu, 2011).

Self-determination has been researched for decades, and various measurement tools have been developed. However, the Arc's Self-Determination Scale, developed by Wehmeyer (1995), and the AIR (Wolman et al., 1994), which is the measurement tool of the American Research Institute, were designed to measure self-determination globally. The Arc's Self-Determination Scale was designed to evaluate students' beliefs about themselves and self-determination. It was constructed based on the definitional framework of self-determination as an educational outcome (Wehmeyer et al., 1992). Measurements of The ARC's Self-Determination have been widely used in research studies. However, so far, there needs to be more research about validation for use in middle school students in Indonesia. In this case, a

measuring tool must be tested for validity to be applied to students. This study aimed to evaluate the validation of the adaptation of the ARC's Self-Determination Scale Indonesian version.

Method

Participants

The sample in this study was 103 junior high school students. The researcher used purposive sampling, a type of sampling technique, namely non-probability sampling, where the technique does not provide equal opportunities for members of the population to be selected as samples (Sugiyono, 2016). Sampling was done by distributing research questionnaires online using the Google form within seven days. Drinking the number of samples in this study was 20 respondents. The formula used to determine the number of samples is as follows:

Minimum sample = number of variable x 20

The sampling technique used in this study is non-probability sampling, meaning that not all populations have the same opportunity to be sampled. The technique uses convenience sampling, namely choosing someone to be sampled as long as he or she is included in the criteria selected by the author.

Instrument

Researchers adapted the Self Determination Instrument developed by Michael L. Wehmeyer (1995), namely The Arc's self-determination scale. This measuring instrument consists of 32 statement items that describe the ability to make choices based on consideration of the need for autonomy, competence, and social relations. The aspects measured are autonomy, self-regulation, psychological empowerment, and self-realization. The researcher modified the measuring instrument by adjusting the existing academic conditions in Indonesia so that 32 unidimensional statement items were obtained with a Likert-4 scale that measures attitude.

Construct Validity Test Measurement

After collecting data, the researcher conducted a construct validity test to ensure that the instrument correctly measures the construct to be measured. In this study, researchers used Confirmatory Factor Analysis (CFA) using Mplus 8.0 software (Muthen & Muthen, 2017) to test the validity of the measuring instrument. In this section, the researcher will present the analysis results relating to the validity test of the measurement of the self-determination variable. The first step is to test the fit model of the concept (theory), which states that all items compiled (there are 32 items) measure self-determination (testing the unidimensional model). After this has been proven, the next step is to conduct statistical tests (significant tests) on the model's parameters, namely the factor loading coefficient of each item.

Result and Discussion

The Results for the Validity of Self Determination Measurement Instruments

The results of the analysis of the self-determination construct (SDe) show that the model is not fit ($\chi 2$ = 00000, df = 170, p < 0.000, RMSEA estimate = 0.085, 90% C.I = 0.068 until 0.082, probability RMSEA <0.05 = 0.000, CFI = 0.889, and TLI = 0.876) because chi-square ($\chi 2$) and RMSEA are not significant. The unidimensional model (one factor) does not fit the data. Several items measure constructs other than self-determination. However, the unfitness of this model could also mean that all items are valid for measuring SDe (one dimension to be measured, but several items are multidimensional).

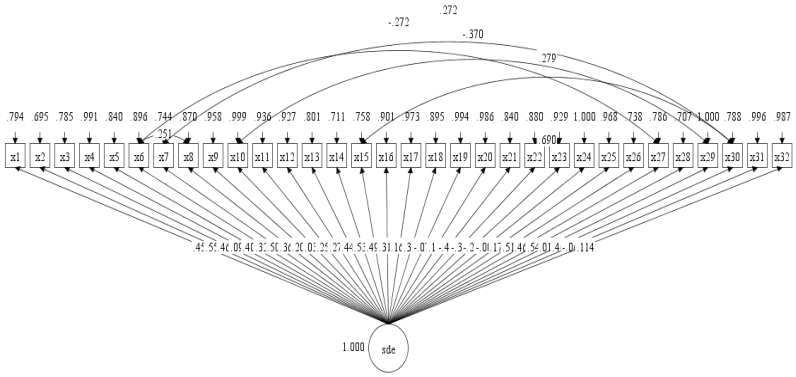
Other items measure SDe and other factors, which have yet to be discovered in this case. This case is also known as item bias. For example, one item on a math test in the form of a story is a valid measure of mathematical knowledge, but simultaneously the item measures language knowledge. Thus, the right or wrong answer is not only determined by knowledge of mathematics but also by knowledge of the language, likewise in this case. There may be several items whose "error of measurement" is correlated with each other because these items, in addition to measuring SDe, also measure other things that are not yet known. Therefore, the next step that the researchers took was to modify the unidimensional model being tested by allowing the correlation between the measurement errors to become independent parameters. This model is done until the model obtained is fit.

The way that can be done to find out which items are multidimensional is to look at the magnitude of the residual value in these items. However, the Mplus software has provided a more accessible and efficient way to detect these multidimensional items by providing a "modification index" index. The correlation between residuals in the item with the most

significant modification index coefficient indicates the correlation between residuals that must be released.

As a result of modification using CFA, a unidimensional model is obtained that fits the data ($\chi 2$ = 644.981, df = 161, p < 0.000, RMSEA estimate = 0.047, 90% C.I = 0.048 until 0.065, probability RMSEA <0.005 = 0.188). If you only look at the chi-square, the model is fit, and also, if you look at the RMSEA and other coefficients such as CFI and TLI (p > 0.90), then the model is fitted with the data (CFI = 0.940, TLI= 0.929). According to Jöreskog and Sörbom (2004), using chi-square to test the fit model is not appropriate if the sample is large enough because the chi-square value results from a direct multiplication between sample size and the resulting log-likelihood.

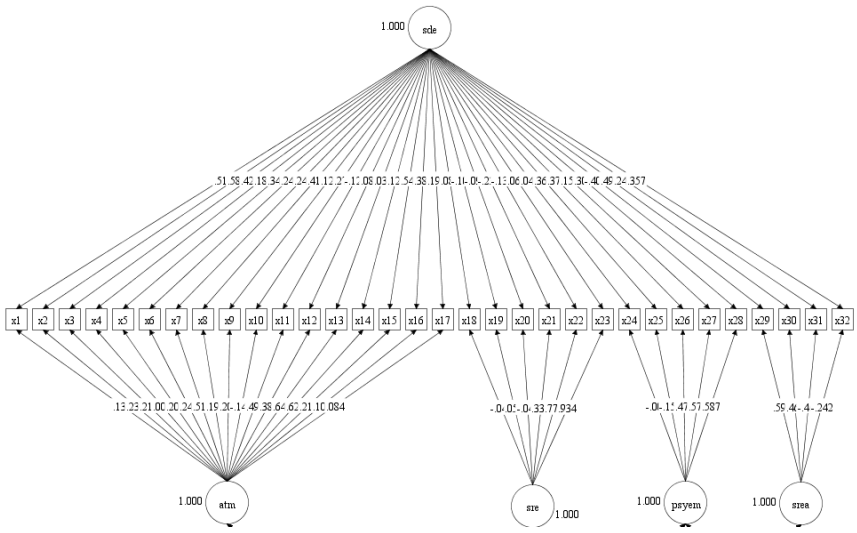
Thus, if you use the chi-square size as a criterion, then a model that is very good and fits the data is considered not fit simply because the sample is large. However, on the other hand, if the sample is not large, the estimation of parameters using the maximum likelihood method becomes less reliable. Therefore, the authors prefer to use RMSEA as a criterion in this study. The model that fits the data here is a unidimensional model accompanied by nine correlations between residuals, as shown in the following diagram:



Figur 1. Unidimensional models that fit the data but are accompanied by Six correlations between residuals

Furthermore, the researcher conducted a CFA analysis with a bi-factor model to find out what factors are measured by the six items that contain these biases. In this case, all theorized (modeled) items will still measure the construct to be measured, namely Sde (Self Determination). However, there are six items of ARC`s scale measuring other constructs that are not correlated with SDe (Self Determination).

That is, there is only one type of bias. However, the results still produce a model that needs to fit the data. Then, by grouping the six items containing the bias into four groups, which means that four other constructs are measured besides measuring Sde, the researcher finally gets a bi-factor model that fits the data as shown in the following figure:



Figur 2. Self-Determination measurement scale diagram
using 32 items bi-factor approach

This model has ($\chi 2$ = 553.522, df = 161, p < 0.000, RMSEA estimate = 0.055, 90% C.I = 0.50 until 0.096, probability RMSEA <0.005 = 0.055, CFI = 0.937, dan TLI = 0.925). From the figure, it can be seen that there are four factors (constructs) measured by the six items that contain the bias. The first construct is measured by items number 6 and 8. After the researcher analyzed the contents of the two items, it turned out that all statements were related to a construct that, according to the researcher, was self-regulatory behaviour. While the second construct was measured by 10 and 29, which were analyzed, it turned out that its content was related to autonomous abilities. Those who score high on these items, apart from showing self-determination, also show high ability in autonomy. In the third construct, 15 and 30, the contents of these items measure self-realization. Furthermore, the fourth construct is measured by items 23,22, and 30; these three items also measure Psychological Empowerment.

For this fit bi-factor model, a significant test is carried out on the factor loading coefficient of each item. The aim is to test the hypothesis of whether each item is statistically significant in measuring a construct being measured, namely self-determination. All items were significant (p < 0.01), so no items were dropped. The factor loading coefficient for each

item, accompanied by a statistical test, can be seen in Table 1:

Table 1. Standardized factor load coefficient 32 self-determination items

Nomor Item	Koefisien Muatan	S.E.	*T-value*	*P-value*	Koefisien Bias
1	0.457	0.045	10.263	0.000	0.000
2	0.603	0.040	14.976	0.000	0.000
3	0.552	0.044	12.651	0.000	0.000
4	0.481	0.039	12.420	0.000	0.000
5	0.485	0.041	21.783	0.000	0.000
6	0.463	0.039	11.751	0.000	0.000
7	0.724	0.039	18.583	0.000*	0.000
8	0.477	0.061	7.763	0.000*	0.557
9	0.440	0.053	8.339	0.000*	0.575
10	0.398	0.071	5.605	0.000*	0.618
11	0.461	0.049	9.316	0.000*	0.205
12	0.375	0.055	6.796	0.000*	0.481
13	0.376	0.079	4.788	0.000*	0.219
14	0.432	0.052	8.317	0.000*	0.000
15	0.613	0.041	14.895	0.000*	0.000
16	0.229	0.087	2.636	0.008*	0.678
17	0.415	0.070	5.975	0.000*	0.448
18	0.762	0.033	22.769	0.000*	0.000
19	0.618	0.052	11.950	0.000*	0.000
20	0.557	0.046	12.200	0.000*	0.000
21	0.788	0.029	17.556	0.000*	0.000
22	0.795	0.024	12.547	0.008*	0.000
23	0.526	0.038	13.752	0.000*	0.000
24	0.765	0.026	9.739	0.000*	0.000
25	0.772	0.025	10.543	0.000*	0.000
26	0.748	0.029	22.773	0.000*	0.000
27	0.025	0.052	11.470	0.000*	0.000
28	0.084	0.052	11.601	0.008*	0.000
29	0.065	0.055	11.180	0.000*	0.000
30	0.029	0.052	11.567	0.000*	0.067
31	0.304	0.048	6.396	0.000*	0.735
32	0.327	0.053	6.161	0.008*	0.000

Explanation:

S.E : *Standard error factor loading* P-*Value* : Nilai *probability*
T-*Value* : Nilai t-test *) : Signifikan pada level 0.05

As a summary of this bi-factor model, it can be concluded that there are findings as follows:

1. No items need to be dropped because all of them are significant in measuring self-determination, as long as the scoring method uses an accurate score calculation with a bi-factor model, as shown in Figure 1 above.

2. Four types of bias were found in this instrument. The first bias is measured by items number 6 and 8. After the researcher analyzed the contents of the two items, it turned out that all statements were related to a construct which, according to the researcher, was self-regulatory behaviour. While the second construct was measured by 10 and 29, which were analyzed, it turned out that its content was related to autonomous abilities. Those who score high on these items, apart from showing self-determination, also show high ability in autonomy. In the third construct, 15 and 30, the contents of these items measure self-realization. Furthermore, the fourth construct is measured by items 23,22 and 30; these three items also measure Psychological Empowerment.

Even though there are no items eliminated, getting a valid score in the bi-factor model, as above, can only be done using sophisticated software such as Mplus and cannot be done with software in the field of Item Response Theory (IRT) where the assumption of unidimensionality without bias must be met.

In this study, the ARC determination scale was adapted to suit the research sample of class IX junior high school students. The ARC scale in this study was adapted to the Likert scale. The autonomy scale consists of 5 sections totaling 32 which are minimized into 17 question items. Self-regulation statements which totaled nine items were reduced to 5 statement items. This item is different from the original version of the ARC scale, where participants were asked to write sentences in the self-regulation question section. Still, in the modified item, the researcher modified the statement items to become a Likert scale. The psychological empowerment item is modified into 6 out of 16 items on the ARC scale. Meanwhile, the 15 items of self-realization of ARC`s scale were modified and reduced into 5 statement items.

The ARC self-determination scale has been used for several studies using both disabled and non-disabled students as samples, which helps design intervention strategies that can be useful in identifying the individual characteristics of students (Verdugo et al., 2015). Research conducted by Verdugo et al. (2015) aimed to validate the ARC self-determination scale on 279 students with disabilities. The result is that the scale, which consists of 4 parts, namely autonomy, self-regulation, psychological empowerment, and self-realization, shows valid results on the internal structure of the scale. The study results found that there were statement items in the self-regulation section that were interconnected with statement items related to autonomy. Researchers analyzed the contents of the two items; it turns out that all statements relate to a construct which, according to researchers, is self-regulatory behaviour. While the second construct was measured by 10 and 29, which were analyzed, it turned out

that its content was related to autonomous abilities. Autonomy concerns a sense of initiative and ownership in one's actions. It is supported by experiences of interest and value and undermined by experiences of being externally controlled, whether by rewards or punishments. Demand for self-regulation skills (Alten, Phielix, Janssen, & Kester, 2020).

Conclusion

This study concludes that the modified and validated ARC self-determination scale is significantly capable of measuring self-determination, so no items from the modified ARC scale need to be discarded if the calculation uses an accurate score calculation with a bi-factor model. In addition, there are statement items related to one construct to another where the statement items on self-regulation measure each other with the statement items from psychological empowerment.

The limitation of this journal is the need for more samples, and it is hoped that in future studies, researchers can take a sample of more than 200 respondents. The sampling technique must also use stratified sampling by taking respondents from different class levels. Further research recommends that researchers use student demographic data to be studied in terms of differences and more in-depth studies.

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