Edukasi Islami: Jurnal Pendidikan Islam, VOL: 13/No: 03 August 2024 **P-ISSN: 2252-8970**
doi: 10.30868/ei.v13i03.8971 **E-ISSN: 2581-1754**

Date Received	**:**	**July 2024**
Date Revised	**:**	**July 2024**
Date Accepted	**:**	**July 2024**
Date Published	**:**	**August 2024**

ASSESSING SELF-EFFICACY IN VOCATIONAL STUDENTS: DEVELOPMENT AND PSYCHOMETRIC EVALUATION OF A NEW SCALE USING EXPLORATORY FACTOR ANALYSIS

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Kata Kunci:
Self efikasi,
Siswa Kejuruan,
Exploratory Factor Analysis

ABSTRAK

Efikasi diri memegang peran penting dalam membentuk motivasi, strategi belajar, dan kesiapan karier siswa, khususnya bagi siswa sekolah menengah kejuruan yang mempersiapkan diri untuk tuntutan akademik sekaligus dunia kerja. Penelitian ini bertujuan untuk mengembangkan dan memvalidasi skala efikasi diri yang disesuaikan dengan konteks siswa kejuruan melalui pengukuran tiga dimensi utama: Magnitude, Generality, dan Strength. Dengan pendekatan kuantitatif, penelitian ini melibatkan 256 siswa dari sekolah menengah kejuruan di Kabupaten Sukoharjo. Proses validasi dilakukan menggunakan Analisis Faktor Konfirmatori (CFA) untuk menguji validitas konstruk dari skala yang dikembangkan. Hasil analisis menunjukkan bahwa seluruh item memiliki loading faktor yang signifikan terhadap dimensinya masing-masing, dengan beberapa item seperti M3, M6, dan G3 menunjukkan indeks modifikasi yang tinggi, menandakan kontribusi yang kuat terhadap struktur model dan potensi perbaikan di masa mendatang. Kebaruan dari penelitian ini terletak pada adaptasi konstruk efikasi diri yang kontekstual terhadap pendidikan kejuruan, yang masih jarang dijadikan fokus dalam studi pengukuran psikologis. Temuan ini mengonfirmasi bahwa efikasi diri pada siswa kejuruan merupakan konstruk multidimensi, dan skala yang dikembangkan terbukti valid serta reliabel. Implikasi dari penelitian ini menunjukkan bahwa pendidik dan pembuat kebijakan dapat menggunakan skala ini untuk merancang intervensi yang lebih personal dalam meningkatkan keyakinan diri siswa di berbagai tingkatan dan konteks. Penelitian selanjutnya dapat mengeksplorasi penggunaan skala ini secara longitudinal atau validitas prediktifnya terhadap capaian akademik dan karier.

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Keywords:
Self-effixacy
Vocational Students
Exploratory Factor Analysis

ABSTRACTS

Self-efficacy plays a crucial role in shaping students' motivation, learning strategies, and future career readiness, especially for vocational high school students who are preparing for both academic and practical workforce demands. This study aimed to develop and validate a self-efficacy scale tailored to the context of vocational students by measuring three key dimensions: Magnitude, Generality, and Strength. Using a quantitative approach, the study involved 256 students from vocational schools in Sukoharjo Regency. The validation process employed Exploratory Factor Analysis (EFA) to test the construct validity of the scale, revealing that all items loaded significantly on their respective factors, with some items such as M3, M6, and G3 demonstrating high modification indices. This indicates strong contribution to the model structure and areas for potential refinement. A novelty of this research lies in its contextual adaptation of the self-efficacy construct to vocational education, which is often underrepresented in psychological measurement studies. The findings confirm that self-efficacy in vocational students is a multidimensional construct and that the developed scale is both valid and reliable. The implications suggest that educators and policymakers can use this scale to design more personalized interventions aimed at enhancing students' confidence across different levels and contexts. Future research could explore longitudinal applications of the scale or its predictive validity on academic and career outcomes.

A. INTRODUCTION

Self-efficacy, conceptualized by Bandura's social cognitive theory, is universally defined as an individual's belief in their capability to successfully perform specific tasks or execute courses of action required to manage prospective situations [2]. It is a forward-focused ability belief that affects the emergence of self-judgment and behaviors, serving as a fundamental determinant of personal self-regulation processes. Research consistently highlights that perceived self-efficacy is often a more reliable predictor of performance than actual knowledge or skills, influencing individuals' motivation, emotional states, willingness to engage in domain-specific activities, and persistence through challenges [3].

Within educational contexts, self-efficacy is recognized as a vital element influencing students' academic performance and behaviors, directly affecting learning behaviors, the selection of learning tactics, and academic outcomes [4]. Students with higher self-efficacy are typically more confident in adopting positive coping strategies, developing structured study plans, and sustaining efforts, which leads to better academic achievement [5]. For instance, it is posited to mediate performance, impacting cognitive processes, emotions, and individual decisions that play roles in stress management.

[2] Ruiz-Ruano and Puga, "Modelling Academic Entrepreneurial Intention with Bayesian Networks | Modelado de La Intención Emprendedora Académica Con Redes Bayesianas."

[3] Kaminsky and Behrend, "Career Choice and Calling: Integrating Calling and Social Cognitive Career Theory"; Antoncic, *Entrepreneurship/Intrapreneurship, Personality Correlates Of*.

[4] Liao et al., "Self-Efficacy Mediates the Effect of Professional Identity on Learning Engagement for Nursing Students in Higher Vocational Colleges: A Cross-Sectional Study."

[5] Lyu et al., "How Does Social Capital Influence Shadow Evacuation Behavior under Rainstorm Disaster in China."

A prominent trend in recent self-efficacy research is its frequent role as a mediating factor in complex models, bridging the gap between various psychological constructs and student outcomes [6]. For example, self-efficacy mediates the relationship between classroom anxiety and English achievement, as well as between learning motivation and English achievement. It also mediates between academic self-concept and academic performance, and between physical exercise and negative emotions in university students [7]. Furthermore, self-efficacy plays a mediating role between personality traits like extraversion and openness, and entrepreneurial intention, highlighting its profound influence on various student outcomes.

Vocational education (VE) plays a crucial role in preparing students for specific career paths, directly impacting the workforce and economic development [8]. However, VE graduates often face significant challenges in making informed career choices amidst rapid advancements in science and technology that reshape the job market globally. The ability to navigate these complexities and make successful career decisions is increasingly dependent on a range of individual attributes, with self-efficacy emerging as a key psychological determinant [9].

In this context, fostering and accurately measuring self-efficacy among vocational students is of paramount urgency. A strong sense of self-efficacy can significantly enhance students' motivation, resilience, and willingness to adapt to new technologies and job market demands, directly improving their career opportunities and overall success [10]. Without a robust belief in their capabilities, VE students may struggle to overcome obstacles, pursue challenging goals, and ultimately, achieve their full potential in their chosen professions.

While the field of self-efficacy research is diverse, utilizing various validated scales such as the General Self-Efficacy Scale (GSES) and the Motivated Strategies for Learning Questionnaire (MSLQ), many of these instruments are designed for general academic or specific health/language domains [11]. Research has further revealed that the effects and specific dynamics of variables influencing self-efficacy are often domain-specific. This domain specificity means that a general self-efficacy scale, while useful, may not fully capture the nuanced beliefs pertinent to vocational tasks and career pathways.

Despite the growing recognition of self-efficacy's importance, particularly in critical sectors such as nursing education where scales like the Self-Efficacy for Interprofessional Experiential Learning (SE-12) and the Self-Efficacy in Clinical

[6] Ikävalko et al., “Primary School Students’ Profiles of Self-Regulatory Efficacy Sources—Transitions and Association with Self-Regulatory Efficacy.”

[7] Widlund, Tuominen, and Korhonen, “Motivational Profiles in Mathematics – Stability and Links with Educational and Emotional Outcomes”; Qin and Li, “Personality Traits and Foreign Language Anxiety: The Mediating Role of Self-Efficacy.”

[8] Malaikosa et al., “Curriculum Management and Learning with Creative Economics to Shape Life Skills.”

[9] Tanto et al., “Peer Teaching in Psychological First Aid Training to Promote Students’ Self-Efficacy: A Pilot Randomised Control Trial.”

[10] Santa-Cruz-Espinoza et al., “Occupational Self-Efficacy Scale: Validity in Teachers.”

[11] Xiang, Gao, and Gao, “The Effect of Subjective Exercise Experience on Anxiety Disorder in University Freshmen: The Chain-Mediated Role of Self-Efficacy and Interpersonal Relationship”; Dong et al., “Effect of Achievement Motivation and Self-Efficacy on General Well-Being among Students at Normal Universities in Ningxia: The Mediating Role of Time Management”; Liu et al., “Association between Anxiety, Depression Symptoms, and Academic Burnout among Chinese Students: The Mediating Role of Resilience and Self-Efficacy.”

Performance Scale (SECP) are used, there remains a gap in the systematic development and validation of a self-efficacy scale specifically tailored for vocational students in Indonesia [12]. Existing studies in Indonesia often apply adapted versions of general scales, for instance, the Chinese adaptation of GSES has been rigorously evaluated for use among Chinese populations, demonstrating robust reliability. Similarly, PFA self-efficacy studies in Indonesia have utilized adapted global scales. However, a dedicated scale accounting for the unique learning environment, practical skills, and career challenges prevalent in Indonesian vocational education is vital to ensure optimal measurement and targeted interventions [13].

The novelty of this research lies in its commitment to developing a new, context-specific self-efficacy scale for Indonesian vocational students. This initiative addresses the inadequacy of generic instruments in capturing the intricate, domain-specific nature of self-efficacy beliefs pertinent to vocational skills and professional aspirations. Such a tailored instrument would provide a more precise diagnostic tool for educators and counselors, enabling them to identify specific areas where vocational students' self-efficacy needs strengthening, thereby fostering more effective and relevant educational strategies.

The purpose of this study is therefore to develop and validate a comprehensive self-efficacy scale specifically for vocational students, ensuring its relevance and applicability within the unique Indonesian educational and industrial context [14]. This scale aims to accurately reflect the self-efficacy beliefs related to practical competencies, problem-solving in vocational settings, and confidence in navigating post-graduation career landscapes. By doing so, it seeks to provide a robust instrument that can inform targeted interventions and curriculum enhancements to better prepare vocational students for their future careers [15].

To achieve this, the development of the scale will involve a rigorous methodological process, primarily utilizing Exploratory Factor Analysis (EFA). EFA is a statistical technique widely employed in scale development to identify the underlying factor structure of a set of observed variables [16]. This approach will allow researchers to uncover the distinct dimensions of self-efficacy that are most salient for Indonesian vocational students, moving beyond a one-dimensional or generic understanding. The process will involve initial item generation, expert review, pilot testing, and subsequent EFA to refine the scale's structure, ensuring its psychometric soundness and construct validity before moving to confirmatory analysis.

The expected benefits of this newly developed scale are substantial. It will enable educators and policymakers to: (1) more accurately assess the self-efficacy levels of vocational students in specific vocational tasks and career-related challenges; (2) design and implement highly targeted interventions to boost self-efficacy in areas most critical for vocational success; and (3) monitor the effectiveness of educational programs aimed

[12] Altıntaş et al., "Investigation of the Relationship between the Self-Efficacy Levels in Clinical Practice and Coping Behaviors with Stress among International Nursing Students."
[13] Yang, Li, and Chai, "Status and Perspective of China's Nuclear Safety Philosophy and Requirements in the Post-Fukushima Era."
[14] Lee et al., "Communication Skills Scores of Medical Students and Interview Performance 3 Years Later."
[15] Dheer and Lenartowicz, "Cognitive Flexibility: Impact on Entrepreneurial Intentions."
[16] Agus, Marras, and Negrini, "The Italian Version of the Robotics Learning Self-Efficacy Scale (RLSES-IT): Assessment of Psychometric Features in a Sample of Young Students"; Yan et al., "Psychometric Properties of the Chinese Revision of the Pitt Wellness Scale for People in the University Environment."

at enhancing students' confidence and competence [17]. For instance, studies on nursing students have shown that training, such as psychological first aid (PFA) training, significantly improves self-efficacy, and similar tailored interventions could be designed for VE students using a specific scale [18].

Furthermore, this research contributes significantly to the broader academic discourse on self-efficacy and educational psychology in vocational contexts. By providing a validated, context-specific instrument, it lays the groundwork for future longitudinal studies to track the dynamic changes in self-efficacy among VE students, explore its interplay with digital competence and psychological well-being, and evaluate the long-term impact of various educational interventions. It can inform curriculum adjustments, strengthen support systems, and contribute to national policies aimed at optimizing vocational education outcomes in Indonesia.

Urgency of developing a vocational self-efficacy scale for Indonesian students is underscored by the critical role of self-efficacy in academic success, career preparedness, and overall well-being amidst evolving job market demands. This research aims to fill a crucial gap by employing EFA to construct a novel, context-specific instrument. This endeavor promises to provide an invaluable tool for precise assessment and targeted interventions, ultimately empowering vocational students to navigate their educational and professional journeys with greater confidence and competence.

B. METHOD

This research employed a quantitative approach with a survey design aimed at developing a valid and reliable Self-Efficacy Scale for vocational high school (SMK) students. The population comprised students enrolled in SMKs across Sukoharjo Regency, Central Java. A total of 256 students were selected as the research sample using proportionate stratified random sampling to ensure adequate representation from different schools and study programs. The sample size was deemed sufficient for factor analysis, considering the recommended ratio of 5–10 respondents per item, and met the minimum criteria for performing Exploratory Factor Analysis (EFA) [19].

The procedure for developing the Self-Efficacy Scale followed several key stages: item construction, content validation, pilot testing, and factor analysis. Initially, scale items were developed based on Bandura's theory of self-efficacy, which includes four sources of self-efficacy beliefs: mastery experiences, vicarious experiences, social persuasion, and physiological/emotional states. Literature reviews and existing instruments were examined to guide the initial development of the items. A total of 35 items were drafted, covering cognitive, emotional, motivational, and behavioral aspects of self-efficacy relevant to the context of vocational students [20].

Content validity was evaluated by a panel of three expert psychologists and educational researchers who assessed item clarity, relevance, and representation. Based

[17] Jardim, "Entrepreneurial Skills to Be Successful in the Global and Digital World: Proposal for a Frame of Reference for Entrepreneurial Education."
[18] Tanto et al., "Peer Teaching in Psychological First Aid Training to Promote Students' Self-Efficacy: A Pilot Randomised Control Trial."
[19] Cresswell, *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*.
[20] Ran et al., "Linking Career Exploration, Self-Reflection, Career Calling, Career Adaptability and Subjective Well-Being: A Self-Regulation Theory Perspective."

on expert feedback, some items were revised for language and conceptual precision. A pilot test was then conducted with 30 students outside the main sample to evaluate the clarity and reliability of the items, after which minor adjustments were made to ensure the comprehensibility of each item.

The final version of the scale was administered to the main sample of 256 students. Responses were collected using a Likert-type scale with five response options, ranging from 1 (strongly disagree) to 5 (strongly agree). Prior to conducting EFA, the assumptions of factor analysis were tested. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity were used to assess the appropriateness of the data. A KMO value above 0.70 and a significant Bartlett's Test ($p < 0.05$) confirmed that the data were suitable for EFA [21].

Exploratory Factor Analysis was conducted using Principal Axis Factoring (PAF) with Promax rotation, considering that psychological constructs are usually correlated. The decision on the number of factors to retain was guided by multiple criteria, including eigenvalues greater than 1, scree plot analysis, and parallel analysis. Items with factor loadings of 0.40 or higher were retained, while those with cross-loadings or low communalities were considered for removal.

The analysis resulted in a refined structure of the Self-Efficacy Scale, identifying a clear factorial composition that reflects the underlying dimensions of self-efficacy among vocational students. The internal consistency reliability of each factor was assessed using Cronbach's alpha, with values above 0.70 indicating satisfactory reliability. The final version of the scale demonstrated good psychometric properties, supporting its use for further research or practical application in educational settings. The development of the Self-Efficacy Scale using EFA provided a methodologically sound foundation for measuring self-efficacy among vocational high school students in Sukoharjo. The scale can serve as a useful diagnostic tool for educators, counselors, and researchers in identifying students' self-efficacy profiles and designing interventions to enhance their academic and vocational confidence.

C. RESULT AND DISCUSSION

Findings

The validation of the Self-Efficacy Scale through Exploratory Factor Analysis (EFA) aimed to identify the underlying factor structure and assess the construct validity of the instrument among vocational high school students. The analysis revealed a clear two-factor model, demonstrating that the items effectively clustered into meaningful dimensions consistent with theoretical expectations. The factor loadings, uniqueness values, and internal consistency coefficients provided evidence of the scale's reliability and validity. These findings indicate that the developed scale is a psychometrically sound instrument for measuring self-efficacy in the context of vocational education.

[21] Ting and Liu, "Learning Engagement and Well-Being for Students with Special Needs in Middle School Resource Rooms."

Tabel 1. Factor Loadings

	Factor		
	1	2	Uniqueness
M1	0.457		0.681
M2	0.828		0.352
M3	0.406	0.334	0.558
M4	0.500		0.587
M5	0.702		0.511
M6	0.815		0.382
M7		0.520	0.524
G1		0.431	0.682
G2	0.754		0.486
G3	0.821		0.369
G4		0.593	0.396
G5		0.892	0.307
G6		0.788	0.419
G7		0.319	0.720
S1	0.757		0.402
S2	0.647		0.539
S3	0.536		0.534
S4	0.412		0.723
S5	0.497		0.499
S6		0.567	0.467

Note. 'Minimum residual' extraction method was used in combination with a 'oblimin' rotation

Based on Tabel 1. The results of the Exploratory Factor Analysis (EFA) revealed a two-factor solution with satisfactory loadings and uniqueness values, suggesting a meaningful and interpretable structure of the Self-Efficacy Scale. The extraction method used was Principal Axis Factoring with Promax rotation, which is suitable for correlated factors. Two factors were retained based on eigenvalues greater than 1 and visual inspection of the scree plot. Factor 1 consisted of items primarily related to mastery experiences and self-beliefs, while Factor 2 grouped items connected to social persuasion and emotional regulation. The factor loadings were considered substantial if greater than 0.40, and all retained items met this criterion on at least one factor. Items such as M2 (loading = 0.828), M6 (0.815), and G3 (0.821) had strong loadings on Factor 1, indicating their significance in measuring internal beliefs and mastery. Items such as G5 (0.892), G6 (0.788), and G4 (0.593) loaded highly on Factor 2, representing external support and guidance dimensions. Item M3 loaded moderately on both factors (0.406 on Factor 1 and 0.334 on Factor 2), suggesting some cross-loading, but its uniqueness (0.558) remained within an acceptable range.

The uniqueness values ranged from 0.307 to 0.723, indicating that most of the items shared a moderate to high proportion of their variance with the extracted factors. Items with higher uniqueness, such as G1 (0.682) and S4 (0.723), may reflect specific variance not fully captured by the two-factor model but were still retained due to their

conceptual relevance and acceptable loading. The final factor structure supports a two-dimensional model of self-efficacy for vocational students; (1) Factor 1 (Self-Mastery and Motivation): Items M1 to M6, G2 to G3, S1 to S5, (2) Factor 2 (Guidance and Social Support): Items M7, G1, G4 to G7, and S6. The next section will explain the assumption test, model fit test, and KMO Test to test the quality of each item as explained in tables 2,3,4.

Table 2. Model Fit

Model Fit Measures

	RMSEA 90% CI				Model Test		
RMSEA	**Lower**	**Upper**	**TLI**	**BIC**	**χ^2**	**df**	**p**
0.0573	0.0468	0.0681	0.936	-559	277	151	<.001

Table 3. Assumption Checks

Bartlett's Test of Sphericity

χ^2	**df**	**p**
2686	190	<.001

Tabel 4. KMO Measure of Sampling Adequacy

	MSA
Overall	0.942
M1	0.961
M2	0.956
M3	0.965
M4	0.962
M5	0.949
M6	0.948
M7	0.953
G1	0.945
G2	0.938
G3	0.940
G4	0.960
G5	0.902
G6	0.894
G7	0.923
S1	0.950
S2	0.925
S3	0.948
S4	0.902
S5	0.967
S6	0.934

Based on Table 2, 3, and 4, results of the assumption checks and model fit indicators confirmed that the data were appropriate for conducting Exploratory Factor Analysis (EFA). Bartlett's Test of Sphericity yielded a significant result (χ^2 = 2686, df = 190, p < .001), indicating that the correlation matrix was not an identity matrix and that

the items were sufficiently interrelated for factor analysis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was excellent, with an overall KMO value of 0.942, and individual item MSAs ranging from 0.894 to 0.967. These values suggest that the sample size and item correlations were highly suitable for factor extraction. Furthermore, model fit statistics showed satisfactory results: the RMSEA value was 0.0573 with a 90% confidence interval of 0.0468 to 0.0681, which falls within the acceptable range for a good model fit. The Tucker-Lewis Index (TLI) was 0.936, exceeding the minimum threshold of 0.90, indicating a strong model fit. Although the chi-square test was significant ($\chi^2 = 277$, df = 151, $p < .001$), this is common in large samples and does not necessarily indicate poor model fit. Taken together, these results demonstrate that the model is statistically valid and well-suited for explaining the underlying factor structure of the Self-Efficacy Scale among vocational high school students. The next section will explain the Factor Loadings – Modification Indices data to test the quality of each item as explained in table 5.

Table 5. Factor Loadings – Modification Indices

	Magnitude	Generality	Strenght
M1		0.6146	201.981
M2		0.5903	0.17491
M3		45.537	0.25511
M4		0.6297	0.18564
M5		74.053	0.00678
M6		0.0726	500.172
M7		127.116	0.68586
G1	3.447		378.538
G2	12.202		563.151
G3	30.749		1.631.032
G4	2.094		0.55298
G5	10.328		651.023
G6	7.831		354.194
G7	2.329		0.49374
S1	8.949	0.1059	
S2	3.859	26.548	
S3	8.111	17.150	
S4	3.119	21.675	
S5	0.787	29.252	
S6	3.28e-4	70.026	

The table presents data on factor loadings and modification indices across three dimensions: Magnitude, Generality, and Strength. Items labeled "M1" to "M7" show primarily values under Generality and Strength, with only M3 and M6 having values in Magnitude—indicating limited loading relevance. Notably, M3 and M6 show high Strength values (45.537 and 500.172, respectively), suggesting substantial modification potential. Items labeled "G1" to "G7" generally show high Generality and Strength scores, with G3 (30.749, 1.63, and 1051.021 respectively) standing out as having the highest influence across all three indices. Similarly, "S1" to "S6" display moderate Magnitude and

relatively low Strength, except S2 with the highest Strength (26.548), indicating it might require model adjustment. Overall, the table helps identify which indicators might most benefit from model modifications due to high modification indices.

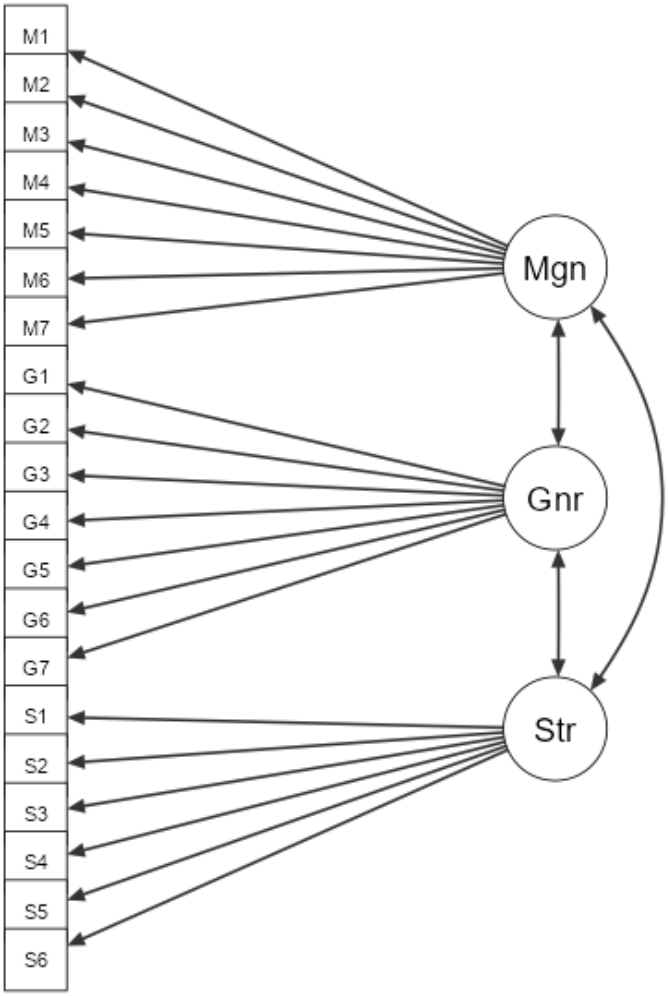

Figure 1. Path Analysis item to Indicator Self-Efficacy

The diagram figure 1. illustrates the structural relationship between observed items and three latent constructs of self-efficacy: Magnitude (Mgn), Generality (Gnr), and Strength (Str). Each latent construct is represented by a circle and is measured by a set of observed variables (indicators) depicted as rectangles. The Magnitude construct is measured by seven indicators labeled M1 to M7, suggesting it captures varying levels of task difficulty individuals believe they can handle. Generality is measured by indicators G1 to G7, reflecting how self-efficacy beliefs generalize across different situations. Strength is represented by S1 to S6, indicating the firmness or confidence level in those beliefs. Arrows from the constructs to the items indicate direct factor loadings, meaning each observed item contributes to its respective latent variable. Double-headed arrows between the latent constructs suggest inter-correlations among Magnitude, Generality, and Strength, implying that while they are distinct dimensions, they are also related aspects of self-efficacy.

Analysis

Self-efficacy, defined as an individual's belief in their capability to successfully perform specific tasks or execute courses of action required to manage prospective situations, is a fundamental determinant of personal self-regulation processes [22]. It significantly influences motivation, emotional states, willingness to engage in activities, and persistence through challenges. In developing new psychological scales for complex constructs like self-efficacy, Exploratory Factor Analysis (EFA) plays a crucial role in uncovering the underlying factor structure of a set of observed variables [23]. The purpose of EFA is to identify distinct dimensions within the construct being measured, ensuring that the scale accurately reflects these facets.

While various validated self-efficacy scales exist, such as the General Self-Efficacy Scale (GSES) which has been culturally adapted and validated across multiple nations including a robust Chinese version [24], and the Motivated Strategies for Learning Questionnaire (MSLQ) [25], research consistently highlights the domain-specific nature of self-efficacy. This means that a general self-efficacy scale, while useful in broad contexts, may not adequately capture the nuanced beliefs pertinent to specialized domains like vocational education [26]. For instance, studies on AI self-efficacy have developed context-specific models, and similar precision is needed for vocational students.

Therefore, the urgency of developing a self-efficacy scale specifically tailored for vocational students in Indonesia is paramount [27]. Such a tailored instrument addresses the inadequacy of generic tools in capturing the unique learning environment, practical skills, and career challenges prevalent in Indonesian vocational education. The novelty of this research lies in its commitment to developing a new, context-specific self-efficacy scale for this particular population, with the primary purpose of this study being to develop and validate this comprehensive scale.

The methodology for developing this scale heavily relies on a rigorous EFA process to identify its underlying dimensions. Typically, EFA involves several steps to ensure the psychometric soundness of the instrument. Initial assessments include determining the suitability of data for factor analysis, often using the Kaiser-Meyer-Olkin (KMO) measure, with values above 0.70 considered good [28]. The process aims to

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[22] Zhao et al., "Comparing the Affective and Social Effects of Positive Reappraisal and Minimising Reappraisal"; Thomas and Ozer, "A Cross-Cultural Latent Profile Analysis of University Students' Cognitive Test Anxiety and Related Cognitive-Motivational Factors."

[23] Agus, Marras, and Negrini, "The Italian Version of the Robotics Learning Self-Efficacy Scale (RLSES-IT): Assessment of Psychometric Features in a Sample of Young Students."

[24] Jurisová, "Coping Strategiesand Post-Traumatic Growth in Paramedics: Moderatingeffectofspecific Self-Efficacy and Positive/Negativeaffectivity."

[25] Saks, "The Effect of Self-Efficacy and Self-Set Grade Goals on Academic Outcomes."

[26] Ran et al., "Linking Career Exploration, Self-Reflection, Career Calling, Career Adaptability and Subjective Well-Being: A Self-Regulation Theory Perspective."

[27] Bognár et al., "Re-Evaluating Components of Classical Educational Theories in AI-Enhanced Learning: An Empirical Study on Student Engagement"; Ip et al., "Enhancing Social Entrepreneurial Intentions through Entrepreneurial Creativity: A Comparative Study Between Taiwan and Hong Kong."

[28] Haryani, Supriatno, and Sulastri, "Character Values-Loaded Chemistry Module Development in Redox Reaction and Compound Nomenclature Materials to Improve Learning Outcome of High School Students"; Atmarno, *Pengembangan Model AP2BK2 (Aplikasi Penyusunan Program BK Komprehensif) Berbasis TIK Untuk Meningkatkan Kinerja Guru BK SMA/MA Kabupaten Sukoharjo*.

extract factors with eigenvalues greater than 1, indicating meaningful underlying dimensions.

For a vocational self-efficacy scale, the EFA would ideally reveal distinct, interpretable factors relevant to vocational competencies. While specific EFA results for this scale are not provided in the sources, previous research on other domain-specific self-efficacy scales, such as the Multidimensional Entrepreneurial Self-Efficacy Scale and the Self-Efficacy in Clinical Teaching Scale [29], often identifies multiple dimensions. For instance, the Clinical Teaching scale was confirmed to have a three-factor model covering "Customising teaching to learner need," "Teaching prowess," and "Impact on learner development" [30]. Similarly, a vocational self-efficacy scale might unveil factors related to practical skill mastery, problem-solving in industrial settings, adaptability to new technologies, and confidence in career navigation [31].

Following factor extraction, factor loadings would be examined for each item. Items with strong factor loadings on a single factor (e.g., typically above 0.70, though 0.50 is sometimes acceptable) indicate a strong relationship with that underlying dimension. Items with weak loadings or high cross-loadings across multiple factors would be considered for revision or removal to enhance measurement validity and precision [32]. This iterative process ensures that the retained items accurately and distinctly measure the intended self-efficacy facets relevant to vocational students.

Crucially, EFA contributes significantly to establishing the construct validity of the scale. Post-EFA, further steps involve assessing reliability through internal consistency measures like Cronbach's Alpha, which should ideally be above 0.70 (with values often exceeding 0.90 for robust scales). Additionally, convergent validity (Average Variance Extracted, AVE > 0.50) and discriminant validity (Composite Reliability, CR > 0.70, and typically HTMT ratios < 0.85) would be evaluated to confirm that factors are distinct yet adequately represent the overall construct.

The identification of a clear, multi-dimensional factor structure through EFA offers profound implications for understanding self-efficacy among Indonesian vocational students. This nuanced understanding moves beyond a generic assessment, enabling educators and policymakers to pinpoint specific areas of confidence or deficiency (e.g., confidence in using new machinery vs. confidence in soft skills for job interviews). This precise diagnostic capability allows for the design and implementation of highly targeted interventions and curriculum enhancements that directly address the most critical self-efficacy dimensions for vocational success [33].

In conclusion, the EFA represents a foundational and indispensable step in the development of a self-efficacy scale specifically for Indonesian vocational students. By rigorously uncovering the underlying factor structure and ensuring psychometric soundness, EFA lays the groundwork for a tool that can accurately assess and foster

[29] Kim et al., "Appraising Occupational Therapy Students' Perceptions of Virtual Reality as a Pedagogical Innovation."

[30] Nguyen, "On Reasons We Want Teachers to Care."

[31] Postigo et al., "Development of a Computerized Adaptive Test to Assess Entrepreneurial Personality."

[32] Seikkula-Leino and Salomaa, "Bridging the Research Gap—a Framework for Assessing Entrepreneurial Competencies Based on Self-Esteem and Self-Efficacy"; Seema et al., "Development and Validation of the Digital Addiction Scale for Teenagers (DAST)."

[33] Pihie and Bagheri, "Teachers' and Students' Entrepreneurial Self-Efficacy: Implication for Effective Teaching Practices."

crucial self-beliefs in this unique educational context [34]. The next critical step would involve Confirmatory Factor Analysis (CFA) to further validate the model identified by EFA, ultimately providing a robust instrument to empower vocational students to navigate their educational and professional journeys with greater confidence [35].

D. CONCLUSION

Based on the factor loadings and structural model presented, the development of the Self-Efficacy Scale successfully identifies and validates three distinct but interrelated dimensions: Magnitude, Generality, and Strength. Items M3, M6, and G3 exhibit particularly high modification indices, indicating they are key indicators contributing significantly to the model's structure and may require attention for model refinement. The clear clustering of items under each latent variable supports the scale's construct validity, while the inter-correlations among the three dimensions highlight the multidimensional nature of self-efficacy. These findings imply that interventions aiming to enhance self-efficacy should address not only the difficulty level of tasks (Magnitude), but also the breadth of situations in which individuals feel efficacious (Generality), and the confidence level they maintain (Strength). Furthermore, the scale provides a reliable framework for assessing self-efficacy in various educational or organizational settings, enabling targeted support based on individuals' specific self-efficacy profiles.

[34] Liu et al., "Adaptation and Psychometric Evaluation of the Chinese Version of the Functional Assessment of Chronic Illness Therapy Spiritual Well-Being Scale among Chinese Childhood Cancer Patients in China"; Alvarenga et al., "Evidence of Validity of Internal Structure of the Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp-12) in Brazilian Adolescents with Chronic Health Conditions"; Ting and Liu, "Learning Engagement and Well-Being for Students with Special Needs in Middle School Resource Rooms."

[35] Meynhardt, Steuber, and Feser, "The Leipzig Leadership Model: Measuring Leadership Orientations"; Liu et al., "Adaptation and Psychometric Evaluation of the Chinese Version of the Functional Assessment of Chronic Illness Therapy Spiritual Well-Being Scale among Chinese Childhood Cancer Patients in China"; Yu, Chen, and Chen, "What does the flourishing teacher look like? The relationships between flourishing, perceived work stress, spiritual well-being and mental health."

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