Development of Competency Based Learning Model in Learning Computer Networks

Raimon Efendi*, Jalius Jama, and Asmar Yulastri
Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia
*raimon.efendi@gmail.com

Abstract. Based on preliminary research that has been done, research problems are The purpose of computer network learning has not been clearly defined based on student needs, the learning process of computer networks is not optimal. The development of computer network learning uses a model of competency based learning aimed at helping educators facilitate students to be active, innovative, and creative in constructing their knowledge, through real experiences students get in the learning process. This research is research and development (R & D) that uses competency based learning models. Development of competency based learning models using the ADDIE model. Based on data analysis, the findings of this study are Competency Based Learning learning model has been successfully developed, The syntax of developed competency based learning models consists of 5 learning steps, Computer network teaching manuals consisting of syllabus and semester learning plan, and WEB-based learning media that are valid, practical, and effective. The results of this study can be used by lecturers, and learning designers in developing or realizing the learning process that can facilitate students to be active, innovative, and creative in developing students' knowledge of computer networks better.

1. Introduction
Technological developments and advancements enable automation in almost all fields. New technologies and approaches that combine the physical, digital, and biological worlds will fundamentally change the pattern of life and human interaction [1], as well as in a very dynamic world of education where curriculum and learning processes must be in line with the development of information technology known as industrial era 4.0 as part of the technological revolution will change the way human activities in scale, scope, complexity, and transformation from previous life experiences. We can see in the world of education in the industrial 4.0 revolution era from two different perspectives, it can be seen as an opportunity, and can also be seen as a threat. various opportunities such as; the birth of a new business unit in the community that is able to penetrate boundless space by utilizing information technology, and vice versa, one of the threats is the result of the automation of the many human works carried out by robots resulting in the loss of human work and new businesses, don’t by humans before.

Increasing the competitiveness and quality of education is closely related to the education process. Quality education can be seen from the side of the process, if the learning process takes place effectively and innovatively and students experience a meaningful learning process, supported by human resources, facilities, adequate infrastructure. Quality learning process will produce graduates who are competent in their field. in line with that Tjalla (2) revealed that the low quality of each type
and level of education is one of the educational problems faced by Indonesia. In general, it can be understood that the low quality of Indonesian human resources at this time is due to the low quality of education. Quality education can be achieved through improving the learning process (3). The classroom learning process is one component of an important educational situation in realizing quality education, effective learning requires professional commitment among lecturers and students (4). Learning must be carried out as well as possible through good planning.

Based on 21st century learning needs, capabilities that must be fulfilled in this era of industrial 4.0 revolution include; Critical thinking, Communication, Collaboration, Creativity. then a new innovation is needed in the learning process to answer those needs and is called competency-based learning. In line with the constructivism approach in learning, there are several decent learning models to be applied in 21st century learning. Learning models that are quite popular are implemented and developed are collaborative learning and problem based learning models. The learning model that currently gets a lot of responses is a collaborative learning model [2]. Collaboration has become a trend of 21st century learning. The community's need to think and work together on issues of critical concern has increased, shifting the emphasis from individual efforts to group work [3]. Slavin [4] revealed that the existence of a team of origin and a team of experts in Jigsaw would stimulate cooperation between students so that it was effective in providing understanding of learning material and creating a better learning atmosphere besides having a positive effect on academic achievement.

The application of Problem Based Learning in professional learning and training has been studied in the last 20 years [5]–[11]. The development of the Problem Based Learning (PBL) model is important to be used to overcome the problem of low student achievement, this is supported by the results of the study [12] Yusof et al. students from aspects of student learning achievement and thinking skills research [13], Savin-Baden & Major [6] states, seeing student experience in PBL, generally shows that students are more satisfied and happy to learn from PBL compared to conventional learning. Fun and effective learning is expected to increase understanding of learning material and be able to improve graduate competency. The role of the lecturer in learning using the Problem Based Learning model is as a facilitator and guide [14]. Based on studies that have been carried out comprehensively through the study of literature, observation and analysis of current learning needs, it can be assumed that a renewal and development of learning models are needed that are able to respond to current needs, especially in this era of industrial revolution. including; Critical thinking, Communication, Collaboration, Creativity.

2. Methodology
The type of research that will be carried out is research and development (R & D) with qualitative and quantitative approaches. Research and development uses the ADDIE model (Analysis, Design, Development or Production, Implementation or Delivery and Evaluations). The form of experiments carried out in this study was to use the True Experimental Design type Two-Group Pretest-Postest Design. The procedure of development research follows the sequence of activities in the ADDIE model which is presented by Branch [15]. Basically the research and development carried out aims to determine the validity, factiveness, and effectiveness of the model developed.

The trial subjects in this study were lecturers and students. Validator in the development of this learning model is a learning model expert, learning media expert, evaluation expert, and language expert. This type of research data consists of quantitative data and qualitative data. Quantitative data consists of instruments of validation, practical instruments, and instruments of effectiveness. Qualitative data consists of the results of discussions, observations or savings, and interviews conducted. to get the data in this study consists of instruments pre-research, validation, practicality, which has calculated the level of validity first. While the effectiveness instrument in the form of test questions was analyzed to determine the level of validity of the item, the power difference, the level of difficulty of the question, and reliability of the test, as well as guidance on observation and interviews also used to find the practicality of product development. The data analyzed in this study are data from the validation results, data from the practicality test results, and effectiveness test data. Data analysis of this study was conducted using descriptive statistical analysis techniques and descriptive techniques.
Descriptive statistics for analyzing learning outcomes tests. While the descriptive technique for analyzing questionnaire results.

3. Result and discussion

3.1 Need Analysis

Based on the needs analysis, there are several things that need to be developed in learning computer networks related to the ability of students to deal with the challenges of 21st century learning needs. Development on aspects of learning objectives 15%, learning materials 15%, learning models 25%, learning media 25%, learning evaluation 20% (figure 1).

![Figure 1. Need Analysis development model](image)

Conclusion of need analysis results is that students and lecturers really need a competency based learning learning model on computer network courses. The results of the analysis are very rational and essential so as to strengthen the motivation of researchers to conduct research and development of competency based learning learning models.

The process of developing the competency based learning model includes five steps in accordance with the ADDIE development model, namely analysis, design, development, implementation and evaluation.

1. Analysis

Analyzing the learning process that is reviewed thoroughly is one of the factors that must be done before we carry out a study both internally and externally. The analysis phase is carried out with various methods which are carried out beginning with library studies, relevant research, and conducting a needs analysis of the implementation of computer network learning that has been going on so far in higher education.

2. Design

This stage is the process of solving problems found in the analysis phase to design a scenario or computer network learning model, activities in this process the researcher formulates a learning model that will be developed by developing the stages (syntax) of competency based learning, designing lecturer teaching guides (learning devices), and designing learning media in the form of WEB. At this stage the design is still conceptual and will underlie the next development process.

3. Development

Learning syntax, guide to teaching computer networks, module books, and WEB-based entrepreneurship learning media that have been designed at the design stage then at the development stage before conducting validation researchers conducted focus group discussions with mentors and experts totaling 5 people who aimed to discuss design that has been formulated beforehand to achieve the research objectives. After the researcher carried out the development of the model, teaching guide, module, and WEB-based learning media, the
researcher then validated the model book and learning device through the filling of validation instruments by experts.

4. Implementation
At this stage designs and methods have been implemented that have been developed in real situations, namely in the classroom. During implementation, the developed model design was applied to the actual conditions to determine the practicality and effectiveness of the Competency Based Learning learning model. This stage aims to test the competency based learning model developed in the S1-2018 Informatics Engineering Study Program at the University of Dharmas Indonesia. The researcher implemented all the validated research products 16 times.

5. Evaluation
Evaluation is a common thing that is done to see how far the model developed has produced predetermined goals, both before and after the implementation stage. This process has several main stages including; assess the quality of the development process, the quality of the product being developed, and then revise the Competency Based Learning learning model in accordance with the expected learning objectives.

Presentation of trial data consists of expert validity test data, practical tests by students and lecturers, effective testing of assignments, student learning outcomes, and success factors in applying computer network learning using competency based learning models. The following are presented data and analysis of data from the results of trials of learning models of competency based learning and learning devices on computer network courses.

3.2 Validity test of the CBL Model
Validation data was obtained from five experts, consisting of language experts, learning media experts and material experts. The experts assessed the research products consisting of learning models, modules, learning media, RPS and SAP on computer network courses. The validator was asked to provide an assessment and suggestions for improving the learning model and learning tools that had been designed. From all validated aspects in the model of competency based learning in the form of models, modules, learning media, RPS and SAP, the average rating of five validators was 0.86 with valid categories. Based on the value of validity obtained from the validator, it can be concluded that the product-based learning model developed is in accordance with the construction requirements of the learning model. It can be concluded that the product development model competency based learning with this competency based learning learning model is valid and can be used in computer network learning in higher education (Table1).

| Product       | Total Respondent | Average | Description |
|---------------|------------------|---------|-------------|
| Module        | 6                | 0.82    | Valid       |
| Media         | 6                | 0.86    | Valid       |
| RPS and SAP   | 6                | 0.86    | Valid       |

3.3 Practicality test of the CBL Model
The learning model of competency based learning developed includes the practical category. Practical testing is done to determine the suitability or implementation of learning devices used by lecturers and students. Practical data obtained from practical questionnaires by lecturers and students on the implementation of computer network learning. Lecturers and students were asked to provide assessments and suggestions for improvements to the use of modules, learning media, and RPS and SAP that were used in computer networking courses. The practicality questionnaire by lecturers was given to 6 lecturers. The practicality panel by students was given in 3 stages, namely in small groups of 3 people, medium groups as many as 6 people, and field tests were given to 24 students. Practical
testing of product development for students includes learning modules and learning media. Based on
the assessment of lecturers and students on the use of modules and learning media in computer
network courses, they are in the range of 80% to 95% with practical and very practical criteria. It can
be concluded that the product development of this competency based learning model, practically used
in computer network learning in higher education (Table 2).

| Product      | Total Respondent | Average | Description   |
|--------------|------------------|---------|---------------|
| Module       | 6                | 85.82   | Very practical|
| Media        | 6                | 90.04   | Very practical|
| RPS and SAP  | 6                | 90.25   | Very practical|

3.4 Effectivity test of the CBL Model

The effectiveness of competency based learning learning models is effective in improving student
learning outcomes and activities. Assessment of effectiveness is done through formative and
summative evaluation of the implementation of learning computer networks with a competency based
learning model. Formative evaluation is done by evaluating learning in each product-based learning
syntax. During one semester of implementation, researchers looked at the development of student
activities from each meeting and conducted an assessment of all activities carried out in each learning
syntax. Summative evaluation is carried out by evaluating students' cognitive learning outcomes,
namely the results of the Semester Final Examination (UAS) Computer Network course. This can be
seen from the data on student learning outcomes after and before using the learning model competency
based learning shows that there is an increase in student learning outcomes before using a learning
model with an average value of 58.54 with after using the competency based learning model with an
average value of 81.45.

For the results of the analysis of the overall observation sheet by computer network lecturers, it
was found that the achievement value of student activities was at a value of 65 with an average score
of student achievement of 82.42% and this was in the very active category. The design and
manufacture of competency based learning learning models on computer networks has gone through
the effectiveness test phase. The effectiveness test results state that the learning model of competency
based learning is effective.

3.5 Confirmatory Factor Analysis test of the CBL Model

From the results of the analysis of data processing above, it can be seen that the measurement model of
the determinants of success in applying the proposed competency based learning model has a p-value
= 0.49086> 0.05; RMSEA = 0.000 5 0.05; GFI = 0.90; AGFI = 0.83; CFI = 1.00; NFI = 0.90. In
addition, each indicator of each latent variable meets the requirements of loading factors above 0.50 so
that it can be accepted, the value of each loading factor is as follows: in the Mo1 learning model
variable: Syntax has a loading factor (0.72), Mo2: social system (0.92), Mo3: Reaction principle
(0.91), Mo4: Support systems (0.65), and Mo5: Instructional impacts and accommodation impacts
(0.78). CFA test analysis of Competency based learning models interprets that the model is fit (good
match).

4. Conclusion

Based on the results of the study, it can be concluded that this study has developed a learning model of
competency based learning which in the development process has gone through the stages of
validation, practicality and effectiveness. This learning model was developed for Computer Network
courses in the Dharmas University Indonesia Information System study program. The learning model
developed is an active learning model. This learning model is also equipped with supporting
components such as SAP, modules, lab worksheets and usage guidelines and model usage guidelines.
The learning model of competency based learning developed is included in the category of valid, practical and effective.

Recommendations for lecturers to be able to use this competency based learning learning model as an alternative learning model in computer network lectures. In learning computer network lecturers are expected to be able to direct students to be able to configure network equipment and overcome troubleshooting, which later can be adapted to developments in the cases faced.

Recommendations for students who use this competency based learning model in order to better explore their potential so that they are able to develop their skills, expertise and creativity, so that they can achieve the competencies desired in accordance with the learning outcome. Recommendations for future researchers so that competency based learning models can be tested on a larger number of trial subjects so that the use of competency based learning models is broader.

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