Development of a CBT-AMDAℓ Training Model for Vocational Education Students to Improve the Competence of Post-Earthquake Building Investigators

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Abstract. Damage to buildings due to the earthquake that occurred in Indonesia needs to be investigated to determine whether the building is safe or not. The need for someone who has competence and is able to handle this needs to be realized through vocational education. This research contains Research and Development, the product was developed using the ADDIE model procedure. Model validity testing is carried out by validating the syntax and content constructs by material, model and language experts. The AMDAℓ model is a product that is produced, has 6 syntax, namely(1) Purpose Information, (2) Presentation of Material, (3) Demonstration Scenarios, (4) Guided Practice, (5) Action and Field Analysis, and (6) Evaluation. The model is declared valid. It is shown thatLoading factor value>0.7 means the syntax indicator is valid, AVE>0.5 means the syntax structure is also valid and Aiken's value is 0.816>0.677.

Keywords: model *AMDAℓ*,training, post-earthquake, competency, vocational.

1 Introduction

A number of experts Crunkilton, 1984; McAshan, 1989; Mulyasa, 2004; Hersey and Blanchar, 1995, explain that the concept of competency includes an individual's knowledge, skills and abilities including traits, behavior and personality, as well as motivation which will play a role in the successful implementation of the tasks assigned to him [2], [4], [6]. These individual abilities are essentially built through the process of internalizing values, knowledge and life experiences, which occurs both in the family, community and especially in the formal education environment. William JR and Jim MG, 2010 explain that competence refers to individual characteristics that contribute to acceptable or extraordinary performance [10]. Competency can be a set of knowledge, skills, behavior, attitudes, and the underlying characteristics of work results. This means that competence is part of a person's personality that has been ingrained and lasts a long time and can predict behavior in various tasks and work situations and cause or predict behavior and performance. Criterion-referenced means that competence actually predicts who does something well or badly, as measured by specific criteria or standards, so that competence is a number of characteristics that underlie a person and shows ways of acting, thinking, or generalizing. situation in a viable manner in the long term. This means that competence is part of a person's personality that has been ingrained and

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Ministerial Decree Number 327 of 2009 "SKKNI Provisions for Construction and Civil Construction Departments" explains that by mastering certain competency standards, relevant personnel will be able to [9]: a) how to complete a task or job, b) how to organize the task or job so that it can be carried out, c) What to do if something is different from the original plan; d) How to use his abilities to solve problems or perform tasks in different conditions. Earthquakes that often hit Indonesia cause a lot of damage to infrastructure such as buildings. The 2015 National Disaster Management Agency (BNPB) report noted that 2045 housing units were heavily damaged, 547 units were moderately damaged and 3107 units were slightly damaged. In 2016 there were 2967 housing units seriously damaged,

Even though there are multi-storey buildings that are still upright and look sturdy after the earthquake, their reliability will definitely decrease. Be it in the physics of the building or in the load-bearing capacity of the structure, the reliability will be reduced. Earthquakes also affect the condition of structural elements such as columns and beams, likewise, deflection of beams or plates will expose steel rods due to cracks and cause steel rods to rust easily. Apart from that, earthquake shocks will also affect changes in the geometric properties of buildings in the vertical and horizontal directions, causing changes in natural frequencies which cause the building structure to become weak. If a building audit and assessment is not carried out immediately, it will threaten safety, comfort and security in the operation of the building.

2 Competency Base Training (CBT) Model

Competency Base Training (CBT) is a results-oriented human resource development method. CBT is a training process designed to develop certain abilities and skills in order to obtain work results in accordance with predetermined performance goals (performance goals). The learning model developed in this research combines CBT learning in the form of Contextual Teaching and Learning and Mastery Learning with Demonstration Learning and Action Learning.

2.1 Contextual Teaching and Learning (CTL)

Nurhadiin Sugiyanto (2007) explains that CTL (Contextual Teaching and Learning) is a learning concept that encourages teachers to connect the material taught with real world situations [7]. Fathurrohman and Sulistyorini (2012) explained that the concept of contextual

learning is that teachers present the real world in the classroom and encourage students to establish connections between the knowledge they have and its application in everyday life. The steps for authentic teaching are shown in Table 2.1. [12]

Table 2.1. Authentic Instruction Learning stages.

No	Stages	Activity
1	Conveying goals.	Conveying the objectives and preparing students, explaining the objectives, background information for the lesson, the importance of the lesson prepares students to learn.
2	Demonstration of knowledge or skills.	Demonstrate knowledge or skills, demonstrate correct skills or present information step by step.
3	Guided training.	Guide training, plan and provide guidance and initial training.
4	Evaluate understanding and provide feedback.	Checking understanding and providing feedback, checking whether students have done the task well, giving feedback.
5	Advanced training and deployment.	Provide opportunities for advanced training and application, preparing to undertake advanced training with special attention to application to more complex situations in daily life.

2.2 Mastery Learning (ML)

Caroll. J.B. and Bloom. B (1971) in Wena (2011) explains the development of mastery learning by presenting a systematic, interesting and concise way to improve student performance [11]. Every student is expected to be able to master basic competencies (basic learning objectives) completely. Adhering to the principle that if each student is given the time necessary to achieve a level of mastery, and if he spends the required time, then it is likely that the student will achieve that level of mastery. Table 2.2 explains that at the orientation stage a learning content framework is determined. The teacher explains learning objectives, tasks and develops student responsibilities during learning. If teaching new skills,

Table 2.2. Mastery Learning learning stages

No	**Stage**	**Activity**
1	Orientation	The teacher conveys the content, steps and learning objectives and reviews previous learning.
2	Presentation	The teacher explains new concepts or skills with examples and gives assignments.
3	Structured Exercise *(structured practice)*	The teacher provides examples of problem solving practices in the form of completing assignments, providing questions and feedback on student errors, and steps that encourage correct answers for each assignment given.
4	Guided Practice *(guided practice)*	The teacher gives assignments and then supervises, monitors, guides and directs the group discussion and provides feedback.
5	Independent Practice	The teacher evaluates by giving independent assignments, gteachers check student work results and if necessary

No	Stage	Activity
	(independence practice)	provide feedback on student work results to increase student retention.

2.3 Demonstration Learning (DL)

Demonstration Learning (DL) give students the opportunity to see and hear relevant details being taught. These details include any necessary background knowledge, procedures or precautions. Demonstrations provide an opportunity to become proficient and are recommended because they leave nothing to chance. Table 2.3 is the demonstration learning stages (Gussen Akhmad Sudrajat, 2008) [8]

Table 2.3. Demonstration learning stages

No	Stages	Activity
1	Explanation of the competencies to be achieved.	The teacher conveys the competencies to be achieved.
2	Presentation of material.	The teacher introduces the material that will be presented briefly.
3	Preparation of materials or tools.	Prepare the necessary materials or tools
4	Demonstration of prepared scenarios	Appoint a student to demonstrate according to the scene that has been prepared.
5	Demonstration analysis	All studentspay attention to the demonstration and analyze it
6	Explanation of analysis results	Each student provides an explanation of the analysis results and demonstrates their experience.
7	Conclude	The teacher draws conclusions.

2.4 Action Learning (AL)

Applications,action learningproduce knowledge and skills that can actually be used in work. Action Learning contains all the advantages of On the Job Training (OTJ), and in many cases, the advantages of Action Learning surpass OTJ because Action Learning involves more strategic challenges that are confronted throughout the organization as a total system.

Table 2.4. Action learning learning stages

No	Stages	Activity
1	Explanation of Tasks	Initial learning for students about the topic by providing background information through lessons with lectures and presenting pictures and photos while students listen carefully to the material provided by the teacher.
2	Forming Groups	Divide groups of students into several groups to later carry out discussions and deliberations, field work and presentations.
3	Identification of problems	After students are divided into several groups, students are given problems to be identified by students in groups.

No	Stages	Activity
4	Setting Goals	Learnersparticipate in group discussions and discuss the objectives of future fieldwork.
5	Setting Actions	After setting goals, students immediately determine the actions that will be carried out in field work.
6	Carrying out Actions	Students work in groups according to the purpose of the field work and the place to go to the field work place for interviews and carry out activities.
7	Make a report	After carrying out the action, students return to the classroom to make a field work report.
8	Presentation	After students have finished doing field work and discussing to make a report, students must present the results of the field work report.

3 Authentic Mastery Demonstration and Action Learning (AMDA*ℓ*) Model

The training model developed in this research establishes collaborative 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 described and analyzed one by one and then conclusions are drawn to create a new syntax according to the needs of the model being developed. The new syntax structure developed is based on derivatives of four learning models, namely Authentic, Mastery, Demonstration and Action Learning, which are abbreviated as *AMDAℓ*.

Model *AMDAℓ*. is a form of learning plan or pattern designed to make someone competent in the field of post-earthquake building investigations through a competency-based training process. The model is structured based on the characteristics of the knowledge to be achieved and helps make it easier to absorb competencies in the required scheme. Table 3.1 is an illustration of the journey from the beginning to the end of the formation of the *AMDAℓ*. model syntax.

Table 3.1. Final Composition of EIA Model Syntax Development.

Initial Model Syntax *AMDAℓ*	Model Development Syntax *AMDAℓ*	Final Model Syntax *AMDAℓ*
1. Conveying objectives and competency achievements.	1. ***Orientation***	1. ***Purpose Information***
2. Explain the stages and description of the material.	2. *Presentation of Materials*	2. *Presentation of Materials)*
3. Guided and independent practice.	*3. Demonstration Scenarios*	3. *Demonstration Scenarios*
4. Demonstrate prepared scenarios.	4. *Guided Practice*	4. *Guided Practice*
5. Carrying out Actions	5. *Action and Field Analysis*	5. *Action and Field Analysis*
6. Make evaluations and reports	*6. Evaluation*	6. *Evaluation*

The syntax structure of the training model needs to be complemented by the activities carried out so that it can be implemented appropriately according to the desired goals. Table 3.2 is an explanation of the syntax and activities of the ***AMDAℓ*** learning model.

Table 3.2. ***AMDAℓ*** model syntax and activities.

AMDAℓ Model Syntax	Activity
1. Information ***objective***	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.
2. 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.
3. 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.
4. 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.
5. 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.
6. Evaluation	Data resulting from direct actions in the field are evaluated and compiled into a report.

4 Product Validation

4.1 *AMDAℓ* Syntax Construct Validation

The results of the SEM-PLS analysis, in Table 4.1, 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. The composite reliability value>0.7 means that the syntax is declared reliable and R2=0.963 is close to 1, meaning that the syntax that is prepared has a big influence on the model.

Table 4.1. Recapitulation of SEM-PLS method analysis results.

Construct/Variable		*Loading Factor*	*AVE*	Composite Reliability	R2 (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			

Construct/Variable		*Loading Factor*	*AVE*	Composite Reliability	R2 (R-square) Model
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			

4.2 *AMDAℓ* Model Content Validation

Data from expert assessments is analyzed using the Aiken's V formula [1], provided that if the V value is > 0.677, it is said that the research product is valid. Table 4.2 shows that the content of the *AMDAℓ* model is valid and rational to use. This is indicated by the V value in all indicator statements of more than 0.677.

Table 4.2. *AMDAℓ* Learning Model Content Validation Results

No	Assessment Aspects	Aiken's V value	Results of Assessment Aspects
1	Rational Model	0.847	Valid
2	Model Supporting Theory	0.840	Valid
3	Development Goals	0.819	Valid
4	Syntax	0.802	Valid
5	Social Systems	0.759	Valid
6	Reaction Principles	0.833	Valid
7	Support System	0.802	Valid
8	Instructional Impact and Accompanying Impact (Implementation Impact)	0.826	Valid
	Average	**0.816**	**Valid**

5 Conclusions

Based on the results of the development and discussion of post-earthquake building investigation training models that can meet vocational education needs, the following conclusions can be drawn:

1) The research produced an *AMDAℓ* learning model that has 6 syntax, namely (1) Purpose Information, (2) Presentation of Material, (3) Demonstration Scenarios, (4) Guided Practice, (5) Action and Field Analysis, and (6) Evaluation.
2) The model is declared valid. It is shown thatLoading factor value>0.7 means the syntax indicator is valid, AVE>0.5 means the syntax structure is also valid and Aiken's value is 0.816>0.677.

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