The Development of Adolescent Academic Self-Efficacy Instruments: Analysis of Rasch Model

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Abstract
Academic self-efficacy is part of social cognitive theory. Academic self-efficacy is an individual's belief in the ability to do a task for achieving optimal goals. The evolution of several developments of self-efficacy instruments found in Indonesia and foreign. But, the limitation of the academic self-efficacy instrument for adolescents encourages the researcher to develop the Adolescents' Academic Self-efficacy Instrument (AASEI).Therefore, this study aims to develop the Adolescents' Academic Self-Efficacy Instrument (AASEI) using the RASCH measurement model. The participants in this study were 656 high school seniors aged 15-18 years. The results revealed that the Adolescents' Academic Self-efficacy Instrument (AASEI) had a good person reliability score (0.86), excellent item reliability (0.99), and a very good Cronbach's Alpha score (0.88). The results of the Rasch analysis revealed that 42 instrument items of Adolescents'Academic Self-Efficacy Instrument fulfill the requirements and can be used to measure adolescent academic self-efficacy in Indonesia**.**

Keywords: Development; Adolecents' Academic Self-efficacy; RASCH Model

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INTRODUCTION

The theory of self-efficacy began with the social cognitive theory of psychologist Albert Bandura in the 1970s and 1980s. Self-efficacy is based on a larger theoretical framework known as social cognitive theory, which postulates that human achievement depends on the interaction between a person's behavior, personal factors (e.g., thoughts, beliefs), and environmental conditions(Bandura et al., 1997)(Hergenhahn & Olson, 2017; B. Zimmerman, 1995). Social cognitive theory is derived from social learning theory. According to social learning theory states that individuals will have the motivation or drive to learn certain

behaviors. Individuals will learn through observation and imitation of certain actions (Bandura et al., 1997; Hergenhahn & Olson, 2017; B. Zimmerman, 1995).

One of the domains contained in self-efficacy is academic self-efficacy(Wirawan et al., 2014). Academic self-efficacy has an important role absolutely for every individual in achieving academic success at school, including adolescents. Adolescents will face various academic demands that they will encounter as a provision for their future and a process to develop and grow. Academic demands require individuals to achieve good learning achievements. A significant predictor of academic or learning outcomes and achievement is academic self-efficacy(Caprara et al., 2008; Honicke & Broadbent, 2016).Academic self-efficacy is defined as an individual's belief in their ability to successfully perform academic tasks at a specified level(Schunk, 1991). In addition, academic self-efficacy is defined more broadly as individual self-efficacy in learning regulation and academic mastery(Bandura et al., 2001; B. J. Zimmerman et al., 1992).In other words, academic self-efficacy is an individual's belief in the ability to do a task. Self-efficacy has 3 aspects or dimensions, namely level, generality, and strength (Bandura et al., 1997). Level is the level of academic difficulty that adolescents believe they can solve as a result of perceptions of self-competence. Generality relates to the breadth of academic fields that are believed to be mastered. Strength refers to the strong or weak belief about the perceived ability to complete academic tasks.

Several instruments have been developed to determine the condition of self-efficacy. Research by(Feldman & Kubota, 2015)used an instrument to test self-efficacy using the GSES (General Self-Efficacy Scale) with 10 items in it. GSES is a general self-efficacy scale developed by*(Schwarzer & Jerusalem, 2010)*.The Physics Self-efficacy Questionnaire - General Academic Self-Efficacy Scale (GASE) (Nielsen et al., 2018)was analyzed using Rasch model, with data from 1018 Danish university students (psychological and technical), with a focus on gender invariance and score adequacy. The Morgan-Jinks Student Efficacy Scale (MJSES) was designed to obtain information about students' efficacy beliefs that may be related to school success. Measurement of the Academic Self-Efficacy Scale(Kim & Park, 2020). In addition, The College Academic Self-Efficacy Scale (CASES) from Western and has been developed by Owen, S. V., & Froman, R. D in 1988 was validated in the Indonesian version by(Ifdil et al., 2019). The academic perceived self-efficacy scale includes 15 items related to two broad domains of self-efficacy beliefs(Caprara et al., 2011).In addition, the development of Rasch analysis on the academic self-efficacy scale of counseling practicum was carried out on students(Christiana & Krisphianti, 2020).

From several developments of existing academic self-efficacy instruments, both abroad and in Indonesia, mostly they develop broad academic self-efficacy instruments that can be used in the social, career, and academic domains. In addition, research on the development of academic self-efficacy instruments was tested only on students. In Indonesia, there was no research on academic self-efficacy for middle adolescents. On the other hand, the research that focuses on the development and academic self-efficacy instruments is urgently needed. Therefore, this study aims to develop an Adolescents Academic Self-efficacy Instrument (AASEI) for adolescents.

The results of this study are expected to provide some research contributions. It is hoped that the Adolescent Academic self-efficacy instrument (AASEI) that will be developed later can become a reference for researchers or educators to measure individual academic self-efficacy. In addition, expanding the discussion on the topic of academic self-efficacy studies in the instrument development section.

METHOD

Desain Penelitian

This study aims to develop the Adolescents' Academic Self-Efficacy Instrument (AASEI) using the RASCH measurement model.

Partisipan

Participants who participated in this study were middle adolescents with an age range of 15-18 years. Sampling by distributing instruments directly to participants and using the Google form as a tool for data collection. The number of participants who participated in completing the academic self-efficacy instrument consisted of 656 teenagers.

Instrumen Penelitian

The development of this academic self-efficacy instrument was developed based on the concept of Albert Bandura with the following aspects: 1) Level, 2) Generality, and 3) Strength. These three aspects are then reduced to indicators that are adjusted based on the definitions of these three aspects. More details are explained in table 1. below:

Table 1. Aspects and Indicators of Academic Self-Efficacy

Level	Optimistic in achieving learning outcomes
	View difficult academic assignments as a challenge
	Actions that show interest in doing schoolwork
Generality	Complete all assigned tasks
	Use past life experiences
	Demonstrate a positive attitude during the whole learning process
Strength	Enthusiasm in completing academic assignments
	Have confidence
	Commitment to do academic assignments.

This academic self-efficacy instrument consists of 45 items in total. in using the scale, this instrument is also guided by Bandura's book entitled "Guide for Constructing Self-Efficacy Scales" modified to a Likert scale of 5 (Bandura, 2006).

Prosedur Penelitian

The results of the Rasch analysis revealed that 42 instrument items of Adolescents'Academic Self-Efficacy Instrument fulfill the requirements and can be used to measure adolescent academic self-efficacy in Indonesia.

Analisis Data

RASCH model analysis was used as a data analysis technique using the Winstep application. This study identified the validity and reliability of data analysis of the development of Adolescent Academic Self-efficacy Instruments.

RESULT AND DISCUSSION

Hasil Penelitian

In developing this academic self-efficacy instrument, validity testing was carried out to determine the validity of the instrument being developed. Validity testing is carried out to determine the accuracy of an instrument in producing data that appropriate with the research objectives. In addition, it is used to measure the level of accuracy of the instrument used (Arsi, 2021). Validity is also used as a process of proving whether the test instrument made were appropriate with the purpose of the test (Sumintono & Widhiarso, 2015).Research data can be analyzed with the RASCH model which is seen in the MNSQ Ideal value. More detailed results are presented in this Figure 1.below:

Figure 1. Statistical Summary

SUMMARY OF 656 MEASURED Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	151.2	45.0	.35	.15	1.02	-.3	1.02	-.3
S.D.	19.2	.0	.46	.01	.57	2.7	.57	2.6
MAX.	208.0	45.0	2.11	.25	3.70	8.8	3.71	8.9
MIN.	91.0	45.0	-1.02	.15	.17	-7.0	.19	-6.8

REAL RMSE	.17	TRUE SD	.42	SEPARATION	2.50	Person RELIABILITY .86
MODEL RMSE	.15	TRUE SD	.43	SEPARATION	2.80	Person RELIABILITY .89
S.E. OF Person MEAN = .02						

Person RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .88

SUMMARY OF 45 MEASURED Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	2203.5	656.0	.00	.04	1.01	-.2	1.02	-.1
S.D.	264.4	.0	.41	.00	.26	5.0	.28	5.2
MAX.	2779.0	656.0	.97	.05	1.72	9.9	1.73	9.9
MIN.	1569.0	656.0	-1.02	.04	.61	-9.1	.61	-9.0

REAL RMSE	.04	TRUE SD	.41	SEPARATION	9.78	Item RELIABILITY .99
MODEL RMSE	.04	TRUE SD	.41	SEPARATION	10.35	Item RELIABILITY .99
S.E. OF Item MEAN = .06						

UMEAN=.0000 USCALE=1.0000
Item RAW SCORE-TO-MEASURE CORRELATION = -1.00
29520 DATA POINTS. LOG-LIKELIHOOD CHI-SQUARE: 79542.85 with 28817 d.f. p=.0000
Global Root-Mean-Square Residual (excluding extreme scores): .9876

Figure 1 above shows the mean MNSQ infit and outfit person values are 1.02 and 1.02. The average value of the MNSQ Infit and Outfit items is 1.01 and 1.02. This value is close to the MNSQ Ideal Value (1.0). Infit and outfit person ZSTD mean values are -0.3 and –0.3. The average ZSTD Infit and Outfit item values are -0.2 and -0.1. This value is close to the ZSTD Ideal Value (0.0). Based on these results it is known that the data presented in this study, namely the adolescent academic self-efficacy instrument meets the requirements for analysis using the RASCH Model.

This test was conducted to find out that the developed instrument can measure what should be measured. The results of testing the unidimensionality of the youth academic self-efficacy instrument can be seen in Figure 2 below.:

Figure 2. Unidimensionality Test

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

	-- Empirical --		Modeled
Total raw variance in observations =	60.7	100.0%	100.0%
Raw variance explained by measures =	15.7	25.9%	26.5%
Raw variance explained by persons =	2.9	4.8%	4.9%
Raw Variance explained by items =	12.8	21.1%	21.5%
Raw unexplained variance (total) =	45.0	74.1% 100.0%	73.5%
Unexplned variance in 1st contrast =	5.5	9.1% 12.3%	
Unexplned variance in 2nd contrast =	2.3	3.7% 5.0%	
Unexplned variance in 3rd contrast =	2.0	3.3% 4.4%	
Unexplned variance in 4th contrast =	1.7	2.8% 3.8%	
Unexplned variance in 5th contrast =	1.5	2.5% 3.3%	

Based on the picture above obtained from the results of the analysis of the RASCH model approach, it is known that the empirical value of the unidimensionality test is 25.9%. This academic self-efficacy instrument can be used because it shows consistency in uncovering psychological constructs as seen from the results of the unidimensionality test reaching 25.9%. This figure indicates that the unidimensionality test requirements of at least 20% are met (Sumintono & Widhiarso, 2015). In addition, it is also known that the variance value moves from 2.5% to 9.1%. That is, the conditions for an instrument can be used if it has a variance value below 15% fulfilled. This adolescent academic self-efficacy instrument can measure the constructs of academic self-efficacy and measure what should be measured (to avoid variances outside the construct).

The rating scale in the RASCH model approach to testing the rating scale is used to evaluate the data. In addition, Andrich Threshold is used to ensure that the polytomous value used is right on target (Boone et al., 2014)The measurement of the rating scale analysis can be shown in Figure 3 below:

Figure 3. Rating Scale Measurement

SUMMARY OF CATEGORY STRUCTURE. Model="R"

CATEGORY LABEL	SCORE	OBSERVED COUNT	%	OBSVD AVRGE	SAMPLE EXPECT	INFIT MNSQ	OUTFIT MNSQ	ANDRICH THRESHOLD	CATEGORY MEASURE	
1	1	2028	7	-.13	-.27	1.19	1.27	NONE	(-2.39)	1
2	2	4365	15	-.03	-.02	.96	.96	-.91	-1.00	2
3	3	9689	33	.20	.24	.85	.82	-.68	-.02	3
4	4	7857	27	.51	.52	.98	.98	.59	.99	4
5	5	5581	19	.87	.82	.97	.99	1.01	(2.44)	5

OBSERVED AVERAGE is mean of measures in category. It is not a parameter estimate.

Figure 3 above shows that the average logit observation value of -0.13 (*Sangat tidakyakin*) increases to a value of -0.3 (*tidakyakin*), increases to a value of 0.20 (*cukupyakin*), then increases to a value of 0.51 (*yakin*), and finally increased to a value of 0.87 (*sangat yakin*). In the Andrich Threshold index table, it is known that the value moves from none to negative and continues to be positive. From the two analyzes obtained, the increase in the average observation value and the Andrich Threshold value indicates that the answer choices used in the adolescent academic self-efficacy instrument do not confuse respondents and can be used

Item fit-order analysis in the RASCH model is used to see which statement items are appropriate with the validity requirements of the RASCH model. Thus, these items can be legitimately used as measuring instruments in research. There are several conditions for determining valid items according to the Rasch Model(Boone et al., 2014; Sumintono & Widhiarso, 2015)as follows:

1. The accepted MNSQ OUTFIT value is 0.5 < MNSQ < 1.5
2. The accepted OUTFIT ZSTD value is -2.0 < ZSTD < 2.0
3. The value of Point Measure Correlation (Pt Measure Corr) received is 0.4 < Pt Measure Corr < 0.85

In making fit order item decisions, it is necessary to pay attention to the number of respondents involved because it affects the ZSTD value. The respondents who exceed 500, the ZSTD value can be ignored (Sumintono & Widhiarso, 2015). In addition, according to Linacre (2012) briefly, the MNSQ (mean-square) is a chi-square calculation (which measures the level of association) for outfit and infit statistics. ZSTD (z-standardized) provides a t-test

statistic that measures the probability of an MNSQ calculation occurring by chance. As long as the MNSQ value is within the specified range then ZSTD can be ignored(Boone et al., 2014).

Respondents who participated in completing the instrument were 656. Therefore, the ZSTD value can be ignored (based on the theoretical explanation above) and only look at the MNSQ outfit value. The item fit order results can be seen in Figure 4 below.

Figure 4. Measure Order

Item STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	PT-MEASURE EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	Item
14	1569	656	.97	.04	1.24	4.6	1.25	4.7	.15	.41	29.1	34.6	P14
33	1645	656	.85	.04	1.35	6.5	1.37	6.9	.11	.42	30.0	35.0	P33
9	1732	656	.71	.04	.99	-.2	1.00	-.1	.24	.42	34.9	35.8	P9
15	1761	656	.67	.04	.80	-4.5	.80	-4.5	.51	.42	42.1	36.0	P15
19	1870	656	.51	.04	.88	-2.5	.88	-2.4	.49	.42	39.0	36.9	P19
18	1876	656	.50	.04	.75	-5.5	.76	-5.5	.46	.42	44.5	37.0	P18
20	1899	656	.47	.04	1.45	8.2	1.48	8.5	.14	.42	28.7	37.2	P20
21	1899	656	.47	.04	1.19	3.7	1.24	4.7	.11	.42	37.7	37.2	P21
2	1993	656	.33	.04	.68	-7.2	.68	-7.3	.48	.41	46.5	37.7	P2
7	2006	656	.31	.04	1.25	4.7	1.26	4.9	.40	.41	31.1	37.7	P7
23	2020	656	.29	.04	1.14	2.8	1.16	3.0	.34	.41	35.7	37.7	P23
29	2046	656	.25	.04	.73	-6.2	.73	-6.1	.51	.41	47.6	37.8	P29
28	2059	656	.23	.04	1.47	8.4	1.57	9.9	-.13	.41	34.0	37.7	P28
26	2107	656	.16	.04	1.06	1.2	1.07	1.3	.38	.41	37.3	37.7	P26
22	2108	656	.16	.04	.77	-4.9	.77	-4.9	.55	.41	45.9	37.7	P22
31	2118	656	.14	.04	1.10	2.1	1.10	2.0	.48	.41	37.0	37.7	P31
37	2124	656	.13	.04	1.12	2.4	1.14	2.8	.25	.41	38.3	37.7	P37
39	2131	656	.12	.04	1.09	1.7	1.17	3.4	.26	.41	39.5	37.6	P39
27	2149	656	.10	.04	.83	-3.6	.83	-3.7	.49	.41	42.5	37.6	P27
30	2183	656	.05	.04	.93	-1.4	.92	-1.5	.44	.40	41.2	37.5	P30
1	2202	656	.02	.04	.61	-9.1	.61	-9.0	.50	.40	51.5	37.4	P1
8	2205	656	.01	.04	.93	-1.4	.97	-.5	.36	.40	43.9	37.5	P8
12	2219	656	-.01	.04	.72	-6.2	.72	-6.3	.55	.40	45.7	37.5	P12
35	2247	656	-.05	.04	.79	-4.6	.79	-4.6	.57	.40	44.8	37.3	P35
16	2255	656	-.07	.04	.72	-6.2	.72	-6.1	.55	.40	50.5	37.2	P16
3	2257	656	-.07	.04	1.31	5.6	1.34	6.2	.23	.40	31.7	37.2	P3
25	2268	656	-.09	.04	.79	-4.6	.79	-4.5	.59	.40	42.4	37.2	P25
10	2295	656	-.13	.04	1.01	.2	1.02	.3	.45	.39	38.6	37.0	P10
32	2308	656	-.15	.04	.71	-6.4	.72	-6.2	.55	.39	46.6	36.9	P32
11	2324	656	-.17	.04	.78	-4.7	.77	-4.9	.54	.39	45.9	36.8	P11
40	2324	656	-.17	.04	.73	-5.8	.73	-5.8	.61	.39	47.3	36.8	P40
41	2388	656	-.28	.04	1.01	.1	1.04	.8	.43	.39	38.3	36.6	P41
44	2398	656	-.29	.04	1.37	6.6	1.45	7.8	.24	.38	37.8	36.5	P44
45	2405	656	-.30	.04	1.01	.2	.99	-.2	.55	.38	32.9	36.4	P45
42	2433	656	-.35	.04	1.36	6.4	1.38	6.7	.22	.38	35.7	36.4	P42
43	2436	656	-.36	.04	.77	-4.9	.76	-5.0	.62	.38	41.0	36.4	P43
36	2440	656	-.36	.04	.85	-3.1	.83	-3.5	.62	.38	39.5	36.4	P36
4	2454	656	-.39	.04	1.30	5.3	1.30	5.3	.35	.38	36.3	36.5	P4
34	2494	656	-.45	.04	.88	-2.3	.86	-2.7	.51	.37	41.2	36.5	P34
17	2500	656	-.46	.04	1.55	9.2	1.62	9.9	.09	.37	30.3	36.5	P17
38	2530	656	-.52	.04	.87	-2.5	.85	-3.0	.54	.37	38.4	36.4	P38
6	2543	656	-.54	.04	.86	-2.9	.83	-3.4	.49	.37	42.5	36.5	P6
5	2578	656	-.60	.04	1.06	1.1	1.04	.7	.44	.36	34.5	36.7	P5
13	2581	656	-.61	.04	1.72	9.9	1.73	9.9	.30	.36	30.6	36.7	P13
24	2779	656	-1.02	.05	1.04	.7	.99	-.2	.45	.32	42.5	40.6	P24
MEAN	2203.5	656.0	.00	.04	1.01	-.2	1.02	-.1			39.4	37.0	
S.D.	264.4	.0	.41	.00	.26	5.0	.28	5.2			5.8	.9	

Based on the figure 4. it can be seen the value of the MNSQ outfit P28 (1.57), P17 (1.62), and P13 (1.73). These three items do not meet the standard criteria for valid items according to the RASCH model and are stated. Therefore, of the 45 items developed, 42 valid and reliable itemscan be used by other researcher in Indonesia.

Reliability is used to describe the extent to which measuring instruments can obtain information consistently and can be used repeatedly (Sumintono & Widhiarso, 2015). Reliability analysis can be seen in the RASCH Model approach in the summary statistics section (see Figure 1.) with several assessments that need to be seen, there are, person reliability, item reliability, and Cronbach's Alpha. Reliability analysis can be seen in the following table:

Table 2. Reliability Value

	Mean Measure(SD)	*Separate*	*Reliability*	*Alpha Cronbach*
Person	0.35	2.50	0.86	0.88
Items	0.00	9.78	0.99	

From the results of the data analysis, the result of person reliability was 0.86. It can be concluded that the adolescent academic self-efficacy instrument is in a good category. Then the results of the reliability item 0.99 can be concluded that the quality of the items in the instrument is in a special category. In addition, the value obtained for Cronbach's Alpha is 0.88 and it can be concluded that the Cronbach's Alpha value is in the very good category.

Pembahasan

From several developments of existing academic self-efficacy instruments, both abroad and in Indonesia, mostly they develop broad academic self-efficacy instruments that can be used in the social, career, and academic domains. In addition, research on the development of academic self-efficacy instruments was tested only on students. In Indonesia, there was no research on academic self-efficacy for middle adolescents. On the other hand, the research that focuses on the development and academic self-efficacy instruments is urgently needed. Therefore, this study aims to develop an Adolescents Academic Self-efficacy Instrument (AASEI) for adolescents.

The results of this study are expected to provide some research contributions. It is hoped that the Adolescent Academic self-efficacy instrument (AASEI) that will be developed later can become a reference for researchers or educators to measure individual academic self-efficacy. In addition, expanding the discussion on the topic of academic self-efficacy studies in the instrument development section.

CONCLUSION

The Adolescents Academic Self-efficacy Instrument (AASEI) has a good person reliability score (0.86), excellent item reliability (0.99), and a very good Cronbach's Alpha score (0.88). Of the 45 items that were developed after being tested for validity (construct, scale, content) and reliability testing, 3 items were declared invalid and 42 items were eligible to be used to measure adolescent academic self-efficacy.

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