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Research Article

VALIDITY OF PRODUCT ON THE DEVELOPMENT OF COMPASS, OBSERVATION, DEMONSTRATION, EVALUATION *(CODE)* TRAINING MODEL

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The objective of this research was to measure the validity level of a product from the Compass, Observation, Demonstration, Evaluation (CODE) training model. Furthermore, this research was conducted using ADDIE steps. The instrument used to measure the model validity is a questionnaire through the validation sheet. Based on the validity test of the model development, it was obtained that the CODE training model book, Control System Training Module, Control System Training Module using CODE Model, Instructor Guide, and Learner Guide were declared valid, so they can be applied in training.

Keywords: CODE models, mechatronics and industrial robots, guides, control system modules

Introduction

The development of industrial sector, particularly in Indonesia, has a close relationship with the human resources produced by the world of education. The ability of operate faster, more cost-effectively, and more innovatively has become a priority for today's manufacture industrial actor in Indonesia.

Pravin Popatrao Shinde (2014) stated that there are several different methods of plastic molding in developing injection, those are blow molding, injection molding, rotary molding, and compression molding. Each technique has its own strength in the manufacture of certain items. The development of injection molding machines for small industries has been developed by Oyetunji (2010) and Indra Mawardi (2014), who have created injection molding machines with the capabilities of forming small plastic particles by injecting liquid resin into a closed and then the mold cooled and harden into the product desired. Machine is designed and built as a prototype to produce a very small plastic parts. In this case, the design, operation and components assembly concept, working figure, and material selections are made based on the calculations of the plunger injection diameter, number of teeth required for the plunger rack and spur gear, angular speed, number of revolutions, torque, and power obtained from the selected electric motor and leverage on the handle of the machine. Parts/components machine is then assembled according to the design. Afterr the machine is built, then the density polyethylene was tested using high and masterbatch.

Although the development of technology in the industrial sector in Indonesia lately is quite rapid, but in order to be more competitive, more government support is needed, including costs which are certainly not small and adequate supporting facilities. Furthermore, in order to support the development of technology, it is expected that education sector is ready to produce students who are able to compete in the field of microcontroller technology to develop technological tools in the fields of industry, health, military, and others. Therefore, preparation is needed to produce competence according to the expertise on demand by the current technology world. The development of science increases rapidly. This includes the development of mechatronics and robotics fields, where students are expected to be able to make/change a manual machine into an automatic machine. Automation is basically used to help humans in doing routine things, since they have limitations in terms of accuracy, especially in the fields of industrial machines, health, military, and others. However, some companies still use manual methods in their production process as well as some tools that are not used perfectly or are not run automatically.

Industrial Mechatronics and Robots are one of the courses in the Department of Mechanical Engineering Education, of the Faculty of Engineering UNIMED. This course is currently using the conventional learning model. This learning model refers to a direct learning model, in which the lecturer becomes as a source of learning or teaching center (lecturer-centered learning). Such learning allows a detailed knowledge transfer from the lecturer to the students. Such a condition is one of the factors that can produce graduates who have not been able to meet the demands of the current global market.

Participants of education are expected to become professional, responsible, know, understand, and respond to what happens in the industrial field fast. During the training process, participants are introduced to new problems and trained to find solutions. In addition, their also can develop their abilities, solve problems encountered, as well as make decisions quickly. If there is a problem in doing a job, the participants must be able to find various alternative solutions.

One of the objectives to develop the learning process by adjusting to its times,

particularly in the fields of technology and industry, is to develop the potential of control system expertise and master product manufacturing to produce a quality workforce which can meet the demand of job and the latest technological developments. Therefore, the training activities process must be in accordance with the plans that have been determined, so that the level of material mastery is achieved. The learning process at campus aims to develop the academic potential and personality of students, so that they can master science and technology according to the demands and developments of the world of work. Furthermore, the learning/training process in the world of work aims so that the students can master the standard competencies, as well as develop and internalize professional attitudes and values as qualified workers, either working for other parties or opening their own businesses.

Education also means an institution in charge of setting the goals, content, system, and organization of education. These institutions include families, schools, universities, and communities. Judging from the aspect of the current learning method, the general learning method applied is lecture with the assistance of powerpoint media as the software and other electronic components in the forms of hardware.

Based on the results achieved in the mechanical engineering education study program of the department of mechanical engineering education, faculty of engineering Unimed in the last 3 (three) years of odd semester 2018/2019 academic year to the odd semester of 2020/2021 year, the industrial mechatronics and robot courses obtained competent values. However, it still needs to be improved in terms of the learning process because technological developments require ready-to-use competencies in entering the world of work.

Technological innovations developed are in the forms of developing training models to improve the participants' competence who are still stuck in the theory of the control system process. The development of the industrial field has used injection molding machine technology so that participants are required to be able to follow the development of the industrial world that uses sophisticated technology. In terms of commercial technology developed, the model in injection molding machine control system training is expected to be practiced at other universities in the future. In addition, participants can develop control systems that can be used in industry, health, military, and others.

The development model employed by the researcher is the training of the injection molding machine control system using the ATMega128 microcontroller as the injection molding machine controller to adjust the parameters that affect the plastic production process including fatigue temperature, pressure limit, resistance time, pressing time, molding temperature, injection speed, and mold wall thickness. The influence of these parameters on shrinkage defects in plastic materials is a problem that must be investigated by controlling using a different microcontroller system with the existing machines. Therefore, due to the current advance of science and technology, a system for controlling industrial machines using a microcontroller has been developed and can be applied to all manual machines such as automatic doors, weet potato slicing machines, peanut skin peeler machine, material transfer machines (robotic arm), and others. In this case, microcontroller is one type of tool that is often used to develop an industrial machine.

Researchers have developed a Compass, Observation, Demonstration, Evaluation (CODE) training model which has a control system training step on an injection molding machine, those are delivering the competencies to be achieved, students orientation on the problems, looking for initial technology, organizing participants to learn, guiding an investigation to individual and groups, paying attention to demonstrations and analyze them, developing and presenting the work, as well as analyzing and evaluating the problem solving process. Through the development of the CODE model, it is expected that the participants understand the control system training process on injection molding machines which leads to

the production of product models of books, modules, instructor guides, and participant guides.

This study aimed to validate the product of Compass, Observation, Demonstration, Evaluation (CODE) training model development and reveal the validity level of products obtained.

Method

This research applied a development method using ADDIE model, but the current research was only conducted to the validity test stage which was produced from the Compass, Observation, Demonstration, Evaluation (CODE) model. The research samples involved were experts, instructors, and students who enrolled the courses in mechatronics and industrial robots in the Department of Mechanical Engineering Education, Faculty of Engineering, UNIMED.

Results and Discussions

The results of product validity test on the development of Compass, Observation, Demonstration, Evaluation (CODE) training model in the mechatronics and industrial robot course in the Department of Mechanical Engineering Education, Faculty of Engineering, Unimed, can be seen as follows:

1. **Developmental Stage**
   a. ***Focus Group Discussion*** **(FGD)**

      Before applying the design of CODE learning model development, a Forum Group Discussion (FGD) process was carried out. This stage was attended by 5 experts or validators who have expertise in each relevant field.

      Based on the results obtained from the FGD, several inputs and suggestions were obtained on the CODE model that was built and the resulting product needed to be improved.

   b. **Experts' Validation**

      After verification was conducted through the FGD, the researchers made revisions according to the suggestions and inputs from the experts. Furthermore, validity tests were also performed by the experts on instrument validity, practicality and effectiveness on research products. The research products that have been validated include instrument validation, CODE training model book, Control System Training Module, Control System Training Module with CODE Model, Instructor Guide, and Student Guide.

a. Results of Product Validation

1). Analysis of Product Validity

There are several products that have been validated and contained instrument to products.

a). Validation of Validity and Practicality Assessment Instruments

After the FGD was implemented, the next stage is instrument validation so that it is appropriate and relevant to be used. For instrument validation, it contains aspects of statements, presentation feasibility, content feasibility, construction, and language.

Graph of Instrument Validity Results:

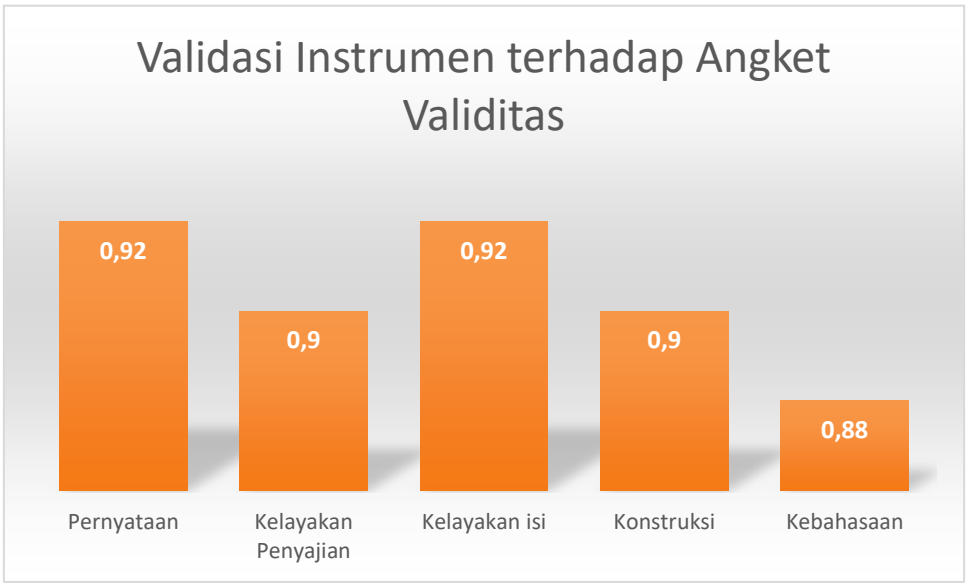


Figure Analysis results of Instrument Assessment Validity

The results of instrument validation on the statement aspect was 0.92, presentation feasibility was 0.9, content eligibility was 0.92, construction was 0.9, and language was 0.88.

This process was then continued by instrument lifetime validation as follow:

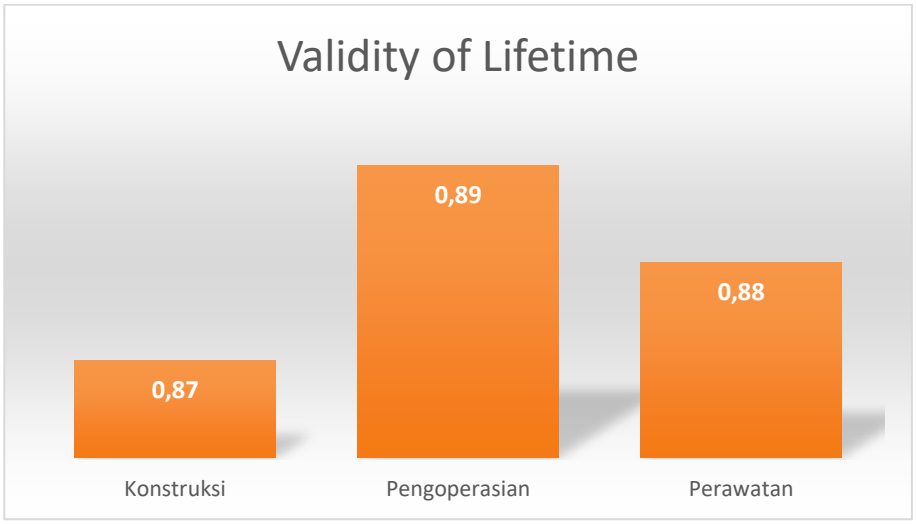


Figure of Validation Results of Instrument Lifetime

Based on the validation of Tools Lifetime instrument, it was obtained that the instrument lifetime obtained construction aspect of 0.87, operational aspect of 0.89, and maintenance aspect of 0.88.

Furthermore, the instrument practicality was also validated, obtained the following results:

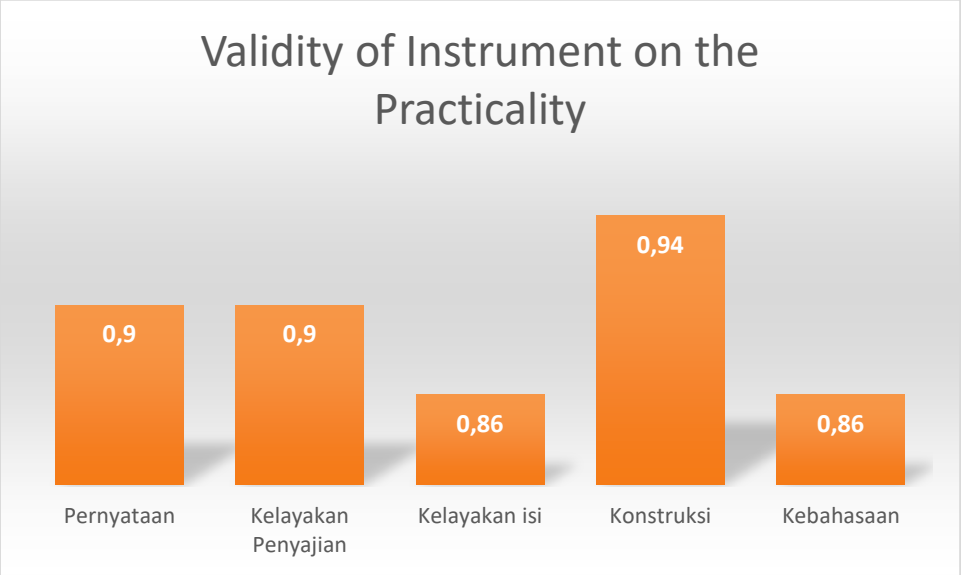


Figure Analysis Results of Instrument Practicality

Based on the calculation results, the practicality of the instrument obtained statement of 0.9, presentation feasibility of 0.9, content eligibility of 0.86, construction of 0.94, and language of 0.86.

In the instrument used to test the effectiveness of the test questions, affective assessments, and psychomotor assessments, the following results were obtained:

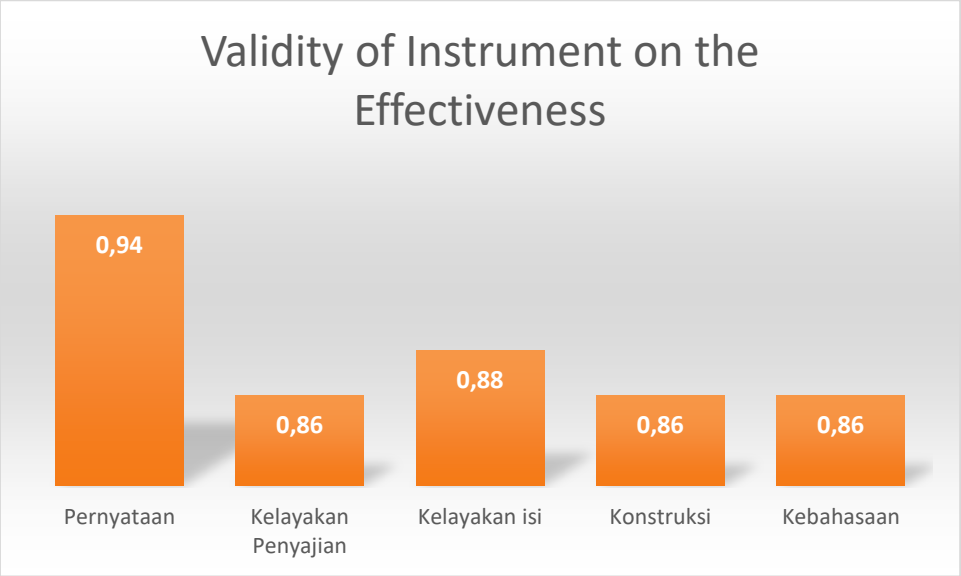


Figure of Analysis Results of the Effectiveness of Instrument Assessment

Furthermore, the validity test results of the instrument for the effectiveness in measuring the students' abilities was conducted. It obtained the aspect of statement of 0.94, presentation feasibility of 0.86, content feasibility of 0.88, construction of 0.86, and language of 86.

Based on the validity test results of the instrument for validity test, practicality, and effectiveness, it is concluded that all instruments are valid, so they can be used in research.

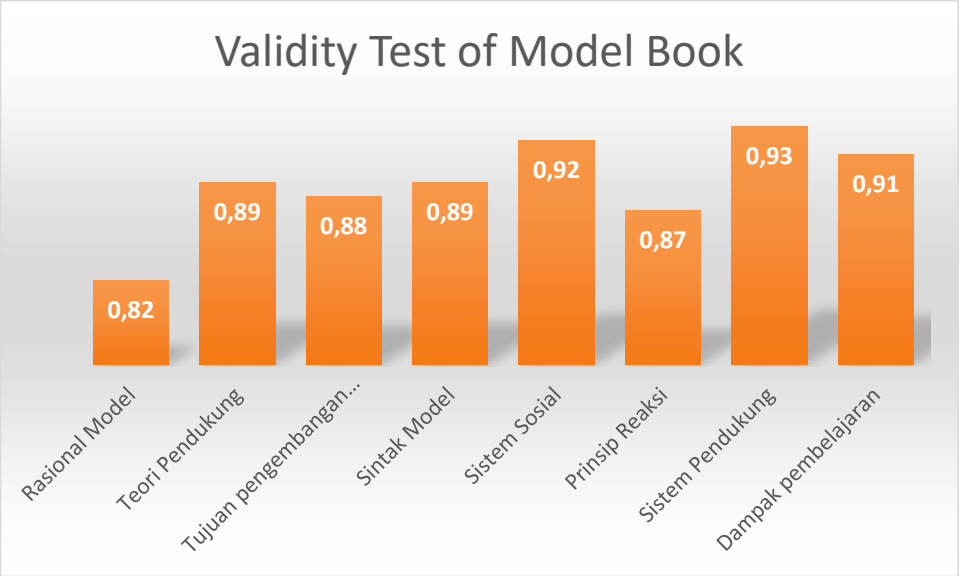
b). Validity of Model Book

The validity test results of the model book contain aspects of Rational Models, Supporting Theories, Purpose of Model Development, Model Syntax, Social Systems, and Supporting Systems.

Table of Analysis Results of Model Book Validity

Rational Model	Supporting Theory	The purpose of developing the model	Model Syntax	Social System	Reaction Principle	Supporting System
0.82	0.89	0.88	0.89	0.92	0.87	0.93

Validity test results of model book is illustrated in the following figure:



Based on the validity test that was carried out by the experts, the Rational Model was 0.82, the supporting theory was 0.89, the goal of developing the model was 0.88, the Model Syntax was 0.89, the social system was 0.92, the Reaction Principle was 0.87, the support system was 0.93, and the learning impact was 0.91. The validity test results showed that the model book is valid and can be used in training.

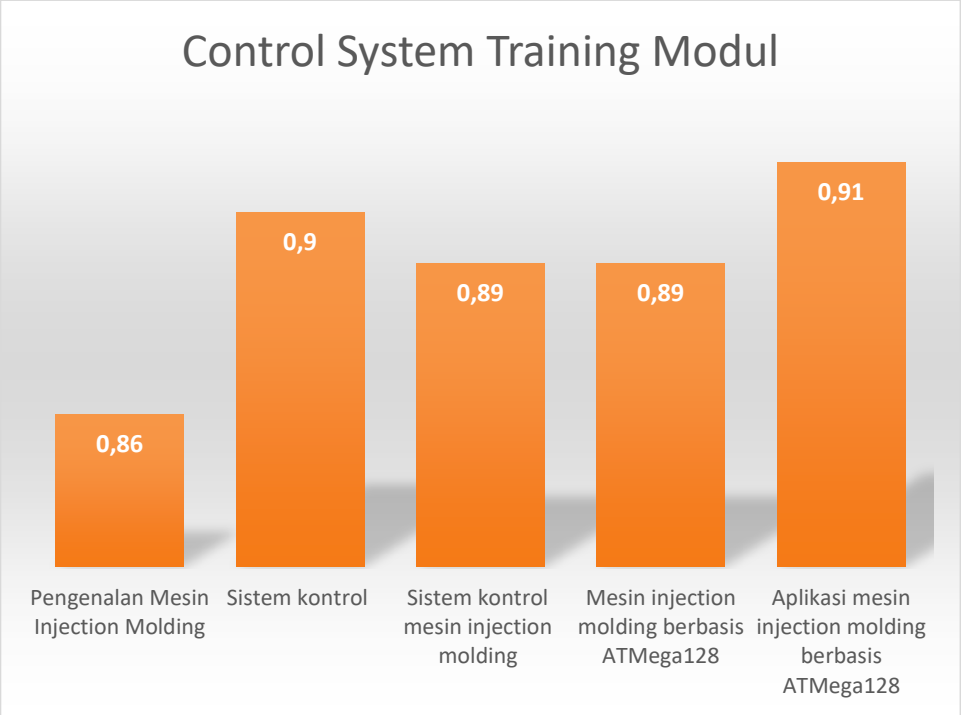
b). Validity of Control System Training Module

The validity test of the control system training module on the aspects of Introduction to Injection Molding Machines, Control systems, Injection molding machine control systems, ATMega128-based injection molding machines, ATMega128-based injection molding machine applications was conducted. The results are as follow:

Table of Analysis Results of Control System Training Module Validity

Introduction to Molding Injection Machine	Control System	Control System of Molding Injection Machine	ATMega128-based Molding Injection Machine	Application of ATMega128-based Molding Injection Machine
0.86	0.9	0.89	0.89	0.91

Validity test of Control System Training Module is illustrated as follow:



Based on the validity test that was carried out by the experts, the control system training module obtained aspects of Introduction to Injection Molding Machines of 0.86, Control system of 0.9, Injection molding machine control system of 0.89, Injection molding machine based on ATMega128 of 0.89, and Application of injection molding machine based on ATMega128 of 0.91. This validity test results showed that the control system training module is valid and can be used in training.

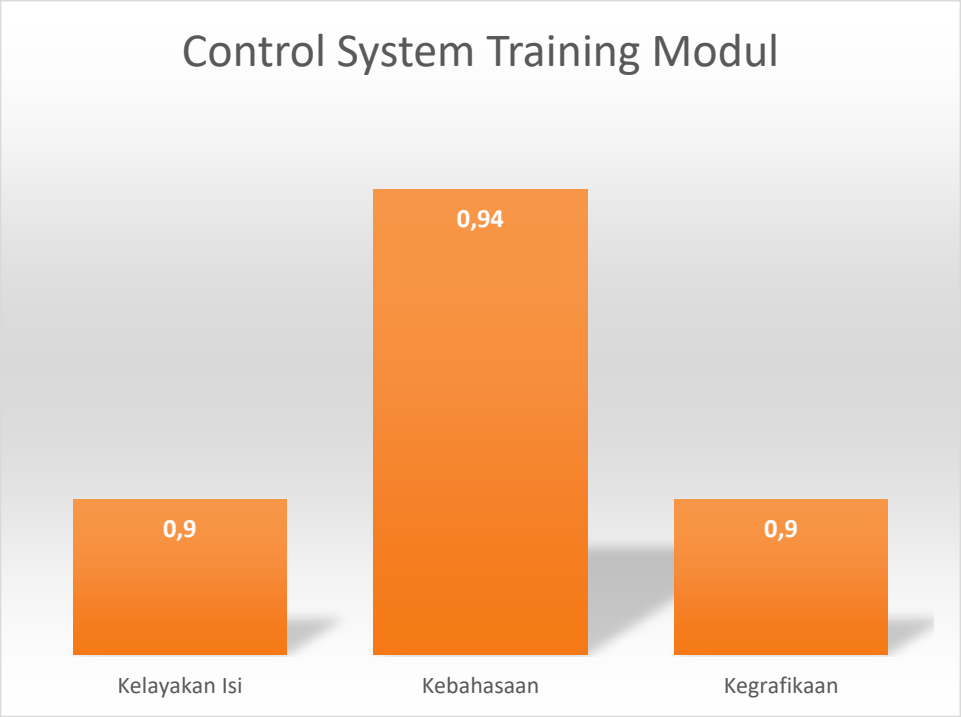
c). Validity of Control System Training using CODE Model

The validity test results of the Control System Training Module using the CODE Model was conducted on the aspects of the feasibility of content, language, and graphics. The results are:

Table of Analysis Results of Control System Training Module using CODE Model Validity

Content Feasibility	Language	Graphic
0.9	0.94	0.9

Validity test results of Control System Training Module using the CODE Model are as follow:



Based on the validity test conducted by the experts, the Control System Training Module using CODE Model obtained the content feasibility aspect of 0.9, language aspect of 0.94, and graphic of 0.9. These validity test results showed that the Control System Training Module using CODE Model is valid and can be used in training.

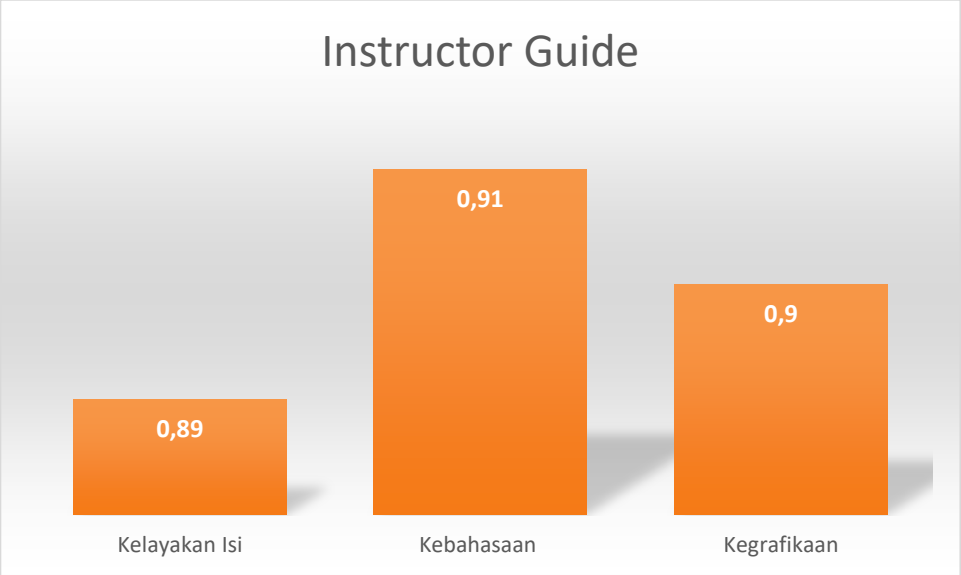
d). Validity of Instructure Guide

Validity test was conducted on the instructor's guide, particularly on the aspects of the feasibility of content, language, and graphics. The results are:

Table of Analysis Results of Instructor Guide using CODE Model

Content Feasibility	Language	Graphic
0.89	0.91	0.9

The results are further illustrated in the following figure:



Based on the validity test that was carried out by the experts on the instructor guide, the aspects of feasibility obtained 0.89, linguistic aspect obtained 0.91, and a graphic aspect obtained 0.9. Based on these results, it showed that the instructor's guide using CODE model is valid and can be used in training.

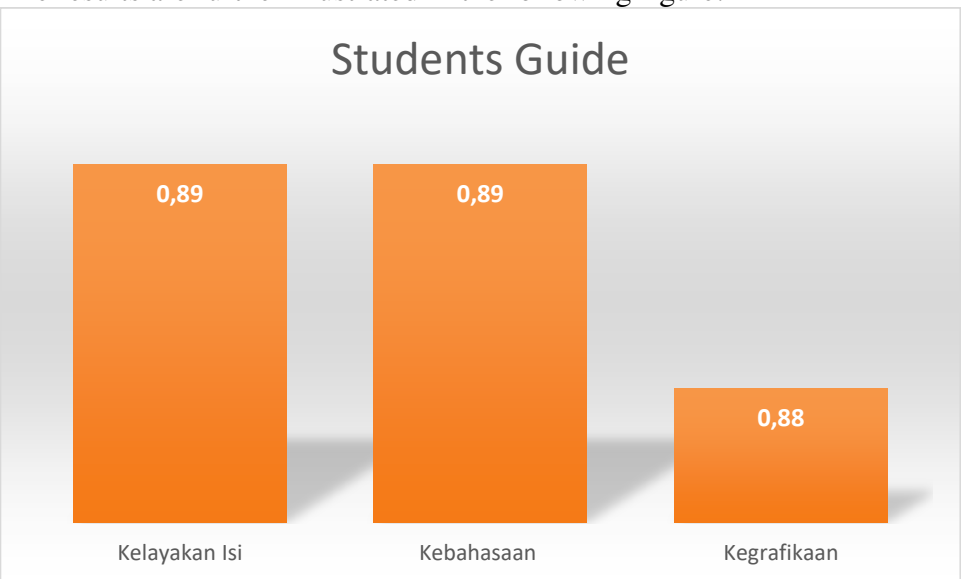
e). Validity of Students' Guide

The validity test was conducted on the student guide on the aspects of the content feasibility, language, and graphics. The results obtained are:

Table of Analysis Results of the Validity of Instructor Guide using CODE Model

Content Feasibility	Language	Graphic
0.89	0.89	0.88

The results are further illustrated in the following figure:



Based on the validity test results obtained the student guide obtained a value of content feasibility aspect of 0.89, a language aspect of 0.89, and a graphic aspect of 0.88. The validity test showed that the student guide using the CODE model is valid and can be used in training.

Conclusions

Based on the findings, it is concluded that the Compass, Observation, Demonstration, Evaluation (CODE) training model is valid and all products produced, including CODE training model book, Control System Training Module, Control System Training Module with CODE Model, Instructor Guide, and Participant Guide are declared valid and can be applied..

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