E-MODULE BASIC AERONAUTICAL FIXED SERVICE BASED ON LEARNING MANAGEMENT SYSTEM

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Abstract
Aeronautical Fixed Service is one of the courses in the Diploma 3 Aeronautical Communication Study Program which studies telecommunications services between point to point aimed at air navigation safety and the creation of regular, efficient and economical air service operations. For purpose supports the learning activities of flight safety cadets and users who want to add insight into the world of aviation. This research uses a type of development research or Research and Development (R & D). The model developed in this study uses the Waterfall model, which aims to design and develop an LMS filled with Aeronautical Fixed Service (AFS) course material. The result of this research is an E-module that contains learning material for the Basic Aeronautical Fixed Service course in accordance with the academic syllabus of the Aviation Communication study program. And then In the results of the average calculation, a percentage index of 87.71% was obtained in the strongly agree category and the remaining 12.29% were not researched more.

Keywords: Aeronautical Fixed Service (AFS), Waterfall Model, E-Modul.

INTRODUCTION

The development of information and communication technology in Indonesia occurs in various aspects of life, one of which is education [1] [2]. One of the benefits of internet information and communication technology in the field of education is as a learning tool [3]. Technology in this field of learning is known as e-learning or online courses. Academic institutions, which are vital to the country's economic future, were struck hard by the COVID-19 pandemic [4] [5] [6].

Online learning provides cadets with the ability to learn anywhere and anytime. Cadets have greater flexibility about when and how they carry out their learning activities [7]. Online learning can solve the limitations of conventional learning. Some of the skills required in learning with online media include knowledge of technology, time management and institutions, and online technology connections. Online learning does not require a long time and process to quickly and easily improve learning achievement [8] [9]. E-learning provides a self-paced platform that offers adaption to the recipient's learning objectives and speed of acquiring knowledge [10]. Therefore, academic institutions worldwide were compelled to renounce the conventional and commonly used face-to-face mode of instruction and implement an online teaching-learning facility immediately [11]. Online teaching-learning facilities, both synchronous and asynchronous, consequently forced students to make a quick transition from traditional classroom instruction to self-paced virtual study (emergency distance education) [12]. The effectiveness of which mostly depends on careful design and planning of required lessons and the selection of appropriate implementation options [13]

Surabaya Aviation Polytechnic has and develops a Learning Management System (LMS) facility as a system that helps teachers create syllabuses, manage learning materials, manage cadets' learning activities [14]. This Learning Management System (LMS) facility is in the form of a website application with the name https://courses.poltekbangsby.ac.id/ which is open source and uses the Moodle platform.

Students must achieve digital readiness in the new self-directed learning environment [12]. However, a substantial number of students could not benefit from online classes because of inadequate preparation for e-learning, lack of prerequisite skills, lack of connectivity and financial hardship [15] .

Electronic modules can be defined as a presentation of independent learning materials that are systematically

arranged into smallest learning units to achieve specific learning objectives, which are presented in electronic format, where each learning activity in it is connected by links as navigation that makes students more interactive with the electronic modules used, the presentation of electronic modules is equipped with video tutorials, evaluation questions and illustrative images to enrich the learning experience [16].

Diploma 3 Aeronautical Communication is one of the study programs at Surabaya Aviation Polytechnic which is built for skills, communication skills and expertise in providing aviation services. These services can be in the form of flight traffic information, weather condition information, and flight messaging / news information,.

There is one course that is about Basic Aeronautical Fixed Service (AFS). Aeronautical Fixed Service (AFS) is a telecommunication service between certain fixed points (point to point) provided primarily for the safety of air navigation and for regular, efficient and economical air service operations [17].

Learning Management System (LMS) or also known as Virtual Learning Environment (VLE) is a software application used by educators, both universities/colleges and schools as an internet-based online learning media (e-learning).By using LMS, lecturers/teachers/instructors can manage programs/classes and exchange information with students. In addition, access to learning materials that take place within a specified period of time can also be done [18].

In education needs to take advantage of technological advances, one of which is by presenting electronic modules as an easily accessible learning medium. For cadets of the Aeronautical Communication Study Program at the Surabaya Aviation Polytechnic, the module can be used as a means of improving learning. Website-based learning modules can be used as a means of learning the material needed by cadets quickly, easily and completely. Seeing from the learning needs that can be accessed online which will later function in virtual learning activities

Based on the explanation above, as a form of Final Project preparation that aims to create effective learning and help educators fill the training program by utilizing the development of technology. Therefore, the author will design e-modules as interesting teaching materials so that users can easily master and add insight to the material. The author intends to make a Final Project with the title "Design E-Module Basic Aeronautical Fixed Service Based on Learning Management System at Aviation Polytechnic Surabaya".

This research is only limited by designing electronic modules and materials presented in Basic Aeronatical Fixed Service (AFS) learning in the form of theory in accordance with curriculum requirements. How to make aviation communication study program cadets able to understand learning material with interactive learning available learning videos, practice questions for each chapter, and as one of the independent learning materials without depending on the teacher where cadets can set the learning period or not according to their abilities. The purpose of this research is to design an electronic module of Basic Aeronautical Fixed Service (AFS) material that is used by users so that it helps improve fluency in teaching and learning activities. Therefore, to fulfill the aims and objectives of this research, the following questions were asked:

1. How to design an electronic module of Basic Aeronautical Fixed Service (AFS) material on the Learning Management System of Surabaya Aviation Polytechnic?

METHODS

Research and Development (R&D)

The research method in this project is Research & Development (R&D), this research purposes to create a product and then test its effectiveness. It is hoped that using this research method can produce new innovations in the world of education [19]. This research develops from research and development of various forms such as software or hardware in the form of modules, books or other learning media. In this product research that will be developed is a learning e-module [20].

The model developed in this study uses the Waterfall model, Waterfall model provides a sequentially ordered software lifecycle approach starting from analysis, software design, implementation, testing and operation and maintenance [21]. The steps of the Research and Development of the Waterfall model are as follows:

1. Requirement Analysis
   - At this step, the author must know all the information about the needs of the electronic module, such as the usefulness of the e-module product desired by the user. Information on these needs can be obtained from interviews or discussions with course instructors.
2. System and Software Design
   - The design of the module designed is tailored to the needs of the learning material. This aims to provide a complete picture of the design designed and how the appearance of a material to be presented on the Learning Management System.
3. Implementation and Unit Testing
   - Software development is split into small modules that will be combined in the next phase.

In addition, this phase also tests and checks the functionality of the modules that have been created.

4. Integration and System Testing
   - The modules developed and tested in the implementation stage are then integrated into the overall system. After the integration process is complete, the overall system is checked and tested.
5. Operation and Maintenance
   - Here the finished product will be run or operated by its users. In addition, maintenance can also be carried out which includes fixing errors, improving the implementation of system units, upgrading system services according to new needs.

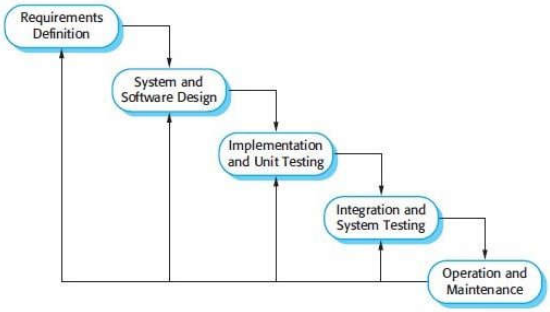

Figure 2.1 Waterfall Development Model
Source: *[21]*

Figure 2.1 explains the development of e-modules. In the first stage, namely by knowing the needs of the software designed by conducting interviews with users. Furthermore, choosing a design that is developed according to the needs of the material according to the provisions of the curriculum. After getting the appropriate design, you can start compiling the material according to the subject matter of the Semester Learning Plan. After that, testing to course validators related to teaching materials that will be compiled. After getting a response from the validator and making improvements, you can combine all the material according to the subject matter into the Learning Management System.

Instrument/Tool Design

The author makes an e-module of Basic Aeronautical Fixed Service material according to the syllabus in the Aviation Communication study program. It contains 9 subjects which are divided into 7 topics and 2 meetings for the implementation of UTS and UAS. The content of the module includes flipbooks, images, videos and a collection of exam questions. Then this module will be implemented and uploaded to the Web Learning Management System account owned by the Surabaya Aviation Polytechnic Aviation Communication study program.

Table 2.1 E-Module Content

Topic	Subject Matter
Topic 1	Aeronautical Communication Service
Topic 2	Point to Point voice and data Radio Communication Procedure
Topic 3	AFS Message
Topic 4	AFTN Message Format, AFTN Traffic Record And Code Abbrevation
Topic 5	Location Indicator And Flight Plan
Topic 6	ATS Messages
Topic 7	Failure of Communication

Table 2.1 above explains the content of the electronic module content designed which consists of topics and subject matter. Here the author makes 7 topics with different subject matter and is adjusted to the syllabus. The 1 topic discusses Aeronautical Communication Service, topic 2 discusses Point to Point voice and data Radio Communication Procedure, topic 3 about AFS Message, topic 4 AFTN Message Format, AFTN Traffic Record and Code Abbrevation, topic 5 Location Indicator And Flight Plan, topic 6 ATS Messages, topic 7 Failure of Communication.

Test Technique

The author took a material validation test with a material expert lecturer and a media test with a media expert lecturer using a validation assessment form. In addition, the author conducted an e-module trial to 23 populations. By taking 23 samples from Diploma 3 Aeronautical Communication VI cadets. The testing technique carried out by the author is through a questionnaire distributed to a predetermined sample.

The results of product testing using a questionnaire will be calculated using a Likert scale calculation. With the Likert Scale, the variables to be measured are translated into variable indicators. The indicator is the starting point for compiling instrument items in the form of statements or questions. The items are then given a score ranging from 1-5, to explain the scoring technique, a table will be given to describe it below :

Indicator	Score
Strongly Agree (SS)	5

Agree (S)	4
Enough (C)	3
Disagree (TS)	2
Strongly Disagree (STS)	1

When all data is obtained, calculations will be made. The Likert scale has the following calculation formula:

Likert Scale score value = T x Pn
Where:
T = Total number of respondents who voted
Pn = Likert scale score number options.

And then, the authors interpret the calculation score. How to get the interpretation results first known the highest score (X) and the lowest score (Y) for the explanation of the assessment items with the following formula:

X = Likert highest score x number of respondents
Y = Likert highest score x number of respondents

After interpreting the calculation score, then the presentation calculation is carried out with the Index Formula (%), which is:

$$\text{Index Formula (\%)} = \frac{\text{Total Skor}}{\text{Y}} \times 100\%$$

RESULT AND DISCUSSION

The design of electronic modules that have been carried out and obtained research results and discussions that will be described at each stage of Waterfall, namely knowing product needs (requirements), product design (design), product preparation (implementation), product testing and validation (verification), product improvement (maintenance).

1. Requirement Analysis

The analysis of the needs that the author found during the learning of the Basic Aeronautical Fixed Service course at the Surabaya Aviation Polytechnic is still using conventional modules in the form of thick printed modules. Where the author analyzes that the print-based module is less efficient, takes up space when carried and is not durable because the clarity of the ink color is decreasing. In addition to the analysis described above, the authors collect data to be accurate through interviews with lecturers of Basic Aeronautical Fixed Service via chat WhatsApp.

2. Software Design

The results of this design are arranged according to the needs, ideas and creativity of the author. In this design, the author used the help of Canva. The following is the initial design of the e-module product made by the author.

Figure 3.1 E-Module Cover Page Design
Source : Processed by the Author (2023)

Page design that the author has designed. The cover design was designed using Canva. In this case the author uses the dark mode theme in creating a design of the e-module product. The cover page also includes the Surabaya Aviation Polytechnic logo, the Aeronautical Communication Diploma 3 Study Program logo, the name of the institution, namely the Surabaya Aviation Polytechnic and the title of each topic.

3. Implementation

Here the author applies the results of the initial e-module design that has been designed according to needs and creativity. And at this stage the author implements the initial design of the e-module to the Heyzine website to be used as a flipbook. The following is a snapshot of the results of the e-module flipbook

Figure 3.2 Flipbook E-Modules
Source : Processed by the Author (2023)

Figure 3.2 shows one of the pages on the e-module that is already in the form of a flipbook and on one of the page snippets there is a background taken from one of the activities taking place at the Dirgantara Officer Field. To access the results of the e-module, you can use the url link that will be submitted by the author. On one of the pages it contains QR barcodes and YouTube. In addition, it also contains definitions regarding the material of the e-module topic.

4. System Testing

After compiling the e-module into the Heyzine website software, then at this stage the author applies the results of the e-module design in the form of a flipbook and implements the e-module on the Learning Management System of Surabaya Aviation Polytechnic accessing https://courses.poltekbangsby.ac.id/. The following is a snapshot of the display on the Learning Management System Poltekbang Surabaya page.

- Login page of Surabaya Polytechnic LMS

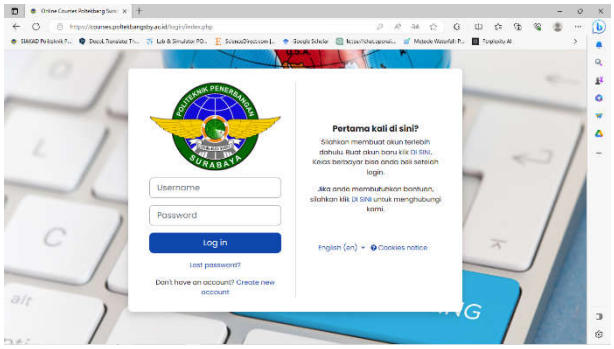

Figure 3. 3 Login Page of Surabaya Polytechnic LMS
Source: Author's Documentation (2023)

In Figure 3.3 is the login page on the Surabaya Polytechnic LMS. Where to access the course provided users must use a username and password. On this LMS login page if the user does not have an account, then they can first create an account.

- Home Page

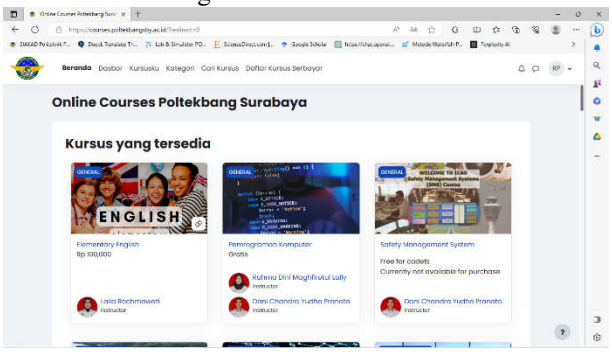

Figure 3.4 Home Page of Surabaya Polytechnic LMS
Source: Author's Documentation (2023)

In Figure 3.4 is the home page on the Surabaya Polytechnic LMS. Where on this page contains several courses / learning programs and instructors from these courses.

- Dashboard Page

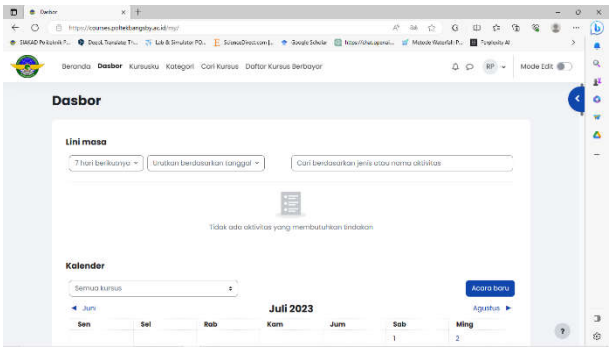

Figure 3.5 Dashboard Page of Surabaya Polytechnic LMS
Source: Author's Documentation (2023)

In Figure 3.5 is the dashboard page on the Surabaya Polytechnic LMS. On this dashboard page we can determine the time and date when we will carry out an exam. Also on this page we can search based on the type or name of the activity we want to find.

- My Courses page

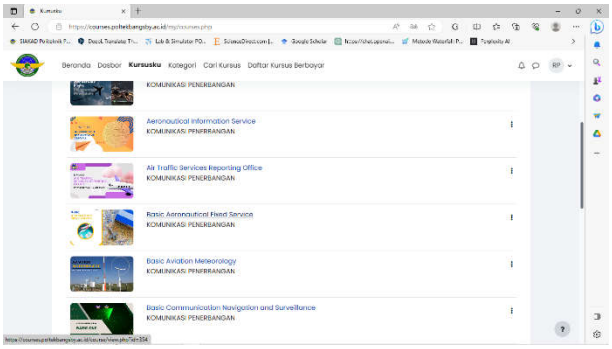

Figure 3.6 My Courses Page of Surabaya Polytechnic LMS
Source: Author's Documentations (2023)

Figure 3.6 displays the LMS my course feature at Poltekbang Surabaya. Where the purpose of this my course feature is to display the results of courses or learning programs that have been created by the admin or content creator. In this my course feature only displays the results of courses or learning programs that have been created by the admin.

- Topic Page

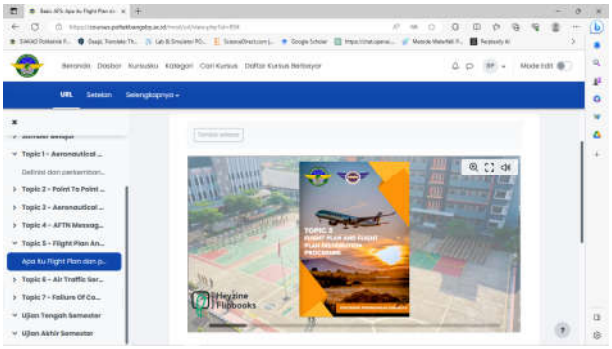

Figure 3.7 Topic Page of Surabaya Polytechnic LMS
Source: Author's Documentation (2023)

Figure 3.7 is a snapshot of one of the topics on the Surabaya Polytechnic LMS. On that page we can see some e-module design results that have been divided into several sessions or topics.

5. Maintenance

Maintenance is the last phase of the Waterfall development design model. Data at the maintenance stage comes from two types of subjects, namely from the media expert validation test and material expert validation. Data from media expert validation comes from IT expert lecturers at Surabaya Aviation Polytechnic. As well as material expert validation comes from lecturers of Basic Aeronautical Fixed Service material experts at the Surabaya Aviation Polytechnic.

CONCLUSION

Based on the results of the e-module design that has been carried out, several conclusions can be drawn as follows:

1. This research produced a Basic Aeronautical Fixed E-Module design that can be applied to help or facilitate lecturers and cadets in teaching and learning activities. Especially in Basic Aeronautical Fixed Service learning material. E-Module Basic Aeronautical Fixed Service carries characteristics as a learning resource or teaching material with flipbooks and based on the Learning Management System.
2. Basic Aeronautical Fixed Service learning media is very important for the provision of understanding for cadets, teachers or participants who want to increase knowledge and insight into aviation science. So an innovation and development must be needed so that the quality of teaching and learning can be better and learning resources are more varied.

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