Structural Model of Pedagogy-Andragogy-Heutagogy Continuum on Pedagogical Competencies of Indonesian Vocational High School Teacher

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Abstract. Teachers should promote self-regulated learning so the students can be long-life learners. One way to promote self-regulated learning is by interplaying pedagogy, andragogy, and heutagogy and encouraging teacher pedagogical competencies. Current research aims to investigate the relationship between pedagogy, andragogy and heutagogy praxis with teachers' pedagogical competencies. The response of 393 teachers was modeled using the structural equation model with the partial least square method (PLS-SEM). The measurement models indicate that the instruments used are valid and reliable. The structural model shows an interplaying among pedagogy, andragogy and heutagogy approaches in Indonesia. These approaches may also promote the pedagogical competencies of Indonesian Vocational High School teachers. Further research may include additional variables as mediator variables.

Keywords: Pedagogy, Andragogy, Heutagogy, Continuum, Pedagogical Compentencies

1 Introduction

Today's workforce demands self-motivated employees, but employers are aware that today's graduated students of vocational high schools and university lack of skills and competencies needed [1], [2]. Vocational high schools and universities should respond to this issue by ensuring an ideal learning process that may promote student self-regulated learning. Students that regulate their learning may quickly adapt to workplace needs.

Some approaches may increase self-regulated learning to learning such as andragogy [3] and heutagogy [4]. These approaches are widely used to engage students in a learning environment in a student-centered learning process. Andragogy and heutagogy are parts of the learning continuum, including pedagogy [5], [6]. The pedagogy-andragogy-heutagogy continuum is

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viewed as a progression of learning approaches from pedagogy andragogy to heutagogy [7]. In classroom practices, these three approaches may be interplayed [8]–[10].

The interplay of the approaches may promote the teacher's pedagogical competencies. There are 10 pedagogical competencies: (a) mastering the characteristics of students from the physical, moral, social, cultural, emotional, and intellectual aspects, (b) mastering learning theories and educational principles of learning, (c) developing curricula related to subjects/fields of development that being taught, (d) conducting educational learning, (e) utilizing information and communication technology for learning purposes, (f) facilitating the development of the potential of students to actualize their various potentials, (g) communicating effectively, empathically, and politely with participants students, (h) conducting assessments and evaluations of learning processes and outcomes, (i) utilizing the results of assessments and evaluations for the benefit of learning, (j) taking reflective actions to improve the quality of learning [11]. These pedagogical competencies are the main aims of Indonesian teacher training (PPG).

Pedagogy-andragogy-heutagogy continuum states that andragogy and heutagogy are a progression of pedagogy [7], [12]. Mixing these approaches is also possible in classroom practices [10], [13], [14]. This concept and classroom practice needs to be supported with empirical data drawing the relationship between these three approaches. There needs to be research that shows these related approaches, especially when they are connected to the chance to promote the teacher's pedagogical competencies. The current research will investigate the relationship of the pedagogy-andragogy-heutagogy continuum on teachers' pedagogical competencies in vocational high schools.

2 Methods

Variables in current research are modeled with a structural equation model with a non-parametric estimation of partial least squares (PLS-SEM). Each variable is built in a reflective model. The reflective model reflects construct measurement by its measured indicator [15]. PLS-SEM has become widely used in social sciences, engineering, health, and psychology [16], [17]. The popularity of PLS-SEM comes from its characteristics of giving a robust result on a small sample and non-normal data distribution[18]. PLS-SEM result evaluation consists of measurement and structural model evaluation [19]. Some indicators evaluated in measurement model evaluation on reflective constructs are factor loadings, indicator reliability of item, composite reliability of construct, average variance extracted, and discriminant validity [20].

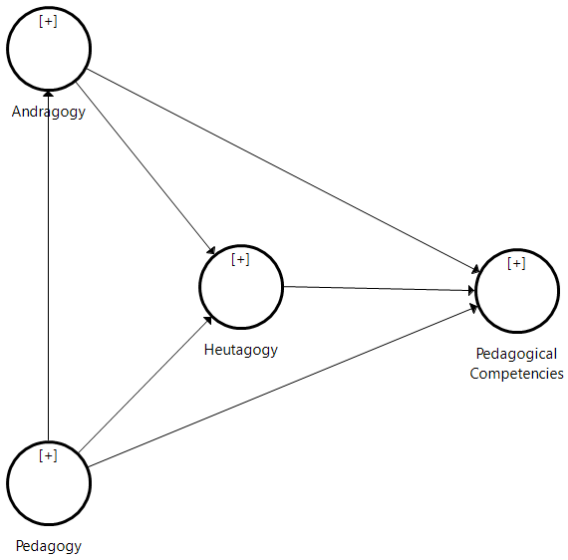

Fig. 1. Frame work of Pedagogy-Andragogy-Heutagogy Continuum on Pedagogical Competencies.

2.1 Population and Sample

The population of the current research is Indonesian Vocational High School teachers in two provinces of South and West Sulawesi. A standard way to determine sample size in SEM is still debated. Some researchers say a minimum of 200 samples is enough [21], [22]. The respondents of the current research are vocational school teachers in Indonesia. A total of 393 teachers participated in the research and fulfilled the minimum number of samples on SEM.

2.2 Instrument

The data of the current research was gathered using an e-questionnaire. The questionnaire is widely used in education and evaluation research [23]. Using a questionnaire can reduce the cost of the research [24] and rapidly gather quantifiable data and information [25]. The response of the instrument will be 5-scale Likert.

The development of the instruments is based on the variables of pedagogy, andragogy, and heutagogy [26]. The competencies of pedagogy are measured using 10 competencies in [26].

3 Methods

3.1 Results

PLS-SEM analysis has two components to be evaluated: the measurement model and the structural model [27], [28]. These two components will be evaluated to investigate the relationships between constructs.

Measurement models. The measurement model of PLS-SEM aims to assess the reliability and validity of items and constructs in the model. The validity and reliability of items and construct may affect the result of the structural model. Valid and reliable items and constructs made the structural equation model meaningful [29].

Table 1. Factor Loadings, Reliability and Validity of Items and Constructs

Variables	Indicators	Factor Loadings	VIF	Rho_A	Composite Reliability	AVE
Pedagogy	PED1	Out	Out	0.792	0.849	0.531
	PED2	0.625	1.389			
	PED3	0.684	1.34			
	PED5	0.75	1.646			
	PED6	0.816	1.811			
	PED7	0.753	1.649			
Andragogy	AND1	0.715	1.605	0.822	0.864	0.517
	AND2	0.807	2.332			
	AND3	0.8	2.083			
	AND4	0.575	1.258			
	AND5	0.745	1.69			
	AND6	0.642	1.455			
Heutagogy	HEU1	0.724	1.519	0.816	0.86	0.507
	HEU2	0.751	1.649			
	HEU3	0.799	1.81			
	HEU4	0.643	1.371			
	HEU5	0.627	1.376			
	HEU6	0.715	1.439			
Pedagogical Competencies	PAC1	0.704	1.74	0.883	0.904	0.513
	PAC2	0.689	1.647			
	PAC3	Out	Out			
	PAC4	0.707	1.662			

PAC5	0.642	1.536
PAC6	0.71	1.756
PAC7	0.71	2.067
PAC8	0.704	2.206
PAC9	0.814	2.596
PAC10	0.752	2.079

Factor loadings evaluate indicator reliability [28]. Factor loading of each item should exceed 0.708 [29], but loadings of 0.4 are acceptable on newly-developed instruments [15], [30]. The results show that almost all indicators give satisfactory indicator reliability except PED1 and PACK3. After evaluating indicator reliability, we should also evaluate their reliability as a construct.

Construct reliability can be assessed through Cronbach Alpha, Rho A and composite reliability. Cronbach alpha is the most widely used measurement of construct reliability, but it is shown to be the least precise among 3 measurements [17]. Rho A is a more precise measurement than Cronbach Alpha but less precise than composite reliability [31]. Based on this information, the measures of construct reliability used in the current research are rho A and composite reliability. Construct reliability should also exceed 0.708 to be a reliable construct [32]–[34]. The results shown in table 1 indicate that these four constructs have a reliability value of more than 0.708. Thus, we can conclude that the constructs are reliable.

Items and construct have been proven to be reliable. The next step in evaluating the measurement model is investigating the discriminant validity of the construct. Discriminant validity ensures that each construct is unique and measure different phenomenon [35]. 3 measurements can be used in evaluating the discriminant validity of the construct: (1) Fornell-larcker criterion, (2) Cross loadings, and (3) Hetero-trait Mono-trait ratio [35], [36]. Among these measurements, the Hetero-trait Mono-trait ratio (HTMT) gives a more accurate result [29].

Table 2. Descriptive Statistics and HTMT of Constructs

Constructs	Descriptive Statistics		HTMT		
	Mean	SD	Andragogy	Heutagogy	PACK
Andragogy	4.27	0.66			
Heutagogy	3.99	0.78	0.716		
PACK	4.18	0.73	0.675	0.831	
Pedagogy	4.07	0.89	0.536	0.589	0.617

The measurement model results show that all constructs have an HTMT ratio less than 0.85, which is the larger ratio the construct should earn to have a good discriminant validity [17].

After ensuring items and constructs are reliable and valid, the result given by the structural model can be meaningful.

Structural Model. The structural model or inner model evaluates paths between construct [28]. The evaluation includes some steps: (1) collinearity assessment, (2) hypothesis testing on path coefficient, (3) coefficient determination, and (4) effect size [37].

Collinearity assessment. Collinearity means that the indicators formed are not interconnected [38]. Collinearity assessment aims to check whether there is multicollinearity exists using variance inflated factor (VIF) [32], [33]. Multicollinearity is unlikely to occur in the items since it has VIF lower than 3 (table 1) [15], [17], [20], [36].

Hypothesis testing on path coefficient. Hypothesis testing on path coefficients aims to test the significance of path coefficients on the structural models. Since PLS-SEM is a non-parametric method, the test will be done using resampling techniques like bootstrapping [20]. The bootstrapping resample method was done using 5000 replications [18].

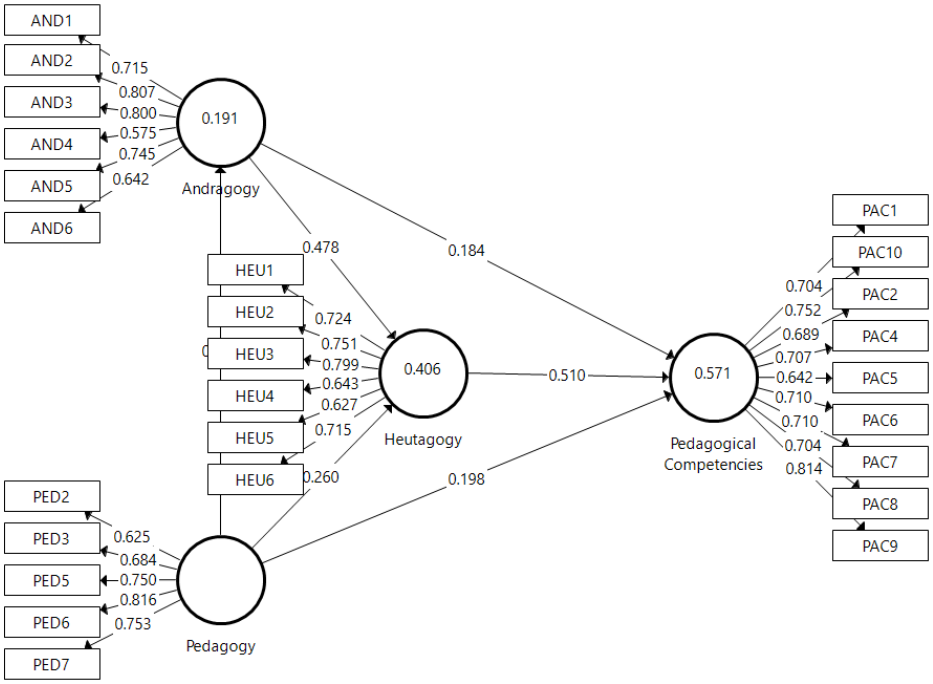

Fig. 2. Structural Model of Pedagogy-Andragogy-Heutagogy Continuum on Pedagogical Knowledge of Vocational High School

One way to investigate the effect of one construct on another is by using the total effect [17]. The total effect is the sum of one construct's direct and indirect effects on another [32]. Using a total effect to conclude the relationship between constructs provides a complete picture [39].

Table 3. Total Effect on Paths of PAH Continuum Model

Path	Path Coefficient	Confidence Interval		Conclusion
		2.50%	97.50%	
Pedagogy -> Andragogy	0.442	0.322	0.554	Accepted
Pedagogy -> Heutagogy	0.473	0.362	0.572	Accepted
Pedagogy -> PACK	0.521	0.426	0.606	Accepted
Andragogy -> Heutagogy	0.481	0.384	0.572	Accepted
Andragogy -> PACK	0.43	0.325	0.529	Accepted
Heutagogy -> PACK	0.51	0.413	0.602	Accepted

The bootstrapping method derives t-values and confidence interval, but the researcher should use interval confidence in inference testing [40]. The results show that Pedagogy practice has significant total effect on Andragogy ($\beta = 0.442$), Heutagogy ($\beta = 0.473$) and Indonesian Teacher Pedagogical Knowledge ($\beta = 0.521$). Andragogy also indicate a significant effect on Heutagogy ($\beta = 0.481$) and Indonesian Teacher Pedagogical Knowledge ($\beta = 0.43$). Heutagogy may also significantly affect the Indonesian Teacher Pedagogical Knowledge ($\beta = 0.51$).

3.2 Discussion

The result may reflect the pedagogy-andragogy-heutagogy continuum since pedagogy praxis has affected andragogy and heutagogy praxis. Interplaying among these three approaches is also possible [14], [41], [42]. The largest effect on pedagogical competencies of a vocational high school teacher is shown by pedagogy praxis. The results may come from pedagogy being a basic teaching method. Pedagogy is also the first step in the pedagogy-andragogy-heutagogy continuum [7]. The pedagogical competencies mostly accommodate teacher-centered learning. The competencies indicate that teachers should be mastering students' characteristics, learning theories and educational principles of learning, and developing curricula related to subjects/fields of development being taught. These indicators tend to represent teacher-centered learning which is closer to pedagogy approach.

Andragogy and heutagogy praxis have a significant effect on teachers' pedagogical competencies. Teacher competencies ask a teacher to facilitate the development of students' potential to actualize their various potentials. This competency reflects the based characteristics of Andragogy and heutagogy.

Pedagogy, Andragogy, and Heutagogy praxis are shown to have a significant relationship. It can prove that teachers may interplay these three approaches in the classroom. But among these three approaches, heutagogy gives the least means of response. This situation may indicate that

heutagogy praxis is minimal in Indonesian vocational high school teachers. Teachers with the least heutagogy praxis score require control and structure in the course [43]. The need for control and structure is low. It can be considered moderate since Andragogy, as a pedagogy progression, has the largest response mean. Teachers in the andragogy approach have less control in the classroom, and students are shown to be more mature and have more autonomy than those in the pedagogy approach [44].

4 Conclusion

Pedagogy-andragogy-heutagogy continuum has existed in the classroom practices of vocational high school teachers. These three approaches are shown to be connected. Good continuum practices may promote the teacher's pedagogical competencies, which can construct the students as long life-learners.

The current research was applied to vocational high school teachers, which can be the limitation of the research. The research also constructs the instruments on limited references. Future work may be done by applying research on more general teachers. The instruments should also result from a systematic review of the literature. Adding variables, especially moderator variables, may advance the research investigating the pedagogy-andragogy-heutagogy continuum praxis based on gender and teaching experiences.

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