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MEASUREMENT MODEL OF CONTRIBUTED FACTOR AND INDICATOR TOWARDS VOCATIONAL EDUCATION PRODUCTIVITY

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ABSTRACT: This study aimed to: (1) identify the validity and reliability of indicators of factors that contribute to the productivity of vocational education; (2) create measurement model of contributed factors and indicators to the productivity of vocational education.The data were collected by using instruments that have been tested for validity and reliability. The research population is Diploma III graduates of vocational education from the Engineering Faculty of Universitas Negeri Padang and Padang State Polytechnic. Sampling technique used was simple random sampling, in which the respondents were 395 graduates from Diploma III of vocational education from Faculty of Engineering of Padang State University and PadangState Polytechnic. Data were analyzed with LISREL 8.80 in the form of normality test and multicollinearity test and were continued with asymptotic covariance matrix estimation and confirmatory factor analysis.The results of the research showed that there were 23 valid and reliable indicators in reflecting the six variables; they were managerial leadership, with idealized influence, inspirational motivation, intellectual stimulation, individualized consideration; academic atmosphere with physical environmental indicators, learning environment, and academic environment; lecturer competence with pedagogic competency indicator, professional competence of personality competence and social competence; learning system, with learner-focused, worker-focused, attribute-oriented indicators; the process of learning with quality information data indicator, learning quality, curriculum quality, resource quality; and productivity of vocational education, with indicators of graduate quality, management quality, internal efficiency, external efficiency, and income.

Keywords: *Productivity, Managers' Leadership, Academic Atmosphere, Lecturers' Competencies, Teaching Process, Productivity*

1. INTRODUCTION

This study is based on the issue of vocational education productivity that needs to be improved. It can be seen from the low productivity figures, the problem of unemployment, relevance, on-time graduation, public trust, graduate quality and others. Based on these productivity issues of vocational education, it is important to identify the problem in the form of factors and any indicators that contribute towards the productivity of vocational education. There was a previous research on school productivity in vocational [18], but it was still partial and there was not any similar research in vocational higher education.

This study aims to reveal the measurement model of indicators of vocational education productivity factors and variables that affect the productivity of vocational education comprehensively. It means that the model is created by specifying a hybrid model as a confirmatory factor analysis model (CFA), so the resulting model is a model of a whole set of indicators that reflect each variable in relation to the competence of graduates. The detail purposes of this study are (a) to analyze the productivity measurement model of Vocational education, including variables and indicators that contribute to productivity Vocational education; (b) to identify the validity and reliability of the factors and indicators that contribute to productivity vocational education.

2. RESEARCH METHOD

The study involved 395 respondents, who200 graduated from D3 Faculty of Engineering, Universitas Negeri Padang and 195 graduated from State Polytechnic of Padang.

2.1. Data Analysis

2.1.1. *Screening data*
Before performing a confirmatory factor analysis (CFA), a data screening was performed to provide descriptive data description to ensure that SEM assumptions were normality and multicollinearity.

- Measurement Model Analysis/ Confirmatory Factor Analysis (CFA).

The measurement model in this study modeled the hypothesized correlation between the latent variables of managerial leadership (Manlead), academic atmosphere (Atmosac), lecturer competence (Lectcomp), learning system

(Teachsym), process of learning and productivity of vocational education (Product) byobserving 23 variables, based on substance and literature study. Then, the measurement model analysis/ Confirmatory Factor Analysis (CFA) was done, where the measurement model confirm whether the observed variable indeed reflected latent variables. The analysis phase includes model specification, data collection, making a simpleprogram, running programs with LISREL 8.8, and output analysis.

Analysis of output, in general, is to examine the offending estimate (including negative error variance / Heywood cases); standardized loading factor > 1,0; and a large standard error. If there was, then respecification model was needed.

- Analysis of the validity of the measurement model.

- The test of Goodness of Fix Index is conducted through checking the value of chi-square, p-value, RMSEA, Standardized RMR, GFI, AGFI, NFI, NNFI, CFI and others shown on the Goodness of Fit Statistics.

-The reliability analysis of the measurement model is done by calculating the construct reliability (CR) and the variant extracted (VE) values of standardized loading factor and variance error with the following formula [7]:

$$CR = \frac{(\sum \text{std.loading})^2}{(\sum \text{std.loading})^2 + \sum e_j} (1)$$

$$\mathbf{VE} = \frac{\sum \mathbf{std.loading^2}}{\sum \mathbf{std.loading^2} + \sum \mathbf{e_j}} \mathbf{(2)}$$

with:

$\sum e_j$ = *errormeasurement* for each indicator

A construct has good reliability if the value of construct reliability (CR) ≥ 0.70 and the value of variance extracted (VE) ≥ 0.50 [9].

3. FINDINGS AND DISCUSSION

3.1. Confirmatory Factor Analysis (CFA).

The determination of observed variables, consisted of 23 variables, has been done based on the literature study. Furthermore, the measurement model confirmed whether the observed variable was indeed a measure/reflection of a latent variable. Therefore, Confirmatory Factor Analysis (CFA) was conducted.

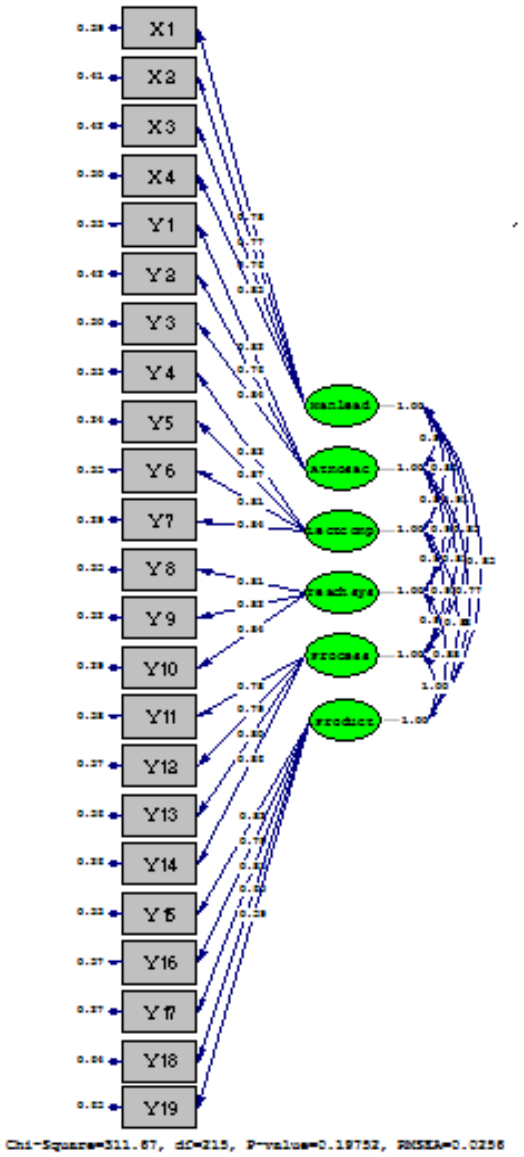

Figure 1.Measurement Diagram Model of Determinant Factor of Vocational Education Productivity (standardized solution).

There were several steps in analyzing the model towards the output, as follows.

3.1.1. *Preliminary analysis of the estimation results.*

The first step was analyzing the existence of offending estimate, namely the existence of negative error variance (Heywood cases) and standardized loading factor > 1.0, and the value of the standard error was very large. The observation results showed that there was not any negative error variance or standardized loading factor which was > 1.0. The value of variance error was observed based on Output, and there was not any negative variance error found.

3.1.2. *Analysis of the measurement model validity*
The measurement model validity was analyzed by using two ways, as follows: a) examining the t-value of the loading factor of the observed variable. A variable has a good validity to the construct or latent variable if the t-value of its loading factor is greater than the critical value (or ≥ 1.96 for the 5% significance level). [13] and [5]. From Figure 2, it can be seen that from all observed variables, there was no t-value which was smaller than 1.96. The smallest value was 7.374 at Y19; b) Performing a Standardized loading factor (λ) check of the observed variables in the model, whether the value was ≥ 0.70 [13], or ≥ 0.50 [11], where the standardized loading factor values can be seen in the standardized solution in Figure 1 or the printed output section in completely standardized solution. The observation of validity analysis shows that all the standardized loading factors (λ) of the observed variable were ≥ the cut off value set, i.e ≥ 0.50. In relation to the measurement model validity, the observed variable having t-value < 1.96 or standardized loading factor less than the selected cut-off value of ≤ 0.70 or ≤ 0.50 was excluded (or not included in the model), or in other words, the observed variable was removed from the model. Based on the validity analysis, it could be stated that everything was ≥ of the cut-off value specified. From both the validity analysis of output, it is concluded that the result of factor load estimation from the model is valid.

3.1.3. *Model overall fit analysis.*
From the Goodness of Statistic analysis, it was observed that the matching index, Normed Fit Index (NFI) = 0.974, Non-Normed Fit Index (NNFI) = 0.990, Parsimony Normed Fit Index (PNFI) = 0.928, Comparative Fit Index (CFI) = 0, 99, Incremental Fit Index (IFI) = 0.992, Relative Fit Index (RFI) = 0.969 (all were ≥ 0.90, good model matches [3] RMSEA 0.0256 (≤ 0.05) this indicates a good fit model [3].The value of Standardized Root Mean Square Residual (SRMR) 0.0269 (≤ 0.05) indicates a good fit model while Goodness of Fit Index (GFI) 0.839 is the marginal fit (0.8 ≤ GFI ≤ 0.9 is the marginal Fit according to [13], and the value of Adjusted Goodness of Fit Index (AGFI) 0.793, is also categorized as marginal fit (0.8 ≤ GFI ≤ 0,9 is the marginal fit according to [13]. Chi-Square 311.57 and p-value 0.19702 is a good fit (p-value ≥ 0.05). For values χ2 / df = 311.57 / 215 = 1, 44 (<2, meet by Meyer, 2013) it means that the overall model shows a good match.

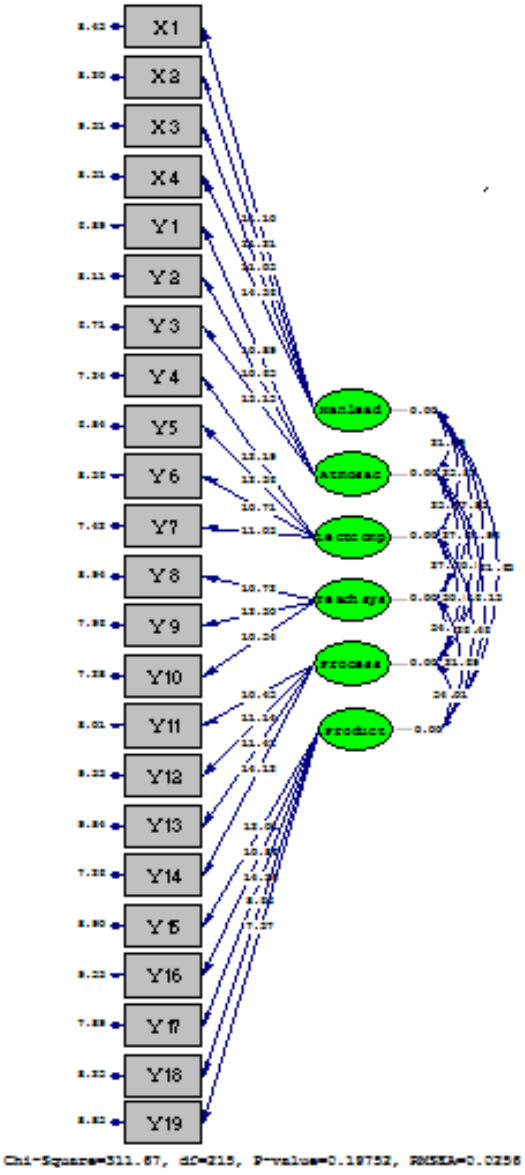

Figure 2. Measurement Diagram Model of Determinant Factor of Vocational Education Productivity (T-value)

3.2. Model Reliability Analysis.

The relationship between observed variables/indicators with latent variables can also be assessed from the combined reliability for each latent variable through construct reliability and variance extracted. The values of standardized loading factors and error variances (errors) were taken from the track diagrams of the printed output of the completely standardized solution title and the LAMBDA-X subtitle (for standardized loading factors) and THETA DELTA (errors), (for error variance). From the calculation results, it was cleared that all values of Construct Reliability (CR) were > 0.70 and Variance Extracted Value was > 0.50. It means that the reliability of the

variables Manlead, Atmosac, Lectcomp Teaches, Process, and Product was reliable. A construct has good reliability if the value of Construct Reliability (CR) is ≥ 0.70 and Variance Extracted value (VE) is ≥ 0.50 [9].

In analyzing the reliability of individual indicators, it can be seen from the squared multiple correlations (R2) of the indicator through the LISREL OUTPUT option. R2 explains how much the proportion of the indicator variance was explained by the latent variable, while the rest was explained by the measurement error. From the output, it can be seen that from the latent variable of the leadership of the management, X4 (individual consideration) is the most reliable indicator, followed by X1 (idealized influence), X2 (inspiration motivation) and X3 (intellectual stimulation).

The research findings related to the academic atmosphere variable reveal that Y3 (learning environment) is the most reliable indicator, followed by Y1 (physical environment), then Y2 (academic environment).From the latent variable of lecturer competence, Y4 (pedagogic competence) is the most reliable indicator, followed by Y7 (social competence), Y6 (personal competence), and Y5 (professional competence). Besides, for the latent variables of the learning system, Y9 (work-centered) is the most reliable indicator, followed by Y8 (learner-centered), and Y10 (focused-attributes).

The latent variables of the learning process are Y14 (resources quality); Y13 (curriculum quality); Y12 (learning quality); Y11 (data quality and information). As for the latent variables of educational productivity, Y17 (waiting period) is the most reliable indicator, followed by Y15 (quality of graduates), Y16 (relevance), Y18 (public trust), and Y19 (income).

The relationship between observed variables/indicators with latent variables can also be assessed from the combined reliability for each latent variable through construct reliability and variance extracted. According to [9], a construct has good reliability if the value of construct reliability is ≥ 0.70 and the value of variance extracted is ≥ 0.50. Likewise, [1] state that the cut-off rate to say whether composite reliability is good enough is 0.60. The research findings show that all indicators are reliable, i.e. all indicators provide reliable measures for each latent variable. Based on the discussion above, it can be concluded that based on validity and reliability test (both in terms of individual indicator reliability and composite reliability, through construct reliability measurement and variance extracted), all indicators are valid and reliable, as well as all latent variables are reliable.

Table 1. Construct Reliability (CR) and Variance Extracted (VE

Variable	CR (≥0,70)	VE (≥0,50)	Reliability Conclusion
Manlead	0,866	0,619	Good Reliability
Atmosac	0,848	0,650	Good Reliability
Lectcomp	0,901	0,695	Good Reliability
Teachsys	0,865	0,681	Good Reliability
Process	0,885	0,657	Good Reliability
Product	0,854	0,546	Good Reliability

The explanation of factor or latent variable along with each indicator is as follows:

3.2.1. *Managerial leadership.*

Indicators of the latent variable of managerial leadership adapted from [10], [8], and [2], involve idealized influence, inspirational motivation, intellectual stimulation and individual consideration, with a questionnaire named Multifactor Leadership Questionnaire. The Multifactor Leadership Questionnaire has been used in various countries extensively for the past 20 years, which is valid and reliable for various cultures and types of organizations. According to [10], it is appropriate to be applied to this study, where managerial leadership indicators include idealized influence, inspirational motivation, intellectual stimulation and individual consideration have good validity and reliability to measure leadership constructs of vocational education managers.

The results of calculations and conclusions of validity and reliability for managerial leadership variables show that all indicators were valid (unstandardized t-values were greater than 1.96 and standardized loading has ≥ 0.50) and all indicators were reliable (Construct Reliability value CR) ≥ 0.70 and Variance Extracted Value (VE) ≥ 0.50), in the opinion of [9] and [11]. Therefore, it can be stated that the validity and reliability of managerial leadership variables are good, which means that all indicators are valid and consistent in measuring managerial leadership variables. The indicators for the managerial leadership in this study are: (1) individualized consideration includes giving attention to the individual, respecting differences between individuals, giving advice and direction. Leaders treat the subordinates differently but equally and equitably in order to maintain open contact and

communication; (2) idealized influence/charisma like to synchronize the values expressed through words and the values embodied in action, gain pride, respect, and trust. Leaders are charismatic and have a power and influence. Leaders awaken and encourage academicians with a vision and sense of mission that encourages them to do more effort in achieving goals; (3) inspirational motivation is about to motivate the subordinates, discuss high expectations, use symbols to focus efforts, and express goals. Leadership behavior stimulates the enthusiasm of the subordinates towards the task and can raise their confidence towards the ability to complete the task in achieving the goal; (4) intellectual stimulation includes creating a climate conducive to the development of innovation and creativity, appreciating promotional ideas, developing rationality and solving problems thoroughly. Leaders encourage the development of rationality by considering creative and innovative ways; individualized consideration, giving attention to the individual, respecting the differences between individuals, giving advice and direction. Leaders treat their subordinates differently but equally and equitably in order to maintain open contact and communication.

3.2.2. *Academic atmosphere*

Academic atmosphere variable, which has three indicators namely learning environment; physical environment; and the academic environment, referred to by [19]is proved to be valid and reliable in measuring the variables of academic atmosphere in vocational education. This is evidenced by the results of validity and reliability tests of individual and combined composite test.

Physical environments adopted from [15] are in the form of completeness and feasibility: laboratory equipment and workshop, library; classroom teaching aids; instructional media, textbooks and teaching materials and; facilities and infrastructure, is valid and reliable for this study.

The academic environment referred to [15], and adjusted to the obligations of universities as providers of education, research and community service, the Law Republic of IndonesiaNo. 12 of 2012 in this study proved as valid and reliable, as being set in the questionnaire in this study, including: full academic support, but all intelligence and competence are supported; high expectations for the success of the academic community; support for academic programs and academic activities of students and lecturers; interaction between lecturers and students through research activities and community service; interaction of faculty and students through seminar, symposium and others.

In accordance with the recommendation from [19], learning environment as an indicator of the academic atmosphere is valid and reliable. The learning environment refers to the social, psychological and pedagogical contexts of learning. Based on the questionnaire, learning environment in this study includes student cohesiveness, educators support, learners involvement in learning, investigation activities, task orientation, student co-operation, and equality.

3.2.3. Lecturer competence

The latent variable of lecturer competence, referenced from Law of Repulic Indonesia, Number 14 Year 2005 and research result of [14], and [12], (Y5 (professional competence), Y6 (personal competence), and Y7 (social competence) the results of this study has good validity and reliability, proved by the results of validity and reliability test that has been described previously. Therefore, it can be concluded that the four indicators are valid and reliable in measuring the competency variables of vocational lecturers. Indicators of research findings from lecturer competence variable are pedagogic competence, personality competence, social competence, and professional competence, which are also part of the standard for human resources assessment which is contained in the item of BAN-PT, standard 4.

3.2.4. *Learning system*

The approach of the learning system to vocational education refers to the learning that focuses on the development of attribute skills (attribute-focused), learner-centered learning; work-centered learning adopted from [4]. This study was proved as valid and reliable in measuring the learning system variables in vocational education. The meaning of the learning system described in the questionnaire in this study is related to the principles, strategies and philosophies of vocational education: the learning system is built based on the planning relevant to the objectives, learning and hierarchy. Learning is carried out by using challenging strategies and techniques, encouraging students to think critically about exploring, creating and experimenting with the use of multiple sources. Implementation of learning has mechanisms to monitor, review, and periodically improve lecture activities (lecturers and students attendance), preparation of lecture materials, and assessment of learning outcomes.

3.2.5. *Learning process*

The indicators for latent variable of learning process are the quality of data and information; quality of learning; the quality of the curriculum; and quality of resources, from the results of this study, it is proved that this study has good validity and reliability in reflecting the ability to measure

the latent variable of learning process, based on the results of validity and reliability test. The four indicators are valid and reliable in measuring the factors or variables of the learning process in vocational education. This is similar to the findings of the research conducted by [18].

3.2.6. *Productivity of vocational education*
Constructive educational productivity adapted from [6]; [17]is conducted by asking several questionnaires. Vocational education productivity indicators include the graduates quality; management quality; internal and external efficiency; and income. These five indicators are valid and reliable in measuring/reflecting the factor of vocational education productivity, based on the results of data analysis in this study.

4. CONCLUSION

Based on the research findings and previous discussion, there are several conclusions can be noted as follows:
4.1. The indicators and determinant factors that contribute towards the productivity of vocational education which are proved to be valid and reliable are: (1) managerial leadership: idealized influence/charismatic, inspirational motivation, intellectual stimulation, individualized consideration; (2) academic atmosphere: physical environment, academic environment, learning environment; (3) Learning System: learner-centered; work-centered and focused-oriented; (4) lecturer competence: pedagogical competence, professional competence, personality competence, and social competence; (5) learning process: quality of information data; the quality of learning; the quality of the curriculum the quality of the resource; (6) the productivity of vocational education: the quality of graduates; the quality of management; internal efficiency; external efficiency, and income.

4.2. Measurements Model of factors and indicators that contribute to the productivity of valid and reliable vocational education are shown in Figure 1 (standard solution) and Figure 2 (T value) with the following notation: Manlead = managerial leadership; Atmosac = academic culture; Lectcomp = lecturer competence; Teachsys = learning system; Process = learning process; Product = productivity of vocational education. The indicators are as follows: X1 = idealized influence; X2 = inspirational motivation; X3 = Intellectual Stimulation; X4 = Individualized consideration; Y1 = physical environment; Y2 = learning environment; Y3 = academic environment; Y4 = pedagogic competence; Y5 = professional competence; Y6 = personality competence; Y7 = social competence; Y8 = learner-focused; Y9 = worker-focused; Y10 = attribute-oriented; Y11 = quality of data and information; Y12 = quality of learning; Y13 = curriculum quality; Y14 = quality of resources; Y15 = quality of graduates; Y16 = quality of management; Y17 = internal efficiency; Y18 = external efficiency; Y19 = income.

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2. ETHICS

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

FOREWORDS

This proceeding aims to disseminate valuable ideas and issues based on research or literature review in the field of vocational, technical and engineering studies, which have been presented in 4th International Conference on Technical and Vocation Education and Training. This conference has taken place in Hospitality Center Universitas Negeri Padang, November 9-11, 2017.

The theme of Conference focused on the perspective of technical and vocational education and training for sustainable society to face the challenges of 21st century, globalization era, and particularly Asian Economic Community. To overcome the challenges, we need the innovation and change in human resources development. Technical vocational educational and training have essential roles to change the world of education and work in order to establish sustainable society.

Undoubtedly, TVET need to enhance the quality of learning by developing various model of active learning, including learning in the workplace and entrepreneurship. Create innovation and applied engineering as well as information technology. Improvement of management and leadership in TVET Institution, and development of vocational and technical teacher education.

Many ideas and research findings have been shared and discussed in the seminar, more than 176 papers have been collected and selected through scholars, scientists, technologist, and engineers'. as well as teachers, professors, and post graduates students who participated in the conference.

Eight keynote speakers have taken a part in the conference, namely Prof. Intan Ahmad, Ph.D. (Director general of learning and student affairs, Kemenristek Dikti) and Prof. Josaphat Tetuko Sri Sumantyo, Ph.D. (CEReS Chiba University) and Prof. Dr. Maizam Alias (UTHM Malaysia) and Prof. Ganefri, Ph.D. (Rector of UNP) and Prof. Dr. Ramlee bin Mustapha (UPSI Malaysia) and Prof. Nizwardi Jalinus, Ed.D. (Chair of TVET doctoral program, FT UNP) and Prof. Michael Koh, Ph.D. Dr. Fahmi Rizal, M.Pd., MT (Dean of FT UNP). They all have a great contribution for the success of the conference.

Finally, thank a million for all participants of the conference who supported the success of 4th International conference on TVET 2017 and most importantly, our gratitude to all scholars who support and tolerated our mistake during the conference.

Padang, 9 November 2017

Prof. Dr. Nizwardi Jalinus, M.Ed
Chair of Scientific Committee

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