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TRAINING ON E-MODULE COMPILATION BASED ON PjBL WITH A STEM APPROACH TO DEVELOP THE NUMERACY LITERACY ABILITY OF MATHEMATICS TEACHERS IN DONGGALA DISTRICT

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Abstract

E-modules or electronic modules are non-printing digital modules that are developed with special computer-assisted applications, and multimedia elements are provided to make them more attractive and interactive. To make the module more interesting, teachers also need innovation in developing modules, namely modules based on approaches, methods or models. One that can be developed is combining the PjBL learning model with the STEM approach. The combination of the application of the STEM approach with the project-based learning (PjBL) learning model can encourage cooperation between educational institutions and industry. The PjBL model emphasizes project-based learning with a STEM approach that requires integration between natural science, technology, engineering, and mathematics. The combination can develop critical, creative, and collaborative thinking skills in their students. However, the reality in the field based on interviews with the head of the Donggala district mathematics MGMP, there is no e-module for mathematics learning based on PjBL with a STEM approach for teachers and students in Donggala Regency. Teachers who are members of the Mathematics Subject Teacher Conference (MGMP) as partners of this service are still experiencing problems in making modules / e-modules that are interestingly interactive and link them to learning approaches and models. These problems are caused by various factors, including members of the Donggala district mathematics MGMP who do not understand: 1) the principles of interesting and interactive e-module design, 2) techniques for making PjBL-based e-modules with a STEM approach, 3) techniques for designing and implementing effective project-based learning (PjBL) and combining science, technology, engineering, and mathematics in chemistry learning (STEM). The solution offered to overcome the partner's problems is to provide workshops/training: 1) the principles of attractive and interactive e-module design, 2) making PjBL-based e-modules with a STEM approach, 3) how to analyze and interpret mathematics materials related to project-based learning (PjBL, as well as analysis of mathematics materials related to science, technology, engineering, and mathematics and their incorporation techniques in mathematics learning (STEM) The purpose of this service activity is to overcome partner problems in compiling and developing PjBL-based e-modules with a STEM approach so as to improve the numeracy-literacy skills of teachers who are members of

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the Donggala district mathematics MGMP. The outputs that have been achieved are that the members of the partner group have made PjBl-based e-modules with a STEM approach so that there is an increase in their numeracy literacy skills and publish the e-modules and process them into the form of PjBl-based books / modules with a STEM approach that has an ISBN and HaKi.
Keywords: E-Module, Math Teacher, Numeracy Literacy, STEM, PjBL

INTRODUCTION

The Donggala District Mathematics Teacher Council (MGMP), based on DKG data, has a group membership of around 30 teachers. Members come from 17 public and private schools namely SMAN 1 Banawa, SMAN 1 Sindue, SMAN 1 Sirenja, SMAN 1 Balaesang, SMAN 2 Balaesang, SMAN 3 Balaesang, SMAN 1 Dampelas, SMAN 2 Dampelas, SMAN 1 Sojol, SMAN 2 Sojol, SMAN 1 Rio Pakava, SMAS Nasional Wani, SMAN 1 Banawa Tengah, SMAN 1 Sindue Tombusabora, SMAN 1 Sindue Tobata, SMAN 1 Balaesang Tanjung, SMAS YPTB Ketong. The group of mathematics teachers spread across these schools were less active in participating in MGMP. The percentage of attendance that participated in MGMP was only about 35%.

The material discussed in MGMP is still limited to learning tools (preparation of lesson plans), learning evaluation and class action research (Figure 1). Therefore, there are still many essential problems needed in schools that have not been revealed in MGMP which is no less important is the role of technology in improving the quality of learning, such as the use of models, approaches and interactive learning media [1]. Mathematics teachers are required to be able to develop their ability to use technology to create more interesting and relevant learning experiences for students, such as the use of appropriate learning models and media.

Figure 1 One of the implementation of MGMP Mathematics activities in Donggala Regency

Interactive learning media that can be used can be in the form of electronic modules (e-modules). E-modules are electronic versions of modules, where access and use are done through electronic devices such as computers, laptops, tablets, or even smartphones [2]. The advantage of e-modules from printed teaching materials is that e-modules are complete with interactive media such as video, audio, animation and other interactive features that can be played and replayed by students when using e-modules. E-modules are considered innovative because they can display teaching materials that are complete, interesting, interactive, and carry a good

cognitive function. Modules are used for facilitate students to understand the material presented independently or through educator guidance with interesting module material content [3].

To make the module more interesting, teachers also need innovation in developing modules, namely modules based on approaches, methods or models. Problems related to the popular and widely implemented 21st century learning models, including the Project Based Learning (PjBL) learning model, Inquiry Based Learning (IBL), and the one that is currently being widely published is the STEM-PjBL approach [4]. STEM is an acronym for science, technology, engineering, and mathematics [5]. The combination of the application of the STEM approach with the project based learning (PjBL) learning model can encourage cooperation between educational institutions and industry. The PjBL model emphasizes project-based learning with a STEM approach that demands integration between natural sciences, technology, engineering, and mathematics. This combination can develop critical, creative, and collaborative thinking skills in their students.

However, the reality in the field based on an interview with the head of the Donggala district mathematics MGMP, there is no PjBL-based mathematics learning e-module with a STEM approach for teachers and students in Donggala Regency. This is because many teachers still do not have adequate skills in 1) the principles and design of interesting and interactive e-modules and the applications/software used in: making e-modules, 2) the implementation of effective Project Based Learning (PjBL) in accordance with the curriculum, 3). The STEM approach, which combines science, technology, engineering, and mathematics in learning.

Based on the description that has been presented, it can be concluded that the ability of teachers, especially those who are members of the Donggala Regency Mathematics MGMP in compiling e-modules based on PjBL with a STEM approach still needs to be improved. Therefore, in an effort to help teachers improve their understanding of making these e-modules, training needs to be held for teachers. The service team was inspired to carry out a community service activity, entitled "Training on Compiling e-modules based on PjBL with a STEM approach to Develop Numeracy Literacy Skills of Mathematics Teachers in Donggala Regency". Through this training, it is hoped that mathematics teachers in Donggala Regency can respond to the challenges of the times by utilizing technology optimally in the learning process. Thus, this training will provide a positive contribution to improving the quality of education in Donggala Regency and preparing the younger generation to face the increasingly complex demands of the future.

METHOD

Approach method

The approach methods offered to solve partner problems are: 1) Presentation of materials related to the principles of interesting and interactive e-module design. 2). Presentation of materials related to the analysis and interpretation of mathematical materials related to project-based learning, 3) Presentation of materials related to the analysis of mathematical materials related to science, technology, engineering, and mathematics and their integration techniques in mathematics learning (STEM), 4) Discussion and Q&A related to the material of the principles of interesting and interactive e-module design, PjBL and STEM, 5) Providing

training and practice in compiling e-modules based on PjBL with a STEM approach, making a question bank book with an ISBN that can be used by partners in their respective schools. 6) Providing assistance to ensure that the materials presented to partners can be implemented properly so that the results obtained can achieve the target, namely partner teachers can create e-modules based on PjBL with a STEM approach.

Implementation of Activities

The community service program for MGMP Mathematics partners was implemented at SMAN 1 Sirenja, a school that is easily accessible to all activity participants. The stages of implementation of the activities carried out were: a) Socialization was carried out with related agencies, the head of the Donggala Regency Mathematics MGMP, the principal and the Donggala Regency Education Office, b). Training/workshops, practice and mentoring which include, delivery of materials and discussions on: 1) Development of Digital Literacy, e-module Design, Interpretation of Mathematics Materials based on PjBL-STEM and Techniques for compiling e-modules based on PjBL-STEM and group division. The activities were carried out interactively through face-to-face meetings, sessions were divided into material delivery followed by discussions in the form of feedback in the process of achieving knowledge according to the objectives of PkM. Activities at this stage are expected to provide benefits to partners, namely an increase in partner pedagogical-math through digital literacy and increased partner insight in designing PjBL-STEM digital literacy-based mathematics e-modules. 2) implementing the practice of compiling PjBL-based e-modules with a STEM approach in digital applications. The expected benefits at this stage are an increase in partner insight in compiling e-modules based on digital literacy. 3) Mentoring the digital integration process of e-modules (canva-flipbook), Making PjBL-STEM e-modules (grade X-XII material). At this stage, it becomes input in achieving the objectives of implementing PkM, partners as targets in PKM activities must have the ability and strategy in compiling modules/e-modules, but if there are weaknesses in the pedagogical-math process and digital literacy, the PkM Team will provide assistance in the process and then assist in making modules. e-modules for grade X-XII material (PjBL-based e-module with a STEM approach).

RESULTS OF PKM IMPLEMENTATION

Implementation of training

The implementation of community service begins with socialization with related agencies, MGMP Mathematics Donggala Regency. This socialization aims to provide information to related agencies regarding community service and so that participants know the purpose of implementing the program by the implementing team so that there is no misinformation. Furthermore, after the delivery of the comprehensive program plan, it is continued with the provision of training related to the theme of community service, namely: Training on the Preparation of e-modules based on PjBl with a STEM approach to Develop Numeracy Literacy Skills of Mathematics Teachers in Donggala Regency.

The training was held at SMAN 1 Sirenja. In the implementation of the training (Figure 2), the participants involved were members of the Donggala Regency Mathematics MGMP.

The number of participants who took part in this training was 30 people.

The training materials include: Principles of designing attractive and interactive e-modules, Analysis and Interpretation Techniques for PjPL-based mathematics materials with a STEM approach, Techniques for making modules/e-modules based on PjBL with a STEM approach and Copyright Creation Techniques (HaKi) and practicing directly and to provide direct experience in compiling modules/e-modules for chemistry materials for grades 10 to 12 and assistance in making modules/e-modules based on PjBL with a STEM approach for Chemistry materials for grades X - XII.

STEM-based learning is a learning approach that emphasizes the relationship between knowledge and skills in science, technology, engineering, and mathematics (STEM) by focusing the education process on solving real problems in everyday life. The purpose of STEM-based learning is so that students' understanding and knowledge of the STEM approach can increase, so that they can be used to solve problems and make decisions for human progress. STEM-based learning is important to implement in the teaching and learning process because it has several advantages, including: (1) Can prepare the next generation who are ready to face the development of the times, (2) Help develop innovation in life, (3) Increase student interest in professions in the fields of science, technology, engineering, and mathematics (STEM), (4) Make learning more in line with life, (5) Help students to build self-concept actively, and (6) Increase student literacy regarding STEM.

STEM-based learning can also be linked to the need to develop 21st century skills for students, namely critical thinking, creativity, collaboration, and communication skills. In line with this, STEM-based learning also requires students to identify a problem, create something to solve the problem, collaborate with classmates to solve problems, and communicate effectively and respond to each other's ideas. To implement STEM-based learning, students are encouraged to find systematic and repetitive ways to design objects, processes, and systems to meet human needs and desires (engineering).

The engineering element in the STEM approach can start from a problem, need, or desire with measurable criteria which are then tested to identify constraints or limitations. The innovation development activities can be carried out in the classroom by adopting a series of processes used by engineers in creating a particular product or technology to meet the established criteria.

Figure 2 Implementation of PjBL-based Module/e-module Creation Training with a STEM approach

The project based learning (PjBL) learning model aims to focus students on complex problems needed to understand lessons through investigation. This model guides students in a collaborative project that integrates as a subject (material) of the curriculum, provides opportunities for students to explore content (material) using various meaningful ways for themselves, and conduct experiments collaboratively. The model uses problems as the first step in collecting and integrating new knowledge based on experience and real activities [6, 7].

The project based learning (PjBL) learning model has benefits, namely students become more active in solving problems, gaining new knowledge and skills, practicing collaboration or group work, and giving students the opportunity to organize projects. Project organization is done by students creating a framework to solve a predetermined problem. Then students design the work process starting from finding and managing information, carrying out the project process to evaluating the results of the work.

Practical Work on Compiling Teaching Materials.

The practice of compiling modules/e-modules based on PjBL with a STEM approach, participants are divided into 3 groups, namely: class X material group, class XI material group and class XII material, with each group accompanied by a community service implementation team and field workers (Figure 3). The activities carried out in the practical work are that participants are guided/accompanied starting from identifying the material to be made into modules/e-modules based on PjBL with a STEM approach, module/e-module creation techniques, so that the desired community service goals can be achieved. Furthermore, they are guided to create modules based on the material/topic. All of these activities are carried out in such a way as to make it easier for training participants to do this continuously. Steps in the project based learning (PjBL) learning model combined with the STEM approach :

1) Refleksi (Reflection)

The goal of the first stage is to bring students into the context of the problem and provide inspiration for things that students can investigate [8]. This phase is also intended to connect what is known with what needs to be learned. [9].

2) Research (Riset)

The second stage of PjBL-STEM learning is the process of student research. The teacher facilitates students to choose relevant readings, or other methods to collect relevant information [8]. In this learning process, students develop from concrete to abstract understanding of the problem [9]. During the research phase, the teacher leads a discussion to determine whether students are developing an appropriate conceptual understanding of the project and relevant concepts. [10].

3) Discovery (Penemuan)

The third stage of PjBL-STEM learning is discovery. The process in this stage bridges the research and information that is known with the needs of the project. This step is when students begin to take control of the learning process and determine what is still unknown [10].

Some STEM project approach models break students into small work groups to present possible solutions to problems, to collaborate with fellow students [8]. Other models use this step to develop students' ability to reflect on the “habits of mind” that the process is designed to build. [9].

4) Application

In the fourth stage of PjBL-STEM learning is implementation. The purpose of implementation or application is to model a solution that is sufficient to solve the problem. In some cases, students test the model against the requirements, the results of which lead students to repeat the previous steps [9]. In other models, this stage extends learning to contexts outside the STEM approach. [10].

5) Application

The fifth stage of PjBL-STEM learning is communication. This stage is an important step in the learning process because of the desire to develop communication and collaboration skills and the ability to receive and apply constructive feedback [9]. Often, reviewers assess authentic assessments (rubrics) based on the completion of this last step [10]. E-modules or electronic modules are non-printed digital modules that are developed with special

applications assisted by computers, and are given multimedia elements to be more interesting and interactive. E-modules are also called media for independent learning because they are equipped with instructions for self-study. E-modules can be filled with material in the form of pdf, videos and animations that can make users learn actively.

The characteristics of e-modules are not much different from printed modules. According to Anwar & Ilham [11] the characteristics of e-modules are: 1) Self-instructional, students are able to learn by themselves, not depending on other parties. 2) Self-contained, all learning materials from one competency unit studied are contained in one complete module. 3) Stand alone, the module developed does not depend on other media or does not have to be used together with other media. 4) Adaptive, the module should have high adaptive power to the development of science and technology. 5) User friendly, the module should also meet the rules of being friendly/familiar with its users.

Figure 3 Practice of making digital teaching materials, accompanied by the Community Service Team

Mentoring

Mentoring activities are carried out to ensure that the material/technology delivered to partners can be implemented properly so that the results obtained can achieve the targets. Group photo with all participants divided into 3 sessions (Figure 4).

The outputs that have been achieved are the Mathematics material modules/e-modules for classes X, XI and XII from the Donggala Regency Mathematics MGMP partners.

Figure 4 Group photo of teachers who are members of the Donggala Regency Mathematics (MGMP)

CONCLUSION

Community service activities for the Subject Teachers' Deliberation (MGMP) of Mathematics in Donggala Regency in the preparation of modules/e-modules based on PjBL with the STEM approach, have been carried out well thanks to good cooperation with various parties. This is illustrated by the output in the form of modules/e-modules that participants have made from the results of this community service training and mentoring.

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