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Construct Analysis of AMDA Model Syntax Using the Structural Equation Modeling-Partial Least Square (SEM-PLS) Method

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Abstract: When a building is damaged by an earthquake, it's essential to assess its safety. The AMDA model is the result of the stages of developing a competency-based training model for Post-Earthquake Building Investigation which is designed to make someone competent in this matter. The construct of a development model needs to be tested for validity, reliability and evaluation of the construct or structural model of the syntax of the model being built. Each syntax is confirmed or tested through the value of loadings factor, Average Variance Extracted (AVE) and composite reliability. Next, the influence between variables is analyzed or the structural model or construct (Inner Model) is evaluated. Construct evaluation can be seen from the value of R2 (R-square) between 0 and 1 (0<R2<1), the greater the value and closer to 1, the greater the influence of syntax on the model. The test was carried out using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The results obtained were loading factor values>0.7, meaning the indicators used in the syntax were valid, AVE>0.5 meaning the syntax was valid, composite reliability value>0, 7 means the syntax is reliable and the value of R2=0.963, a significant influence of the syntax on the model

Keywords:, AMDA model; SEM-PLS; Syntax construct

Introduction

Damage to buildings due to earthquakes (BNPB, 2017; Simanjuntak, 2020) needs to be investigated whether the building is still in a safe condition for use or not and confirmed whether the building structure can still be repaired or not. This investigation requires human resources who are capable and competent to carry out the appropriate method or steps to complete it. Human resources are an ability that exists in every human being which is determined by their thinking power and physical strength (Sunarmintyastuti & Suprapto, 2020) Comprehension is an individual's process of receiving and understanding information obtained from learning (Alighiri et al., 2018). In carrying out this responsibility, teachers in higher education are expected to become agents of change who are able to shape students not only as competent professionals, but also as individuals who have moral integrity and social responsibility (Ningrum et al., 2023). The need for someone who has competence and is able to handle this needs to be realized through vocational education. The vocational education pathway is an educational concept with a career/work orientation (Sutjipto, 2019). where this education is developed to prepare and/or improve the qualifications of human resources as trained and competent workers in their fields to enter the world of work that is profitable for them (Dalimunthe et al., 2016). This explanation is then used as the basis for determining the investigation model and the competencies needed by a post-earthquake building investigator. Competencies are prepared based on literature studies and studies of several existing post-

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earthquake building investigations, such as research by (Syahputra & Triwiyono, 2013; Samsunan, 2018).

The investigation model that is formed is then taught in vocational education which is packaged in a training model. The training model is closely related to the quality of the training process and plays a very important role in the successful implementation of the training process, therefore the training model developed must be appropriate (Gunawan et al., 2020). The competency-based learning model can be carried out with multiple strategies and multimedia so as to provide diverse experiences for students (Arka, 2023; Rahmatiani & Saylendra, 2021; Rulyansah & Wardana, 2020).

The training method in competency-based training is expected to be able to provide learning experiences to students, so that they are able to develop their potential and completely master (mastery learning) step by step the competencies being studied, without having to be burdened. by other things. Meanwhile, what is called competence is basically the integration of knowledge, skills, values and attitudes which are reflected in habits of thinking and acting (Arifin, 2015). which is not related to mastery of these competencies. Competency-based training is a structured approach to training and assessment that is directed at achieving certain results and helping individuals acquire skills and knowledge so that they can perform tasks according to certain standards under certain conditions (Zineb et al., 2017; Khan et al., 2022; Suteja, 2017).

The challenges of the 21st century require preparing students who have competency-based characters for the 21st century to be able to respond, adapt and get along with all the dynamics presented by the influence of globalization. The expected outcomes of competency-based training participants are clearly stated so that they know exactly what to expect. After completing the training, participants must be trained based on their abilities, not just knowing but also being able to do something that must be done. Lecturers together with students can create a planned program for completing competency units in a programmed manner so that they can build a student's attitude to be responsible for their own progress. Conceptually, the training curriculum is designed to carry out or carry out work (action) in the form of demonstrations as a vehicle for learning. Learning outcomes appear in the form of actual results and expected results. Both are learning design decisions when choosing the training model to be used (Herwina, 2021; Ahmed & Sayed, 2021).

Based on these considerations, the training model developed in this research aims to collaborate Competency Base Training (CBT) learning in the form of Contextual Teaching and Learning and Mastery Learning with Demonstration Learning and Action Learning. The syntax of these models is explained and analyzed one by one, then conclusions are drawn to create a new syntax according to the needs of the model being developed. The new syntactic structure developed in this research is based on derivatives of four learning models, namely Authentic, Mastery, Demonstration and Action Learning, abbreviated as AMDA. This AMDA model is a form of design or learning pattern designed to make someone competent in the field of post-earthquake development investigations through a competency-based training process. The model is arranged based on the characteristics of the science to be achieved and is equipped with steps or syntax for its implementation.

The construct syntax of a development model needs to be tested for validity, reliability and evaluation of the construct or structure of the syntactic model of the model being built (Riefky & Hamidah, 2019; Setiawan & Mustangin, 2020; Triwidyati & Tentama, 2020; Febrianti et al., 2023). Tests were carried out using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The use of the SEM-PLS method is based on the consideration that this method does not require a large sample size and the data does not have to be normally distributed. Syntactic construct validity is carried out by looking at the Average Variance Extracted (AVE) value. If the AVE value is > 0.5, it means the data is said to be valid or vice versa (Santos & Cirillo, 2023; Ateş & Altuner Çoban, 2022). Meanwhile, to see the reliability, it can be seen from the composite reliability value. If the value is above 0.70, it means the data is said to be reliable. If the measurement data has been declared valid and reliable, then the influence between variables will be analyzed or the structural model or construct (Inner Model) will be evaluated. Construct evaluation is seen from the R2 (R-square) value between 0 and 1 (0<R2<1), the greater the value, namely closer to 1, the greater the influence of syntax on the model (Hair et al., 2021; Hair et al., 2022).

Method

Research Design

The type of research used is research and development (R&D). Development research is defined as a process or steps to develop a new product or improve an existing product through the provisions of existing rules. The result of this research is a learning model product that is used in post-earthquake building investigation training for vocational education based on testing and then revised to produce a product that is suitable for use.

In educational research, development research is the process used to develop and verify educational products. This stage of the process is called the Borg &

Gall R&D cycle. (Wanto et al., 2020), including research on research findings related to the product to be developed, product development based on these findings, testing areas in the environment where the final product is used, as well as revising it to correct deficiencies found in the stages submit testing. Development research also explains the procedures followed in producing the product, namely explaining the components of the product design being developed, stating the properties of the components at each stage of development, analytically explaining the function of components at each stage of product development, and explaining the relationships between components in the system.

Development Procedure

In general, the development procedure in this research is divided into 3 stages, namely: pre-development, development and application of the model as shown in Figure 1.

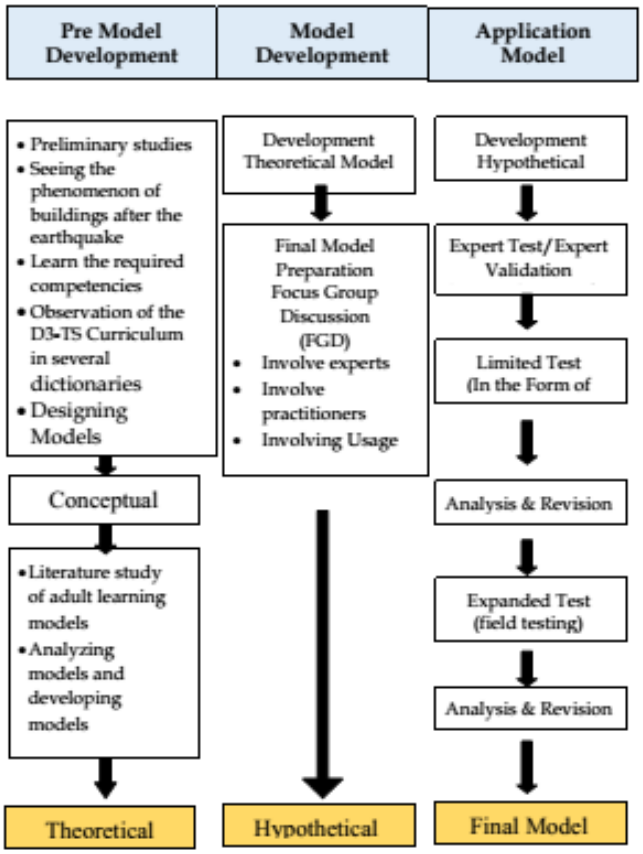

Figure 1. Model development procedure

A conceptual model is an analytical model used to describe the components of a product, analyze the components in detail, and display the relationships between the components that will be developed. A theoretical model is a model that describes a model that is based on related theories and supported by empirical data. The hypothetical model is a model that receives input from experts and practitioners through focus group discussions (FGD). The final model is an empirically tested model.

The learning model product used in post-earthquake building investigation training for vocational education in this research was designed based on the ADDIE development model procedure developed by Dick and Carry in 1996. This model is considered to have efficient, effective and dynamic characteristics compared to the development design model used other. The ADDIE development model has the advantages of being easy to understand, simple, integrative, procedural and has 5 interrelated components (Hidayat & Nizar, 2021).

The ADDIE model is a development framework consisting of five stages to create a model product. The first stage is analysis, where the needs for the model are assessed by identifying problems and determining the appropriate product to meet the objectives. The second stage is design, where the concept of the product is planned and structured. The third stage is development, where the product design is brought to life, and the resulting syntax is tested for construct validity. The fourth stage is implementation, where the developed product is tested in a real-world setting. Finally, the evaluation stage involves reviewing the product's success and effectiveness.

Syntax Construction Validity Test

The construct of a development model needs to be tested for validity, for this reason at the development stage a construct test is carried out on the syntax using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The aim of using this method is to confirm or assess the model whether the model formed is formulated based on theory. The validity of the syntax construction is tested through experts' assessments of the syntax of the AMDA model using a questionnaire instrument for assessing syntax items. The instruments are prepared according to the aspects that will be measured in learning about post-earthquake building investigation needs.

Result and Discussion

At the development stage, the model receives improvements and the model syntax is rearranged based on input and corrections provided by experts during Focus Group Discussion (FGD) activities. The syntax of the development model that has been designed is mixed and matched and adapted to the needs of the improvement model. The syntax analysis of the selected models is prepared as shown in Table 1. These new syntax changes or developments are prepared based on

input and suggestions submitted during the FGD. Apart from that, it also considers an analysis of the needs or characteristics of the goals to be achieved in learning and the tools used. The new syntax structure developed in this research is still based on derivatives of the four existing models in CBT, namely Autentic, Mastery, Demonstration and Action Learning yang disingkat AMDA.

Table 1. Composition of AMDA Model Syntax Development Stages

Initial Syntax AMDA Model	Development Syntax AMDA Model
Convey objectives and competency achievements.	Orientation
Explain the stages and description of the material.	Presentation of Material
Guided and independent practice.	Demonstration Scenarios
Demonstrate the prepared scenario.	Guided Practice
Carry out Action	Action and Field Analysis
Make evaluations and reports	Evaluation

So that a model can be applied appropriately according to the objectives expected in the process of compiling and forming it, a model that has syntax must be equipped with activity explanations. Explanations of activities should be carried out in the form of detailed and clear descriptions of activities between the teacher/instructor and students/participants. Table 2 is an explanation of the activities of the AMDA learning model.

AMDA syntax construct validation was carried out using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. The use of the SEM-PLS method is based on the consideration that this method does not have to have a large sample size and the data does not have to be normally distributed (Ulum et al., 2014). The procedure through the stages ensures that the loadings factor for each syntax indicator must be >0.7. The assessment criteria are carried out by looking at the AVE value, if >0.5 it means it is valid or vice versa. To see reliability, you can look at the composite reliability value, if > 0.70 it means it is reliable. Next, to evaluate the structural model or construct (Inner Model), this is done by looking at the R2 (R-square) value, which is between 0 and 1 (0<R2<1), the greater the value and closer to 1, the greater the influence of syntax on model.

Table 2. Syntax and Activities of the AMDA Learning Model

AMDA Model Syntax	Activity
Orientation	Initial learning to students about the goals to be achieved and competencies that must be obtained by providing background information through lessons with lectures and presenting pictures and photos while students listen carefully to the material provided by the instructor.
Presentation of Material	The instructor explains the stages of post-earthquake building investigation and an overview of the material to be studied to the students. The instructor provides training about the stages in conducting an investigation to students.
Demonstration Scenarios	The instructor demonstrates what has been learned from the exercise using the tools provided and carries out the stages of the scenario that has been prepared and the students participate in the demonstration.
Guided Practice	The training is carried out in a mentoring manner and is carried out until it is believed that the students understand it (completely). To ensure this, students are then given independent training.
Action and Field Analysis	Students take action directly in the field at the building that has been chosen as the object. The investigation stages that have been understood in the training process are applied to real objects in the field. The data obtained is then analyzed.
Evaluation	Data resulting from direct actions in the field are evaluated and compiled into a report.

AMDA Syntax Construct Validation

AMDA syntax construct validation is carried out by 10 (ten) validators based on the needs and goals to be achieved. Before validity and reliability tests are carried out using the SEM-PLS method, it is ensured that the loadings factor for each syntax indicator must exceed the value of 0.7 or be valid. Syntax construct validity is carried out by looking at the Average Variance Extracted (AVE) value. If the AVE value is> 0.5, it means the data is said to be valid or vice versa. Meanwhile, to see reliability, it can be seen from the composite reliability value, if the value is above 0.70, it means the data is said to be reliable. If the measurement data has been declared valid and reliable, the next step is to analyze the influence between variables or evaluate the structural or construct model (Inner Model). Construct evaluation is seen from the value of R2 (R-square) between 0 and 1 (0<R2<1), the greater the value, namely closer to 1, the greater the influence of syntax on the model.

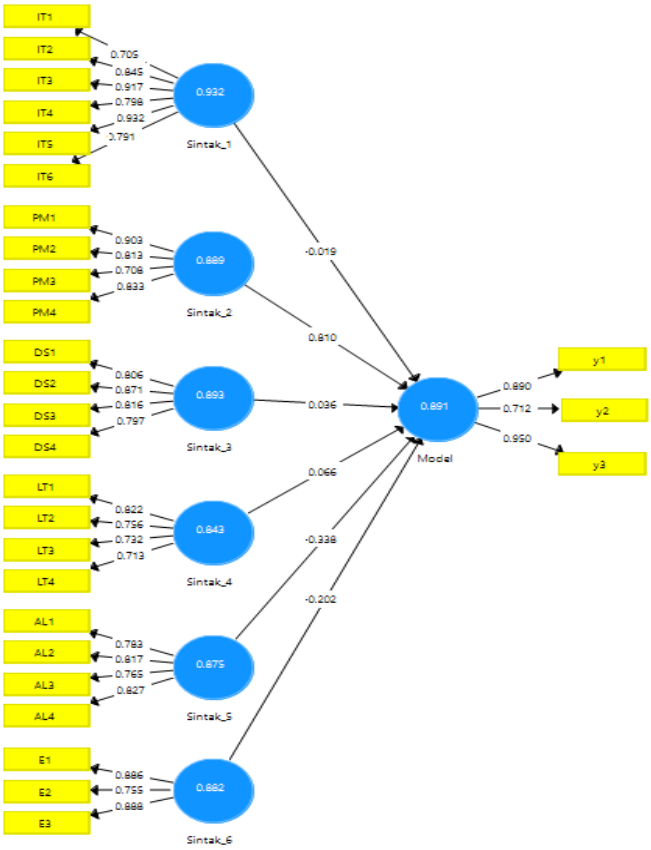

Figure 2. Loading factor and AVE values from SEM-PLS

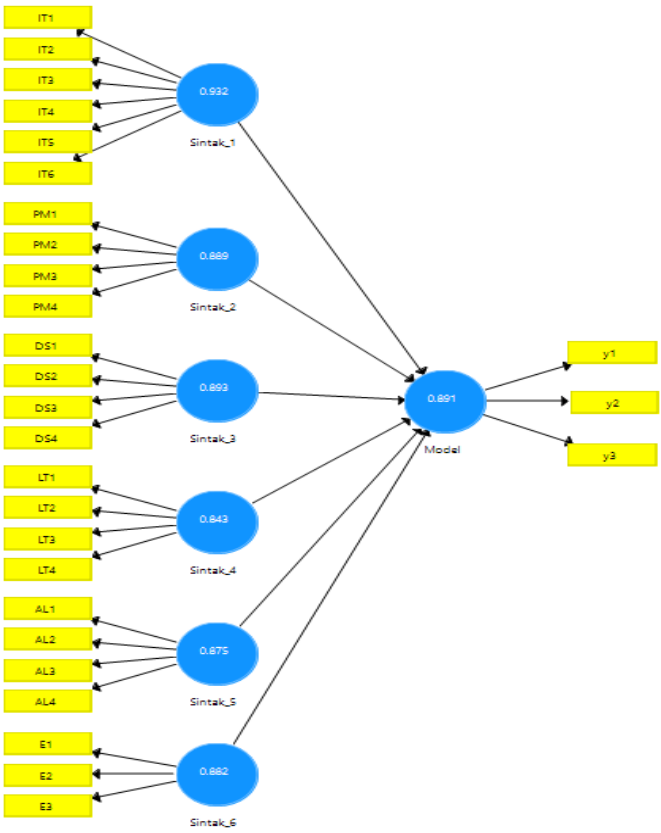

Figure 3. Composite Reliability Value from SEM-PLS

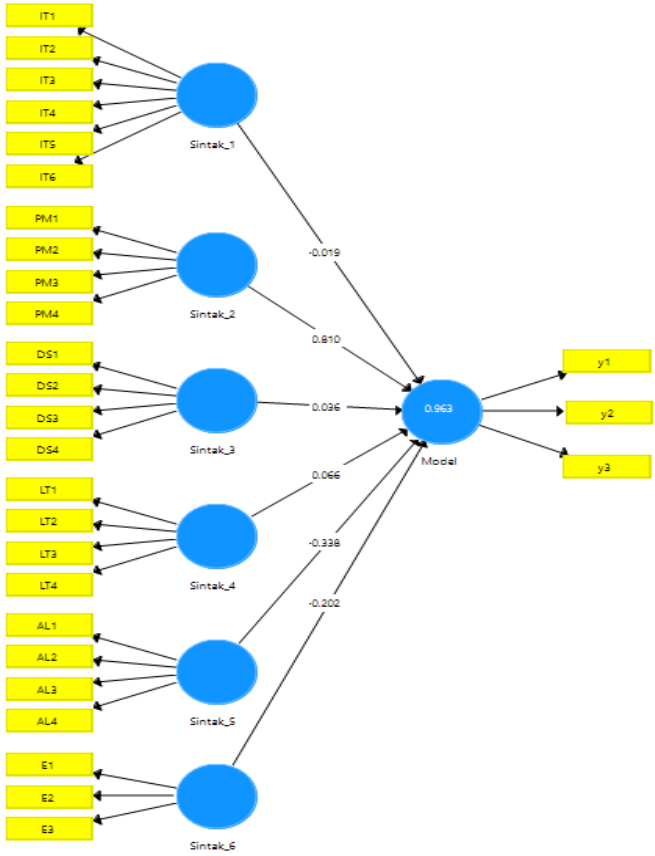

Figure 4. Phath coefficients and R2 values from SEM-PLS

Based on the results of the SEM-PLS analysis, Table 3 and Figure 2 show that the loading factor value is> 0.7, meaning that the indicators used in the syntax are valid, AVE> 0.5, meaning that the syntax prepared is also valid. Figure 3 shows that the composite reliability value is >0.7, meaning the syntax is declared reliable and Figure 4 shows the value of R2=0.963, which is close to 1, meaning that the syntax that is prepared has a big influence on the model.

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Table 3. Recapitulation of SEM-PLS Method Analysis Results

Construct/Variable		Loading Factor	AVE	Composite Reliability	R^2 (R-square) Model
Syntax-1	IT1	0.705	0.697	0.932	0.963
	IT2	0.845			
	IT3	0.917			
	IT4	0.798			
	IT5	0.932			
	IT6	0.791			
Syntax-2	PM1	0.903	0.668	0.889	
	PM2	0.813			
	PM3	0.708			
	PM4	0.833			
Syntax-3	DS1	0.806	0.677	0.893	
	DS2	0.871			
	DS3	0.816			
	DS4	0.797			
Syntax-4	LT1	0.822	0.573	0.843	
	LT2	0.756			
	LT3	0.732			
	LT4	0.713			
Syntax-5	AL1	0.783	0.637	0.875	
	AL2	0.817			
	AL3	0.765			
	AL4	0.827			
Syntax-6	E1	0.886	0.715	0.882	
	E2	0.755			
	E3	0.888			

Conclusion

Based on the results and discussion, it can be concluded that the AMDA Model is the result of the development stages of a competency-based training model for Post-Earthquake Building Investigation. Testing was carried out using the Structural Equation Modeling-Partial Least Square (SEM-PLS) method. SEM-PLS on the syntax of the AMDA model can be concluded that the syntax compiled is valid and reliable. This is indicated by the Loading Factor value of each syntax> 0.7, the AVE value> 0.5 and the Composite Reliability value> 0.7. For the R2 value, a value of 0.963 was obtained and approached 1. From these data, it can be concluded that the syntax compiled has a significant influence on the model.

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Author Contributions

S. Conceptualization; S and B.S. methodology; S., B.S., R.P., N.A. Resources; S and R.P. Data curation; S. Original draft preparation. RP, BS and N.A. Review and editing. All authors have read and approved the published version of the manuscript.

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Conflicts of interest

There is no conflict of interest.

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