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DEVELOPMENT OF A MOODLE-BASED MODULAR LEARNING SYSTEM FOR NETWORK INFRASTRUCTURE ADMINISTRATION SUBJECTS IN CLASS XI COMPETENCE IN COMPUTER AND NETWORK ENGINEERING EXPERTISE

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ABSTRACT

This research aims to develop a Moodle-based modular learning system that can be used in teaching Network Infrastructure Administration subjects in class XI on Computer and Network Engineering expertise competencies. The main objective of the study is to improve the efficiency, flexibility, and quality of learning in these subjects of a technical and practical nature. This modular learning system is designed to provide an interactive learning experience tailored to student needs. The learning modules are structured in a structured manner, covering a wide range of topics relevant to network infrastructure administration. Each module is equipped with learning materials, practical assignments, and assessments to measure students' understanding and skills. The Moodle platform was chosen as the implementation base because of its flexibility in managing learning content, student-teacher interaction, and tracking learning progress. This system development methodology involves the stages of requirements analysis, module structure design, learning content development, integration with the Moodle platform, and testing and evaluation. Evaluation is carried out through internal and external trials involving teachers and students as participants. The results of this study are expected to prove the effectiveness of Moodle-based modular learning systems in improving students' understanding and skills in managing network infrastructure. It is hoped that this research will make a positive contribution to the teaching of technical subjects such as Network Infrastructure Administration. With the adoption of Moodle-based learning technology and modular approaches, it is expected that learning will become more adaptive, interactive, and by the latest developments in the field of network technology. This research can also be the basis for the development of similar systems in other subjects of high technical complexity.

INTRODUCTION

SMK (Vocational High School) is a type of secondary education in Indonesia that focuses on developing vocational skills. SMK aims to prepare learners to enter the workforce by equipping them with practical skills and knowledge in their chosen field. Its curriculum is

designed for more practical and practical than academic, focusing on developing technical skills and competencies. SMK is equivalent to high school in Indonesia and is a continuation of SMP (Junior High School) or MTs (Madrasah Tsanawiyah). The purpose of SMK is to produce competent and skilled graduates who are ready to enter the world of work or continue their education to a higher level (Gusnarib & Rosnawati, 2021).

SMK Negeri 1 Ketapang is one of the vocational high schools in Ketapang Regency and is the oldest vocational school. SMK Negeri 1 Ketapang has 10 majors. Among them is the Department of Computer and Network Engineering commonly known as TKJ. In this department, there are subjects, namely Network Infrastructure Administration, based on the Regulation of the Director General of Primary and Secondary Education of the Ministry of Education and Culture Number: 07 / D.D5 / KK / 2018 concerning the Curriculum Structure of Vocational High Schools (SMK) / Madrasah Aliyah Vocational (MAK) these subjects are included in group C3, namely the Expertise Competency group. Network Infrastructure Administration is carried out in grades 11 (eleven) and 12 (twelve). The ultimate goal of this subject is for learners to understand the configuration and analysis of network infrastructure.

Static Routing is one of the topics present in the Network Infrastructure Administration subject. This topic is given to grade 11 (eleven) students in even semester or semester 2. In some schools doing online learning (online) better known as learning at home due to outbreak conditions, then for the Computer and Network Engineering (TKJ) department from the beginning of entry, has been introduced to virtual classes and various technologies used as learning media. According to teachers in the TKJ department, this is done because almost all productive/vocational subjects require students to interact with the internet network (Indrawan, 2017). This is also what causes students of this department to be able to study anywhere even though they still have to go to school.

Almost all students have a device or laptop or even both. This is indeed recommended at the beginning of entering school. Because of the lack of existing facilities, laptops are devices that must be owned by students. Until using technology as a learning medium, there are no more obstacles in this department (Andriani, 2015).

In this department, learning is carried out face-to-face. For theory, it is carried out in class by prioritizing lectures and discussions. For practicum, it is carried out in the computer laboratory room where this department has a special laboratory, namely the TKJ laboratory. Practical activities are usually carried out using the PjBL or Project Based Learning method. This method focuses on the results in the form of products. To support product documentation, one of them is a practicum report (Suzana et al., 2021).

For assignment activities and providing additional material, teachers use online media such as virtual classes. Every teacher in this department has used Edmodo, Schoology, and Google Classroom as learning media and assignment collection. The emergence of several complaints from teachers and students, including the learning media used is not structured. If there are tasks that have not been done by students, students must first ask the subject teacher, making students still dependent on the teacher.

The weakness of teachers in this department is using many virtual classroom applications, the effect felt by students will waste a lot of space on device devices to make

learning unstructured. There are four types of platforms on the student side, namely Google Classroom, Edmodo, WhatsApp, and Google. The number of teachers who use Google Room is 3 people, 1 person uses Edmodo and 1 person uses a combination of WhatsApp and Google Classroom. The impact of the many virtual classroom applications used is the observation of teachers of Network Infrastructure Administration subjects based on the learning outcomes of students in the 2022/2023 semester 1 academic year, the results of students in class XI TKJ 1 and XI TKJ 2 as many as 15 people did not complete KKM (21%) from 72 students and 57 people completed KKM (79%) from 71 students. The KKM (Minimum Criteria Completeness) score in the Network Infrastructure Administration subject is 80. Based on an interview with the head of the ICT (Computer Technology and Information Technology) expertise study program, information was obtained that many students are still too lazy to read and understand the material presented in the form of files or video links because on the platform used students are not detected to have uploaded files or not (Widoyoko et al., 2022). This can be seen from the number of students who do not understand the material so teachers sometimes have to repeat the material. There have also been complaints about the difficulty of finding tasks on the platform. Because it is stacked with assignments given by the teacher. And the task or material presented does not seem to be in a special unit. So the teacher gives the material first and then sends the assignment. With the hope that students read the material first and then discuss it in class after that do the assignment.

According to (Rahdiyanta, 2016), the competency approach requires the use of modules in the implementation of learning. Modules can help schools in realizing quality learning. The application of modules can condition learning activities to be more well-planned, independent, complete, and with clear outputs. The use of modules will be able to help teachers in providing material and assignments because they are all in one unit so there is no more material or assignments missed by students (Pasaribu, 2022).

One component of learning is learning resources. Learning resources are tools or items that can be used to support the teaching and learning process, either directly or indirectly, in part or in whole (Rusydiyah et al., 2020).

A learning media is needed that can facilitate learning activities. Learning media is used in the framework of communication and interaction of teachers and students in the learning process. Learning media has a non-physical understanding known as software, namely the content of messages contained in hardware which is the content to be conveyed to students in the learning process, both inside and outside the classroom (Dharmawan et al., 2021). The world of education is currently in the digital era, where there will be many applications to support learning. Similarly, teachers and students will inevitably always intersect with the digital world. Digital learning media is learning media that works with digital data or can produce a digital image that can be processed, accessed, and distributed using digital devices Examples of digital devices that are most often encountered are computers, tablets, smartphones, digital cameras, digital clocks, and TVs (Coal, 2021).

The digital learning media used by teachers of Network Infrastructure Administration subjects in the form of virtual classes is Google Classroom. Some students complain if they forget their previous passwords and emails. Until resulting in the loss of material data and

tasks. Some complain that it is difficult to find or recognize which tasks have not been collected. For students' grades, it is difficult to see the total or calculation of the overall grade or final grade of the subject (Sumartini et al., 2022). Meanwhile, teachers complained that they often had to redistribute links on social media such as WhatsApp so that students immediately did assignments or exams.

From the complaints of students and teachers, it is concluded that the application of learning media is not systematic to make students not independent in the learning process (Susanti & Hamzah, 2020). Modular Instruction is a means of a learning process in a certain discussion that is arranged systematically, containing learning materials, methods, learning objectives based on basic competencies or indicators, and instructions for independent learning activities, used by students through exercises presented in Modular Instruction so that the Modular Instruction is packaged in a whole unit to achieve certain competencies (Fitri & Ningsih, 2019). TKJ majors use a blended face-to-face and online learning system. Where compulsory learning is face-to-face and in the network used to share material, assignments, and assessments only (Dwiyogo, 2018).

Based on the above problems, researchers want to develop web-based learning media commonly known as e-learning. This e-learning will manage learning so that it is systematic and able to provide feedback to students. Products are very likely to be developed because e-learning applications are currently very developed. For this reason, the researcher wants to raise the research title "Development of Moodle-Based Modular Learning Systems for Network Infrastructure Administration Subjects in Class XI Computer and Network Engineering Expertise Competencies", with the hope that students will be excited, like, and can help them in the ease of obtaining learning resources and learning difficulties of material containing practice or practicum (Junaidi, 2010).

The purpose of this study is to determine the effectiveness of the Moodle-based modular learning system for network infrastructure administration subjects in class XI computer and network engineering expertise competencies developed. The benefits of research are expected to increase insight and knowledge in training skills as prospective educators and can improve the skills of researchers in the development of a Moodle-based modular learning system for network infrastructure administration subjects in class XI Computer and network engineering expertise competencies for the learning process (Lolombulan, 2017).

application of Moodle-based modular learning approach in Network Administration subjects, which combines e-learning technology with Computer and network Engineering expertise competency curriculum at the Vocational High School (SMK) level. This approach aims to improve learning efficiency, and student interactivity, and provide a more structured and adaptive learning experience according to individual needs in mastering technical competencies in the world of computer networks. Thus, this research contributes significantly to the development of learning models that are innovative and relevant to the development of information technology and industrial needs.

METHOD RESEARCH

This research uses the Research and Development (R&D) method. According to Richey and Kelin (2010) in (Sugiyono, 2010), the field of learning states that this research is now

called Design and Development Research. Previously called developmental research. Design and Development Research is, "the systematic study of design, development, and evaluation processes to establish an empirical basis for the creation of instructional and noninstructional product and tool and new or enhanced model that govern their development" (Gustafson & Kent, 1997). Design and development research is a systematic study of how to design a product, develop/produce the design, and evaluate the performance of the product, to obtain empirical data that can be used as a basis for making products, tools, and models that can be used in learning or non-learning (Mering, 2020).

The Development Design model used is the ADDIE model. According to (Branch, 2009) in Instructional Design: The ADDIE Approach ADDIE is a product development concept. The ADDIE concept is being applied here for constructing performance-based learning. The educational philosophy for this application of ADDIE is that intentional learning should be student-centered, innovative, authentic, and inspirational (Darmawan et al., 2021). The concept of systematic product development has existed since the formation of social communities. Creating products using an ADDIE process remains one of today's most effective tools. ... Translatable ADDIE is a product development concept. The concept of ADDIE is applied here to build performance-based learning (Huang et al., 2019). The educational philosophy for the implementation of this ADDIE is that intentional learning should be learner-centered, innovative, authentic, and inspiring (Djamaluddin, n.d.). The concept of systematic product development has existed since the formation of social communities. Creating products using the ADDIE process remains one of the most effective tools today. The ADDIE learning system design model consists of five steps that need to be done by learning program designers and developers, namely: (1) Analysis; (2) Design; (3) Development; (4) Implementation; and (5) Evaluation (Mering, 2020).

Research Population: This study population consists of grade XI students who follow Network Infrastructure Administration subjects in Computer and Network Engineering expertise programs at vocational high schools (SMK) or equivalent educational institutions. This population includes all students who meet these criteria in the various schools or educational institutions that host the skill program

Research Sample: This research sample will be randomly selected from several schools or educational institutions that organize Computer and Network Engineering expertise programs. The sample will consist of several class XI students participating in the study. The sample size will be determined based on sufficient statistical analysis to produce representative results.

In addition, additional samples such as teachers teaching Network Infrastructure Administration subjects and Moodle administrators involved in system development may also be included in the study to gain their views regarding the implementation of Moodle-based modular learning systems.

With a representative sample of Moodle students, teachers, and administrators, this research is expected to provide a comprehensive understanding of the development of Moodle-based modular learning systems for Network Infrastructure Administration subjects in class XI of Computer and Network Engineering expertise programs.

RESULTS AND DISCUSSION

Moodle-Based Modular Learning System Development Design

The use of the ADDIE design model ((Analyze, Design, Develop, Implement, and Evaluate) at this stage aims to design a Moodle-based modular learning system so that it is suitable for use and utilization by students and majors and can even be utilized by schools (Plotnick, 1997). The stages carried out by the design model procedure are described as follows:

Analysis Phase

Collecting information and data can be said to be the initial identification stage of the existing problem. Several studies and observations were made at this stage.

a. Curriculum Review

There are 2 curricula used by SMK Negeri 1 Ketapang, namely the revised 2013 Curriculum and the Independent Curriculum. The 2013 curriculum is used by grade XI and XII students while grade X students use the independent curriculum. So the curriculum used by class XII students majoring in computer and network engineering is the revised 2013 curriculum.

The 2013 curriculum is competency-based. According to (Shafa, 2014) the character of the goals or competencies of graduates is packaged in the form of integration by emphasizing character education, learning characters that emphasize a scientific approach, and more detailed assessment characters by emphasizing process assessment.

In the 2013 curriculum document, network infrastructure administration subjects have 17 basic competencies for knowledge and 17 basic competencies for skills. The seventeen competencies are implemented in classes XI and XII. For class XI there are 7 (seven) competencies for knowledge and 7 (seven) competencies for skills. These seven competencies are implemented within two semesters. In even semesters there are basic competencies to evaluate static routing (3.4) and configure static routing (4.4). Which is part of the title of the study. Of the many basic competencies that exist, the topic of static routing was chosen by subject teachers as one of the sample topics in network infrastructure administration subjects. This topic will also represent other topics in the curriculum.

The time allocation for network infrastructure administration subjects each week is 6 lesson hours. Where 1 (one) lesson hour equals 45 minutes. The allocation of time is highly considered sufficient to carry out learning activities in theory/knowledge and practice/skills. The Minimum Completeness Criteria abbreviated as KKM in the department is 80.

b. Literature Review

From the observations made, several problems exist in the computer and network engineering department. The problem is obtained from the results of interviews with the students and the teacher.

Students stated that they often have to contact teachers to ask about assignments or grades that have not been completed by KKM. This is because students are confused about which tasks have not been completed or have not been done. Sometimes old teachers give

responses to many who have incomplete grades in the results of assessment reports/report cards. This means it must be completed in the next semester. Some complain that they have to install more than one application/platform for learning media. This is burdensome in terms of students because it drains a lot of students' device storage media. And it will make learners confused in looking for assignments. This is considered impractical by learners.

Even the teacher, must make special communication with students who have not submitted assignments. Obstacles are sometimes difficult to contact these students. Teachers have felt that they are doing the maximum by making virtual classes one of the learning media. It was found that there are more than two platforms used by teachers in the department, namely Google Classroom, Edmodo, and a combination of WhatsApp and Google.

It can be concluded that the problem in the department is that classroom management and the learning system used in the media are not by the applicable curriculum. Competency-based curriculum requires students to complete each basic competency even though each student's time is different. The completeness of student competence can be achieved if the learning media platform used supports the learning system.

c. Relevant Research Studies

Research by Pandu Joyo Sampurno, Rizky Maulidiyah, Hidayah Zuliana Puspitaningrum, University of Jember in 2013 entitled Curriculum Implementation 2013: MOODLE (Modular Object-Oriented Dynamic Learning Environment) in Learning Physics through Student Worksheets on Optical Materials in High School. The research was conducted by students of grade X semester 2 SMAN 4 Jember. The validation results also show a good picture of LKS products. Each LKS has a preliminary task and a fundamental task. The LKS menu consists of a homepage, introduction, LKS, evaluation, download, chat, and discussion forum. The use of ICT-based physics LKS with LMS Moodle in the learning of grade X semester 2 students is practical, which is indicated by the average value of practicality of students. In addition, the use of ICT-based Physics LKS with LMS Moodle is considered effective in improving learning outcomes and fostering noble character values of grade X semester 2 students.

Research by Siti Nurjannah Iswandari, Jimmi Copriady, Asmadi M Noer, and Sri Wilda Alberta, entitled Development of Moodle-based e-modules on Hydrocarbon material, E-modules with the Moodle application has several advantages, learning is more interesting and can be done remotely where educators can still control learning activities, assessments and provide badges for students who succeed in becoming the best, there are discussion forums, quizzes and CBT-based exercises as well as a feedback page and has a security feature limiting access rights where unregistered users cannot open e-modules. The results showed that the Moodle-based e-module developed met very valid criteria from aspects of visual communication, learning design, content, and ease of use with a score of 90.23% in terms of material and 95.67% in terms of media. The results of the student and teacher response tests obtained scores of 91.67% and 93.45% respectively.

Kuatna Muchsin Nugroho's thesis entitled Development of Chemistry E-Module Based on Problem-Solving Using Moodle on Salt Hydrolysis Material for Class XI Senior

High School / Ma Semester II, 2015. The results showed: that the development of Problem Solving-based chemistry e-modules has been carried out through R&D procedures consisting of 9 stages: (2) the feasibility of qualified Problem Solving-based chemistry e-modules "is very feasible for material aspects with a phase percentage of 93.33% and media with a percentage of 92.22% according to experts; (3) the use of Problem Solving-based chemistry e-modules in learning showed a very very significant difference between the control class and the experimental class, with a sig level of 0.05 for both SMAN 2 Surakarta and SMAN Mojogedang (Junaidi, 2010).

Research by Komang Wisnu Baskara Putra, I Made Agus Wirawan, Gede Aditra Pradnyana entitled Development of E-Modules Based on Discovery Learning Learning Models on the subject "Computer System" for Class X Multimedia Students of Smk Negeri 3 Singaraja, in 2017. The results showed that (1) the results of the design and implementation of electronic modules based on discovery learning models developed in Information Systems subjects for class X Multimedia at SMK Negeri 3 Singaraja have been declared successfully implemented based on several trials conducted. (2) The results of the analysis of teacher response data show that the average score of responses is 41 and if converted into the classification table of responses is included in the positive category. As for the response of students to the development of electronic forms, an average score of 64.74 was obtained and after being converted into a classification table, student responses were included in the positive category.

Based on the results of relevant research, it can be concluded that the development of a Moodle-based modular learning system can increase learning interest and learning outcomes.

d. D.Student Character Analysis

The age range of class XI Computer and Network Engineering learners is between 15 and 18 years and belongs to adolescence. Adolescence is the age group of 10-19 years. The three stages of adolescence are early adolescence (11-14 years), middle adolescence (14-17 years) and late adolescence (17-20 years). Middle and late adolescents can look at problems comprehensively. According to (Sudjimat et al., 2021) Adolescents at the age of 15-18 years experience many changes cognitively, emotionally more sensitive, more complex ways of thinking, and often spend time with their friends. Learners are mostly adolescents who have characteristics, needs, and developmental tasks that must be met.

Class XI consists of 2 rumbles and has a total of 72 students. The number of students who have devices is 72 people or 100% and 70% have laptops or portable computers. The ability to use virtual classroom applications or network-based applications is 90%. There is a special internet network for majors. Not sharing with other majors. Gadgets/smartphones and laptops/laptops are allowed to be used while learning. With existing rules, it is used properly as a means of learning.

e. Media Analysis

The media analyzed here is e-learning-based learning media used by teachers. There are more than two mediums used by teachers.

The use of Google Classroom is used for the reason that it has a moderate level of convenience, is a large platform with a large range of supporting applications, and many tutorials on how to use it on YouTube. While the weakness felt by teachers is that it is difficult to display grades as a whole, if possible, they must have special abilities in the Google Sheets application. And it could be that learners don't understand in the sense of reading information on a Google sheet. Classroom management in assignments and materials is also a problem, teachers have distributed assignments and materials some students still ask repeated questions. Until it causes materials and tasks to also be repeatedly shared. The difficulty of carrying out discussion activities. Because there is no this feature. The use of the scheduling feature is still considered not to help the completeness of competence.

Edmodo is only used by one teacher because parents of students are given the ability to see the progress of their children. But in reality, this feature is not utilized optimally. This is because the level of education of parents is at the basic education level only. Because teachers feel that they are used to using this platform, teachers continue to use this platform by not utilizing parental features. The platform is not pocket-friendly according to learners and has poor connections.

The use of a combination of learning platforms WhatsApp and Google Forms is used by teachers because they do not want to be bothered with making virtual classes. So material in the form of doc or pdf files is shared in WhatsApp class groups and assignments or tests are shared in the form of links from Google Forms. However, difficulties will occur when there are students who request the assignment link again.

Seeing the various problems above, it is necessary to find a platform that can overcome problems with teachers. With the hope that the platform that will be used will solve the anxiety about the large accumulation of students who have not completed the competence.

Based on the media analysis above, a learning management-based platform commonly called the Learning Management System (LMS) will answer all the shortcomings felt by teachers. One of the platforms used is Moodle. According to (Sulistyorini & Anistyasari, 2020) Moodle is one of the LMS (Learning Management Systems) that is open source and free. Apart from being an LMS, Moodle is also a CMS (Course Management System) and VLE (Virtual Learning Environment) designed to support face-to-face learning online, as well as provide a place to upload learning resources. A platform for creating dynamic and learning-enabled online teaching sites where users can also build their subsystems within their LMS. Because users can build their subsystems, the implementation of modular learning systems will be easier to build on this platform.

f. Planning Phase (Design)

This planning stage begins with determining server specifications, applications, and department capabilities. For servers, majors agreed to prefer to be installed in the cloud. Because the department does not have a server device or a room. Also, experts in the field of server administration cannot be considered capable.

Cloud servers will be installed by CPanel to ease the burden on teachers in managing LMS. The CPanel and Moodle platform specifications are shown in Table 1 below:

Table 1
Cloud Server Specifications

Server CPanel	
cPanel Version	110.0 (build 7)
Apache Version	2.4.57
Architecture	x86_64
Operating System	Linux
Physical Memory	1 GB

g. Development Stage

The development stage is the stage where Moodle is installed and user rights are set for students, teachers, and admins. Moodle by default provides seven levels of users (actors) to reduce the level of administrator involvement. The seven levels of users (actors) include Administrator, Course Creator, Teacher, Non-editing teacher, Student, Guest, and Authenticated User. Teachers and students can join and participate in full activities in the LMS through access that has been given by the LMS managing manager (administrator) (Sulistyorini & Anistyasari, 2020).

Classroom management is organized according to the standard of the curriculum. Each basic Competency is made into a module until a Moodle-based modular learning system can be realized.

The stage ends with the realization of the initial product. To proceed to the expert validation stage, individual trials, small group trials, and field trials, the results obtained from this stage become the profile of the product developed.

h. Implementation Stage

At the implementation stage, the activities carried out are preparing the teacher and students (prepare the student). To make teachers and learners ready to use the final product.

Preparation for teacher training is to draw up a schedule and activity plan for the teacher. Teacher training is carried out for 2 (two), it should be carried out for 1 (one) day only but the research activity coincides with the Expertise Competency Test activity and preparation for the Final School Examination of the semester, so the activity cannot be carried out in full during working hours. On the first day, April 28, 2023, activities can be carried out from 12 (twelve) to 16 (sixteen). On the second day, April 29, 2023, the activity will be held starting at 10 (ten). Scheduling is done by first discussing the free time of the department teachers, avoiding anyone being unable to attend the training. This is due to the tight schedule of school activities.

Preparation of student training, It is easier to arrange schedules and implementation of activities. There are 2 (two) basic competencies used, namely evaluating static routing (3.4) and configuring static routing (4.4). Activities in the form of delivering theoretical material to obtain knowledge values end with giving formative tests. The next activity is the delivery of practical materials to obtain skill values, ending with making reports and

collecting them through the LMS. All grades obtained will be posttest grades and pretest scores taken from semester one / odd grades on different topics with treatment before using a Moodle-based modular learning system.

i. Evaluation Stage

The final stage of ADDIE is the evaluation, the purpose of this activity is to assess the quality of the product and the instructional process, both before and after implementation. Based on the results of questionnaires from media experts, material experts, and students, it can be concluded that the development of a Moodle-based modular learning system is declared feasible for use.

In the evaluation stage, what is commonly done is to determine evaluation criteria, choose evaluation tools, and conduct evaluations (Branch, 2009). Because the product has been declared suitable for use, the evaluation stage needs to be continued by determining the evaluation criteria, choosing tools, and conducting evaluations.

Development Profile of Moodle-Based Modular Learning System

From the stages carried out in the research, a profile of the development of a Moodle-based modular learning system can be compiled. The research entitled Development of Moodle-based Modular Learning Systems for Network Infrastructure Administration Subjects in Class XI Computer and Network Engineering Expertise Competencies has the aim of overcoming problems felt by teachers and students, namely getting the right learning system and by the 2013 curriculum and learning platforms that support the learning system.

The research method used in this research is Research and Development (RnD). Is a research method to develop and test products that will later be developed in the world of education. By using the ADDIE (Analysis Design Develop Implement Evaluation) research model.

The research was conducted at SMK Negeri 1 Ketapang on the competence of Computer and Network Engineering (TKJ) expertise. Respondents were taken from class XI (eleven) students with a total of 72 (seventy-two) people. Held from March to May 2023.

The results of this study can help classroom management in teachers and increase interest in learning and learning outcomes of students. From the results of trials conducted in the initial trial, namely expert validation of the material, the average result was 4.59 in Table 3.3, included in the very valid category (Gasong, 2018). The average result of design experts is 4.40 in Table 3.3, falling into the very valid category. Furthermore, the expert average result of 4.47 in Table 3.3, falls into the very valid category. From the average results of validation, three experts show that the product of developing a Moodle-based modular learning system is very valid or can be used by the intended teacher or student as a research respondent.

Trials are conducted on students to get responses and revisions to the product so that it becomes suitable for use. From individual trials, an average result of 3.30 was obtained, which in Table 3.4, was included in the category of very happy. The small group trial obtained an average result of 3.40 included in the category of very happy. Furthermore, field trials got an average result of 3.57. This value falls into the category of very happy. It can be concluded that from the three trials, all three are included in the very happy category, which means that

students are happy with the initial product of developing a Moodle-based modular learning system because it increases interest in learning, spurs curiosity, and improves learning outcomes.

The Effectiveness of Moodle-Based Modular Learning System Development

Research effectiveness is the extent to which research plans or objectives or the use of research tools have been achieved. There are 3 independent variables to measure the effectiveness of using models in research, namely planning, implementation, and evaluation.

a) Learning Outcomes

Learning outcomes are known by comparing pretest and posttest scores. Pretest scores are obtained from odd semester grades of network infrastructure administration subjects from different topics, but under conditions that have not used a Moodle-based modular learning system. Posttest grades are even semester grades of network infrastructure administration subjects with topics by the title and have received treatment as users of the final product. The value here is the final value obtained from the value of knowledge and skill value. With calculations according to the applicable provisions at SMK Negeri 1 Ketapang (Prawiradilaga, 2016).

Based on Table 1, there is an average increase between pretest and posttest scores. From a pretest score of 80.77 to a posttest score of 91.91, there is a difference of 11.14. Which means there is a real (significant) improvement in learning outcomes.

The normality test results on the pretest and posttest are shown in Table 4.23, the pretest has a sig value. 0.155 and posttest with SIG value. 0.367. Since the values of both tests are> 0.05, it can be concluded that the data are normally distributed. The normality test uses Shapiro Wilk because the processed data is less than 50 (Razali & Wah, 2011).

The normality test is declared normally distributed, so it can be continued to perform the T-test for two paired samples or paired sample T-test. Using paired sample T-test because the sample has the same subject but undergoes two different treatments (Priyastama, 2017). The results of the paired sample T-test are used to see whether the hypothesis made is acceptable or not. Based on the calculation results with the SPSS application, the value of Sig. (2-tailed) is 0.000. Furthermore, the value of tcalculate = 6.378 and ttabel = 2.045, means tcalculate > ttable. From these two calculations, it can be concluded that H0 is rejected and Ha is accepted, which means that there is an influence on the use of Moodle-based modular learning systems.

The result of the effect size calculation obtained a value of 2.78, based on 4.24 the value is included in the strong effect interpretation. Which means the product has a strong influence on the learning outcomes of learners.

b) Student Response

The results of student responses obtained an average value for affective aspects of 3.58 and psychomotor aspects of 3.56, where the overall average was 3.57. This result, when interpreted in Table 3.4, is included in the category of very happy. This means students are very happy with the use of a Moodle-based modular learning system because it can motivate interest in learning to improve learning outcomes.

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