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Exploring academic resilience among vocational students; development of measurement tools

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ABSTRACT

Vocational students have a greater capacity to overcome academic adversity, and the role of academic resilience is essential to positive academic outcomes and future careers. Exploring the academic resilience of vocational school students requires valid and reliable measurement tools. This study aims to develop a measurement tool for academic resilience in Indonesian vocational school contexts and its evidence validation. This study involved 206 students from various vocational fields in several public vocational schools in Kupang City, Indonesia, with a multistage sampling technique. Twenty-item academic resilience measurement tools were utilized. Validate of the construct was assessed with exploratory factor analysis (EFA) and Alpha Cronbach for reliability. The results demonstrated by both the Kaiser-Meyer-Olkin test and Bartlett's test confirm adequate data. EFA highlights the single-factor model. A total of twelve items were removed, and eight items were qualified, with the highest loading factor score of 0.816 and the lowest score of 0.547. The reliability confirms the high category (0.96). The whole procedure resulted in a measurement tool of eight items to assess academic resilience and contributed to evaluating the efficacy and treatment in Indonesian vocational schools.

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1. INTRODUCTION

Students in vocational schools have unique and typical learning characteristics. In the Indonesian educational system, they are adolescents who have graduated from junior high school (middle school) and choose a vocational school for their subsequent education over three years. Vocational students faced more learning in practice than traditional learning in class [1]. They deal with practical training in the industry, schoolwork, and exams as a part of learning activities, which include cognitive (knowledge), psychomotor (skills), and affective (attitude) [2], [3]. They are prepared to be skilful, independent, and competitive workers [4], [5]. This academic activity differs from other non-vocational students [6], [7]. The various academic activities faced by students in vocational schools highlight the role of academic resilience to exist and exhibit positive academic outcomes.

Academic resilience is an increasingly popular concept in educational settings because of its positive relationship with the performance and achievement of students in schools [8]–[12]. Academic resilience describes one's ability to 'beat the odds', maintaining positive psychological and academic well-being in the

face of education-related adversity [13]–[15]. The previous study explains that students' academic resilience potentially promoted retention and broadened students' education aspirations in school [16]. In addition, when dealing with challenges in schoolwork, students who rely on personal resources, such as academic resilience, tend to encourage all efforts with full energy to achieve their goals [17], [18]. Victor *et al.* [19] explain that resilience among vocational students is essential to successful learning and preparing for future careers.

Promoting resilience in the vocational domain is critical to making equitable, high-quality vocational education accessible to all students. Enhancing students' capacity to persist in dealing with academic adversity and bounce back can be navigating possible vulnerabilities. Cognitive test anxiety [20], low desire to learn, lack of school belonging, low self-confidence [21], and dropout vulnerability [22] are various risk factors related to poor resilience. Some protective factors related to students' resilience in academic activities include parents and teachers, a positive school climate, cooperation at school, and belief in one's abilities [23].

Exploring academic resilience among students in vocational schools needed a trustworthy scale. Previous research developed an academic resilience scale (ARS-30) among undergraduate students with three constructs (perseverance, reflecting and adaptive help-seeking, and negative affect and emotional response) [24] and adapted it in Spanish [25] and Turkish versions [26]. Martin and Marsh [27] developed an academic resilience scale among high school students with six items short-form. This scale reveals students' ability to effectively deal with setbacks, adversity, challenges, and pressure in the academic setting. Specific to the Indonesian context, measurement tools to assess academic resilience are limited among junior high school students [28] and gifted students in senior high school [29]. However, after examining different available measurement tools, it has been observed that do not exist which measure academic resilience in a population of students' vocational schools. This is so because many available tools have been developed for studying resilience in the context of general academic activities, which may not be valid for vocational-based academic activities, where activities are work-oriented. In addition, the statements of such tools were not appropriate in cross-cultural conditions. In this case, we are trying to provide measurement tools accurately for a population of students in vocational schools through development scale procedures.

This study aims to develop and validate measurement tools to assess academic resilience among vocational students in the Indonesian school context. The measurement tool was created to evaluate educators' efficacy and treatment in the context of fostering academic resilience. A short-form self-report model is designed with a theoretical framework of academic resilience by Martin and Marsh [27]. The evaluation process includes students from various vocational fields in several public vocational schools.

2. METHOD

In this section, we present the research design, population and sample, measurement tools, procedures, and data analysis as follows:

2.1. Research design

This research design uses scale development procedures [30] and a quantitative approach to validate measurement tools of academic resilience. In the evaluation of the psychometric properties, the data was collected from a cross-sectional survey with electronic-based instruments. Exploratory factor analysis (EFA) was used to validate the dimensionality, distribution of items, and total factor constructs.

2.2. Population and sample

This study included vocational students in Kupang City, East Nusa Tenggara, Indonesia. A multistage sampling technique was used, starting with i) cluster sampling based on school location; ii) cluster sampling based on vocational fields in each school; and iii) random sampling in each vocational field. A total of 206 students participated in this study with demographic data as follows shown in Table 1.

2.3. Measurement tool

The instrument was developed independently with the theoretical framework of academic resilience by Martin and Marsh [27]. This study created four constructs to measure academic resilience; i) deal with academic setbacks; ii) deal with academic challenges; iii) deal with academic adversity; and iv) deal with academic pressures. Design of measurement instrument to measure academic resilience among vocational students as follows shown in Table 2.

There are 20 items in measurement tools of academic resilience. The response format for each item uses a 5-point Likert scale [31]. The higher score in each item (range 1-5) indicates greater agreement with the statements. Model favorable (10-items) and unfavorable (10-items) items were used proportionally to get accurate item responses.

Table 1. Demographic data of sample

Characteristics		n=206	Percentage (%)
Gender	Male	79	38.3
	Female	127	61.7
Vocational fields	Technology and engineering	10	4.9
	Art and creative industry	10	4.9
	Tourism	38	18.4
	Business and management	71	34.5
	Maritime	26	12.6
	Information and communication technology	51	24.7
School name	Public Vocational High School 1 Kupang (rural area)	81	39.3
	Public Vocational High School 2 Kupang (rural area)	12	5.8
	Public Vocational High School 3 Kupang (urban area)	46	22.3
	Public Vocational High School 6 Kupang (urban area)	41	19.9
	Public Vocational High School 7 Kupang (rural area)	26	12.6

Table 2. Blueprint measurement tool for academic resilience

Indicators	Statements	Item code
Deal with academic seatbacks	Takes a long time to get excited (-)	DAS1
	Difficulty accepting academic failure sincerely (-)	DAS2
	Don't get lost in disappointment (+)	DAS3
	Poor assignment grades and affects trust (-)	DAS4
	Doing self-evaluation when grades are less than satisfactory (+)	DAS5
	Grades points must be better than academic year before (+)	DAS6
Deal with academic challenges	Don't care about the consequences of not doing the task (-)	DAC1
	Confident in completing assignments on time even though many tasks (+)	DAC2
	School assignments are done seriously even though they are difficult (+)	DAC3
	Learning problems are overcome without harming myself and other people (+)	DAC4
	Difficult to complete tasks optimally and on time if there are interruptions (-)	DAC5
Deal with academic adversity	Confident in being able to complete difficult tasks (+)	DAA1
	Procrastinate and don't submit assignments because it is beyond ability (-)	DAA2
	Don't have a solution when having difficulty doing a task (-)	DAA3
	Doing difficult school assignments is a valuable life experience (+)	DAA4
Deal with academic pressure	The stress takes over, so you are lazy about studying and doing assignments (-)	DAP1
	It's hard to face the pressure of homework from teachers (-)	DAP2
	Believe that i am mentally tough in facing exams and assignments (+)	DAP3
	Try to entertain yourself for a moment and continue again when bored (+)	DAP4
	The assignment pressure makes unsure can completely (-)	DAP5

Note: favorable (+) and unfavorable (-).

2.4. Procedures

The measurement tool of academic resilience was developed and evaluated in four phases in this study [30]: Phases 1: search literature that links with each construct and develop item statements. Discussion among research members (n=8) conduct and item agreement in each construct obtained. We formulate possible items and discuss and refine them by carefully considering 20 items for this scale. Phase 2: the draft of the instrument was discussed with education experts (n=3), and psychological measurement experts (n=2) were conducted to review the face and content validity. The relevance of the item group to the content domain, the accuracy and completeness, as well as the potential bias of the item, was evaluated [32]. Phase 3: collect data from respondents with a cross-sectional survey. The electronic-based instrument was distributed through the platform WhatsApp groups of students, assisted by the school counselor, with permission from the school principal. Phase 4: examine psychometric properties and equality using EFA.

2.5. Data analysis

The analysis of data includes mean, standard deviation (SD), and percentage. Psychometric evaluation includes construct validity and reliability. Construct validity was assessed with EFA using the software package for social sciences (SPSS) 26 version. The principal component analysis (PCA) method was used to examine factor structure in EFA, followed by varimax rotation. Kaiser-Meyer-Olkin test (>0.60) and Bartlett's test sphericity ($p<0.05$) were used to determine the suitability of the data. The items that did not fit in factors (factor loading <0.05) were deleted [33], [34]. Estimated reliability using unstandardized parameter estimates (Cronbach's Alpha >0.70).

3. RESULTS AND DISCUSSION

The current study investigated measurement tools to assess academic resilience in a population of students' vocational schools. While earlier studies have explored academic resilience measurement tools,

they have not explicitly addressed in the context of vocational-based academic activities. A total of 20 items were successfully developed in the initial measurement tools. In the construct of academic seatbacks, six items were developed (e.g., *"I evaluate myself when I get an unsatisfactory grade"*). Five items were created to measure the construct of academic challenges (e.g., *"Even though there are many school assignments, I'm sure I can finish them on time"*). In the construct of academic adversity, four items were developed (e.g., *"When I have difficulty doing schoolwork, it is very difficult for me to find a solution"*). Five items were created to measure the construct of academic pressure (e.g., "*The pressure of the current assignments makes me unsure if I can complete the existing subject scores"*). After expert evaluation, all 20 items indicate a high category both on the content validity index using Aiken's formula (V=0.87) and the content validity ratio using Lawshe's formula (CVR=0.74).

An EFA was carried out to examine construct validity. The Kaiser-Meyer-Olkin test (MSA=0.850) and Bartlett's test (χ^2=1813.868; p<0.001) indicated that the sample is adequate and the data are suitable for performing factor analysis. EFA was performed using the PCA [29] with the varimax rotation method [35] and indicates that four-factor structures are adequate in Figure 1. All 20 items were distributed into the four-factor structure with mean score ranges from 2.3 (SD=1.1) to 4.5 (SD=0.8). Item DAS6 has the highest mean score, 4.5 (SD=0.8), and item DAC5 has the lowest mean score, 2.3 (SD=1.1). The distribution of items and factor loading value is presented (EFA[a]) in Table 3.

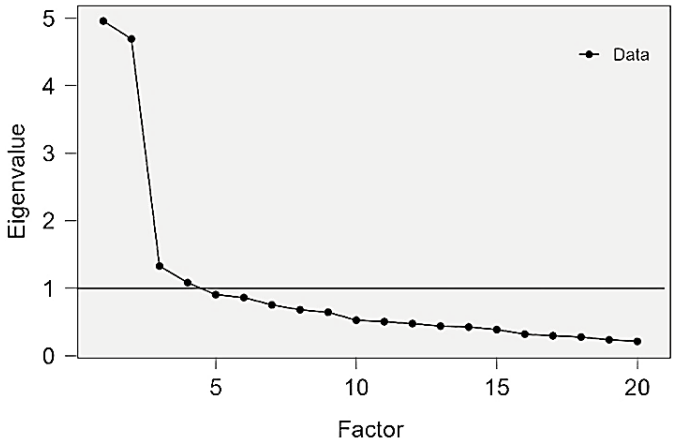

Figure 1. Scree plot EFA

Table 3. The score for each item and finding of EFA (factor loading <0.50 removed)

Items code	Mean (SD)	EFA[a]				EFA[b]
		F1	F2	F3	F4	F1
DAS1	2.6 (1.2)					
DAS2	2.5 (1.1)			0.762		
DAS3	4.1 (0.8)					
DAS4	2.9 (1.3)			0.630		
DAS5	4.0 (0.8)					
DAS6	4.5 (0.8)				0.760	0.688
DAC1	3.8 (1.2)		0.765			
DAC2	4.2 (0.8)	0.505				0.547
DAC3	4.1 (0.8)	0.658				0.641
DAC4	4.0 (0.8)	0.911				0.816
DAC5	2.3 (1.1)					
DAA1	4.1 (0.8)	0.794				0.660
DAA2	3.6 (1.2)		0.837			
DAA3	3.0 (1.1)		0.610			
DAA4	4.2 (0.9)	0.713				0.710
DAP1	3.3 (1.2)		0.761			
DAP2	3.0 (1.2)		0.684			
DAP3	4.2 (0.8)	0.728				0.776
DAP4	4.4 (0.7)	0.540				0.634
DAP5	3.0 (1.1)		0.756			
Kaiser-Meyer-Olkin test MSA			0.850			0.850
Bartlett's test χ^2			1813.868			1813.868
Chi-squared			1088.186			1105.746

The four-factor structure eliminated four items due to poor factor loading (<0.50). Distribution of qualified items in each factor (EFA[a]) included seven items (factor 1), six items (factor 2), two items (factor 3), and 1 item (factor 4). The highest and lowest factor loading values were found on factor 1, item DAC4 (0.911) and item DAC2 (0.505). However, the results of the four-factor structure were re-evaluated because the distribution of items is inadequate with the theoretical framework model. Further, there are limited items distributed in each factor; the fourth factor (F4) only has 1 item (DAS 6), and the third factor (F3) only has two items (DAS 2 and DAS 4). In addition, the fourth factor (F4) and third factor (F3) are also categorized as having the same item criteria (developed to measure the construct of deal with academic seatbacks).

In re-evaluating the factor structure, EFA was performed using the PCA [29], and the single factor method was extracted. EFA confirms that the single-factor structure included eight qualified items (EFA[b]). All eight items are formed; it represents the initial concept with four constructs based on a theoretical framework even though the model is unidimensional. For example, item DAS6 represents the construct of deal with academic seatbacks. Two items (DAC3 and DAC4) in this model also represent the construct of deal with academic challenges. Items DAP3 and DAP4 represent the construct of deal with academic pressure. The last two items (DAA1 and DAA4) in this model represent the construct of deal with academic adversity. The highest loading factor value is 0.816 (DAC4), and the lowest is 0.547 (DAC2). This study's proposed academic resilience measurement tools tended to have an inordinately higher proportion of single-factor models than four-factor structure models. The findings in the current study line with the previous study by Cui *et al*. [36] and Martin and Marsh [27] that confirm the single-factor model on academic resilience measurement tools.

Our study suggests that the academic resilience measurement tools have a unidimensional model and consist of 8 items. The academic resilience measurement tool is strongly explained by the item DAC4, which has a loading factor of 0.816. This item provides information about students' problem-solving in difficult tasks [37]. On the other hand, the weak item in explaining academic resilience is item DAC2 (factor loading=0.547). This item provides information about time management despite many tasks. Overall, measurement tools 8-item have good validity in assessing academic resilience.

The reliability of academic resilience measurement tools 8-items was estimated using coefficient alpha approaches. This approach is an "item-level" internal consistency method using inter-item associations, and it can potentially be applied to estimate the reliability of instruments with composite scores [30]. The reliability test explains the coefficient alpha Cronbach's value of 0.96, considered "excellent" [38]. Good reliability means that a person's score in academic resilience measurement tools is a reasonable estimate of his or her actual score. The reliability of measurement tools in high category line with the previous study by Ramdani *et al*. [28], which found a coefficient alpha Cronbach's value of 0.90.

Psychometric test results confirm that academic resilience measurement tools are satisfactory and reliable. The eight items confirmed that it was feasible to explore resilience in academic settings among vocational school students. The instrument self-report in short form makes it easy for practitioners in schools and academics. Besides being practical, the time required to complete this instrument is shorter and more efficient [39]. School practitioners utilize the 8-item measurement tools to promote positive academic outcomes among students as an initial screening or evaluate the efficacy and treatment. Poor and high levels of academic resilience can be known [40], [41], and school practitioners such as school counselors can help by providing professional services [17], [42].

The limitations of this study lie in the participants. This new item was developed in Timorese culture, which involved students at public vocational schools in Kupang City. However, the participant areas are still insufficient to represent the Timor Island region and Indonesia, so the number of participants needs to be expanded [43]. The participants' scope is also limited so that only vocational school students who are involved have the opportunity and luck. Therefore, further research must test the psychometric trait scale with different populations.

4. CONCLUSION

The measurement tools of academic resilience consist of the 8-item, and the model is unidimensional. Each item has an adequate factor loading, indicating the item can explain the construct, and the high reliability of measurement tools indicates trustworthy instruments. Hence, the 8-item measurement tool can fill the limitations of existing so that practitioners and academics can use it to explore student resilience in their academic activity. School counselor evaluates their treatment in fostering academic resilience context, and policymakers evaluate programs that support promoting academic resilience among students. It is essential for students' academic resilience in vocational school to support positive academic outcomes and future careers.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
I Putu Agus Apriliana	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Kadek Suranata		✓		✓		✓		✓		✓		✓		

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

All participants included in this study provided written informed consent after receiving a clear explanation of the study's aims, procedures, confidentiality measures, and their right to withdraw at any time without repercussions.

ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and the study protocol was approved by the Research Ethics Committee of the Faculty of Public Health-Universitas Nusa Cendana (Number: 2023066-KEPK).

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [IPAA], upon reasonable request.

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