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Problem Based Learning E-Module Development on Statistic Topics

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ABSTRACT: The low level of learning independence, students' problem-solving abilities, and instructional materials that do not yet use digital as a demand for 21st century learning inspire this research. The goal of this study is to create a valid and useful Problem Based Learning based E-Module on data display and measurement material. Data centralized. This is development research (Research and Development/ R&D) employing the Plomp development paradigm. This development strategy employs two stages: preliminary research and prototyping. The subjects of this study were nine SMAN 13 Padang class X students. Observation sheets, interview guides, and questionnaires were employed as study instruments. Techniques for data analysis employ quantitative and qualitative analysis. The E-Module's validity based on problem-based learning was 89.85%, with a very valid category. The E-Module's practicality results were 87.33% in the extremely practical category. Based on the findings, it is possible to infer that the E-Module based on problem-based learning on data presentation material and data concentration measurements at SMAN 13 Padang is valid and practical, and that it may be utilized as teaching material.

KEYWORDS: e-module, problem based learning, indepence

I. INTRODUCTION

Education is one of the capital for accessing the global world, which is a way of living that encompasses all aspects of human life in terms of economics, politics, and culture. Understanding globalization is a notion for 21st century learning, specifically learning that incorporates reading abilities, knowledge capabilities, skills and attitudes, and technological expertise. Children can learn independently and swiftly when they use information technology. As a result, the field of education must likewise keep up with technological advancements in the learning system.

(Daryanto 2017) indicated that the employment of information and communication technology in many parts of life characterizes world development in the twenty-first century. This technology has the potential to connect the world beyond geographical boundaries, allowing it to become borderless. As a result, information can flow rapidly, giving the impression that the world has no geographical limits. As a result, education has witnessed a phenomenon in which students must stay up with current advances in order to compete in the future.

Based on observations made at SMA N 13 Padang, it was discovered that students' freedom in learning is still missing, implying that if they are not directed, they will not learn, and as a result, many duplicate their classmates' work and lack their own learning initiative. Students' low capacity to solve problems, especially when the problem is routine, and teaching materials or learning media that do not yet use technology that increases students' problem-solving abilities. Meanwhile, the instructional materials employed cannot inspire students to learn on their own. LKS (Learner Worksheets), PowerPoint, and printed books are currently used as instructional resources. The educational materials employed do not also entice kids to learn. Therefore, it is necessary to develop technology-literate teaching materials that build independent learning and problem-solving abilities. One form is an electronic-based module that combines with a problem-based learning model.

An E-Module is a software-designed electronic-based module that can be read and accessed using electronic media (Maryam et al., 2019). Learning with E-Modules is beneficial for minimizing students' boredom with traditional modules; therefore, the modules must be coupled with electronic media (Wibowo & Pratiwi, 2018). E-Modules are digital learning tools that are easily available, effective, and can help students develop their independence in understanding educational contents (Nisa et al., 2021). The e'module developed can employ the problem-based learning (PBL) learning model to develop problem-solving abilities.

Problem Based Learning E-Module Development on Statistic Topics

Problem-based learning is a learning technique that employs real-world situations to teach students critical thinking and problem-solving abilities, as well as fundamental topic information and concepts (Nafiah, 2014). Problem-based learning is a learning model that focuses on students, allowing them to think creatively and actively participate in developing their reasoning in the material being taught, so that students can use their reasoning to solve everyday problems (Pratama et al., 2019). The E-Module must be developed utilizing a problem-based learning methodology, which necessitates the use of software. One software that can be used is Flip PDF. Flip PDF Professional is software made by Flipbuilder that can be used in developing electronic or digital teaching materials (Maarif et al., 2022). Flip PDF professional is software that can convert PDF files to digital publication pages that can add images, audio, video, animation, quizzes, buttons, and others, thus making the appearance interactive and attractive, and it looks like a book when flipped back (M et al., 2022).

Statistics material is one of the materials that can be created. There are numerous elements mentioned in statistics material, one of which is presentation of data and centralized measures. Data presentation is the presentation of collected data in two formats, namely diagrams or graphs and tables (Pratikno et al., 2020). Yulianti et al. (2015) define data as a collection of information or occurrences. In the meanwhile, data centering is the study of the mean, median, and mode. According to research conducted by (Agustiva et al., 2016), students continue to make errors in addressing statistical issues, including factual errors, conceptual errors, principle errors, and procedural errors, and students do not comprehend how to calculate the mean or average value, mean, median or middle value. Based on the description above, this research aims to develop electronic teaching materials, namely the Problem Based Learning-based Statistics E'Module which is valid and practical.

II. MATERIAL AND METHOD

The sort of research used is research and development (R&D) using the Plomp development paradigm. The Plomp development methodology is divided into three stages: preliminary research, prototyping, and assessment. The subjects of this study were nine SMAN 13 Padang class X students. The research instruments employed were observation sheets for the early study stage, validation sheets to determine validity, questionnaires to determine practicality, and interviews to determine the learning barriers students encountered. Use the following formula to determine the level of validity and practicality:

$$Validity/Practicality = \frac{The\ sum\ of\ all\ scores}{Maximum\ score} \times 100\%$$

Then analyze the validity and practicality using the following categories:

Percentage (%)	Validity Category
80 < NV/NP ≤ 100	Very Valid/Very practical
60 < NV/NP ≤ 80	Valid/practical
40 < NV/NP ≤ 60	Quite valid/quite practical
20 < NV/NP ≤ 40	Invalid/impractical
0 < NV/NP ≤20	Very Invalid/very impractical

Source: modified from (Riduwan, 2010)

III. DISCUTION AND CONCLUSIONS

Comparative or descriptive research analysis based on outcomes, past research, etc. The findings should be presented in a logical order, with the most important findings provided first and the stated objectives met. The quantity of tables and statistics should be kept to a minimum in order to validate or refute the study premises. Authors should only discuss novel or significant aspects of the findings. It is not permitted to reuse or introduce new material from the Results section. The findings' applicability in the context of existing research or current practice should be emphasized. The results of the research carried out according to the development stages identified by Ploom can be described as follows:

1. Preliminary Research Phase

The research began with a preliminary investigation (preliminary research), which included examining the learning medium utilized by students as well as the students' characteristics. According to the findings of the learning media study, the learning media used did not involve IT or were not digital. Books and Student Worksheets (LKS) are still used as forms of learning media. Existing books and worksheets are less appealing to pupils, and example questions do not promote the development of problem-solving ability. The language employed is then standard, and students do not understand it.

The results of the student characteristics analysis revealed that in learning, students preferred to listen to teacher

explanations, students preferred to study in groups, students preferred to present textbooks using pictures, and students preferred examples of material given that were related to everyday life. Nowadays, students prefer to find class information on their smartphones rather than textbooks. The teaching materials utilized in the material portion are less detailed because they are offered mainly in summary form, and the example questions are less diversified, necessitating you to hunt for additional sources. Meanwhile, the results of the interview analysis of students' problems in learning statistics regarding data presentation material and data data collection measures were that students found it difficult to understand the material and work on questions. The media used when studying are textbooks and worksheets. Students prefer to read worksheets rather than printed books because worksheets are easier to understand than printed books. Students also want learning media that is innovative, creative and has complete material.

As a consequence of the review of the literature, instructional resources in the form of electronic modules, or e'modules, were developed for students to utilize wherever they are. The e'module was also created with problem-solving ideas in mind. Problem-based e-Modules are ideal since the data presentation material is intimately tied to daily life, making issues possible (Ramadanti et al., 2021). As a result, the creation of educational materials in the form of E-Modules that can be used independently, are easily accessible at any time, and have been adapted to contemporary technological developments.

2. Prototyping Phase

The results of the Prototyping Phase or development of teaching materials are as follows:

a. E-module design based on Problem Based Learning

1) E-Modul Cover

The E-Module cover contains information such as the E-Module title, name of the researcher, and images related to the material to be discussed with an attractive combination of colors and background. The cover appearance can be seen in Figure 1.

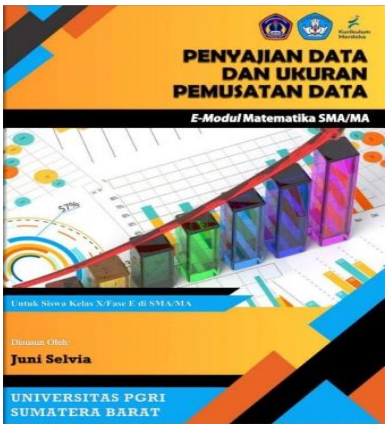

Figure 1. E-Module Cover

2) E-Module Menu

This E-Module menu makes it easier for users to go to the desired page quickly because there are buttons to access that page. The E-Module menu list display can be seen in Figure 2.

Figure 2. E-Module Menu

2) Foreword

The foreword to the E-Module contains brief information regarding the contents of the E-Module being developed, and expectations for the E-Module that has been created. The appearance of the foreword can be seen in Figure 3.

KATA PENGANTAR

Puji syukur penulis panjatkan kehadirat Allah SWT, yang senantiasa melimpahkan segala rahmat, taufik dan hidayah-Nya sehingga penulis dapat menyelesaikan *E-Modul* ini dengan lancar serta dapat menyelesaikan *E-Modul* tepat pada waktu yang telah ditentukan. Penulis menyadari bahwa *E-Modul* ini bisa dikembangkan berkat bantuan dari berbagai pihak. Oleh karena itu, penulis ucapkan terimakasih yang sebesar-besarnya kepada pihak-pihak yang telah membantu penulis.

E-Modul ini disusun untuk memenuhi kebutuhan siswa dan guru profesional di bidang guru matematika. Dengan adanya *E-Modul* ini diharapkan siswa dapat memperoleh kemudahan dan kebermaknaan dalam menjalankan kegiatan pembelajaran mandiri dan terstrukturnya. Selain itu, guru pun dapat merancang, mengarahkan, dan mengevaluasi proses pembelajaran Matematika dengan lebih baik. Secara umum *E-Modul* Matematika ini membahas tentang konsep, teori dan aplikasi teknologi dari materi penyajian data dan ukuran pemusatan data. *E-Modul* ini membahas alur tujuan pembelajaran Penyajian Data dan Ukuran Pemusatan Data materi Semester 2 Matematika SMA/MA fase E/kelas X.

E-Modul ini masih jauh dari sempurna, untuk itu penulis berharap dapat memperoleh kritik, saran, rekomendasi, evaluasi, dan kontribusi nyata dari berbagai pihak untuk kesempurnaan *E-Modul* ini. Apabila terdapat kekurangan atau kekeliruan, maka dengan segala kerendahan hati akan kami perbaiki sesuai dengan ketentuan yang berlaku di mana yang akan datang. Semoga *E-Modul* ini bermanfaat bagi para pembaca terutama siswa SMA/MA fase E/kelas X.

Padang, Maret 2023
Penulis,

Juni Selvia
NIM. 19050013

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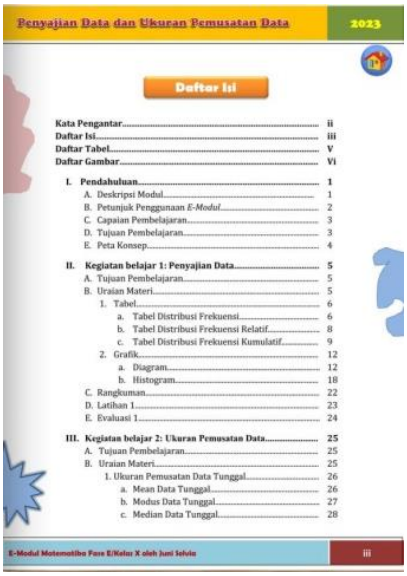
Figure 3. Foreword

3) Table of Contents

The E-Module table of contents contains information about the contents of the E-Module so that readers can easily see an overview of the module contents and can also make it easier to see the page they are going to. The table of contents display can be seen in Figure 4.



Penyajian Data dan Ukuran Pemusatan Data 2023

Daftar Isi

E-Modul Matematika Fase E/Kelas X oleh Juni Selvia iii

Figure 4. Table of Contents

4) Introduction to E-Module

The introductory section is one part of the E-Module structure. In this section there is a description of the E-Module, instructions for using the E-Module, learning outcomes, learning objectives and concept maps. The E-Module description page can be seen in Figure 5, instructions for using the E-Module in Figure 6, learning objectives are in Figure 7 and the concept map is in Figure 8.

Figure 5. E-Module Description Page

Figure 6. E-Module Instructions

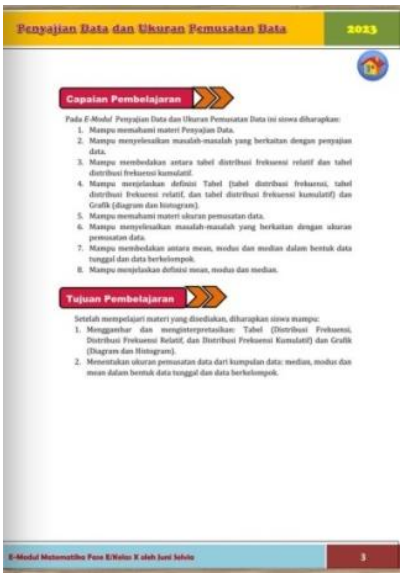


Figure 7. Learning Objectives

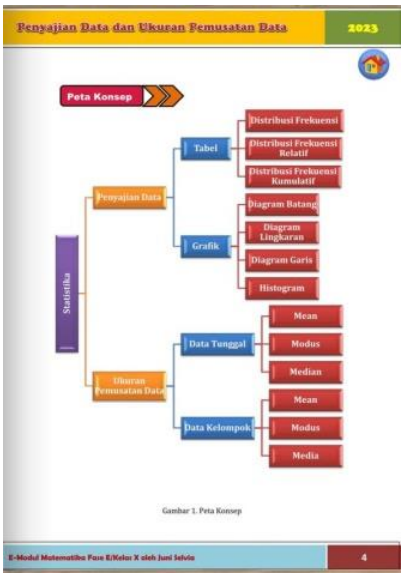


Figure 8. Concept Maps

5) Learning Activities

This e-Module consists of 2 learning activities, where learning activity 1 discusses Data Presentation and learning activity 2 discusses Data Concentration Measures. The display of learning activities can be seen in Figure 9.

Figure 9. Learning Activities 1

6) Exercise

This e-Module is made up of two learning activities, each with exercises connected to the learning material that has been addressed. Figure 10 depicts the training display.

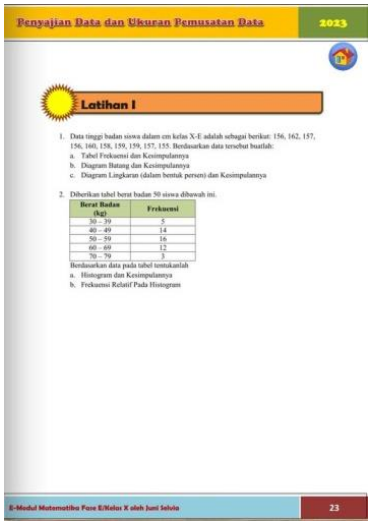


Figure 10. Exercise in Learning Activities 1

7) Evaluation

This e-Module consists of 2 learning activities, where in each learning activity there is an evaluation which is useful for measuring students' abilities related to the learning material that has been discussed. The training display can be seen in Figure 11.

Figure 11. Evaluation in Learning Activities 1

8) Audio and Video in Learning Activities

This e-Module consists of 2 learning activities, where in each learning activity there is audio and video related to the learning material in addition to explanations of the learning material. The audio and video display can be seen in Figure 12

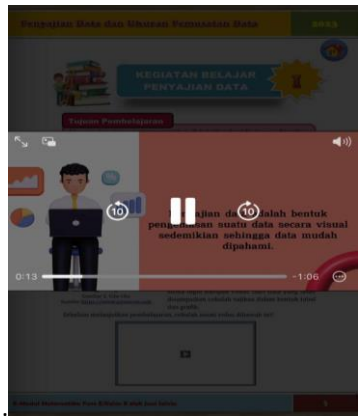


Figure 12. Video in Learning Activities 1

9) Answer Keys

There is an answer key that can help students evaluate learning outcomes independently. The module answer key display can be seen in Figure 13.

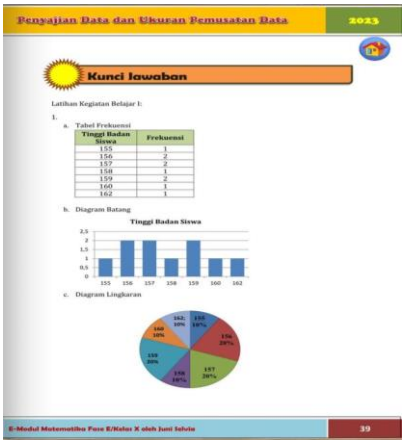


Figure 13. Answer Keys

10) References

In this E-Module there is a bibliography containing reference books used during the preparation of the E-Module. The bibliography display can be seen in Figure 14.

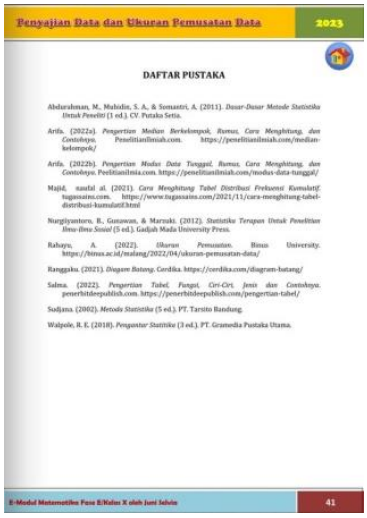


Figure 14. References

11) Glossary

A glossary is useful for helping students understand certain terms. The glossary display can be seen in Figure 15.

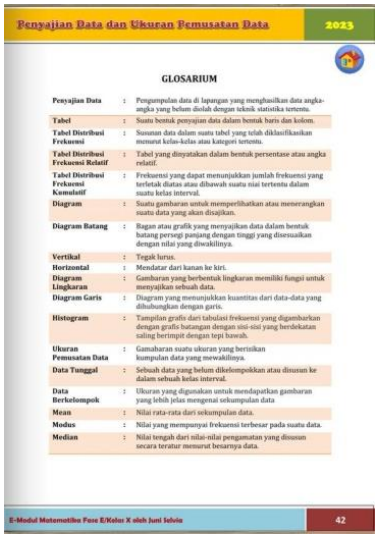


Figure 15. Glossary

b. Validation Results

Validation was carried out by material experts and media experts. The validation results from material experts stated that the E'module

Table 13. Validation Results by Material Experts

Assessment Aspects	Final Score	Category
Content Feasibility Aspect	90,6%	Very Valid
spects of Feasibility of Presentation	90%	Very Valid
Aspects of Language Feasibility	93,8%	Very Valid
Graphic Feasibility Aspects	92,5%	Very Valid
Final Value Validation by Material Expert	**91,7%**	Very Valid

This means that the E-Module is in line with the learning outcomes to be achieved, that the material has been organized sequentially and contains the concept of problem-based learning, that the presentation is very clear and simple to use, that the language used is in line with good and correct Indonesian language rules, and that the graphics are good, appropriate, and appealing.

According to the validation results from media experts,

Tabel 14. Validation Results by Media Experts

Aspek Penilaian	Final Score	Category
Display Aspects	83,3%	Very Valid
Ease of Use Aspect	75%	Valid
Graphic Aspects	87,5%	Very Valid
Final Value Validation by Media Experts	**81,9%**	Very Valid

the E'module was very valid for its good appearance, attractive design, usage of engaging illustrations, ease of use, and convenience of access for students. This signifies that the e'module is usable.

c. Practical Results

The results of evaluations conducted show that the e'module is practical. Evaluations are conducted in the form of one-on-one and small group evaluations. Three students were evaluated one on one, and the students' practicality score for ease of use was 97.92% in the very practical category. This means that readers can easily use or access the E-Module. The efficient element of learning time scored an 83.33% in the very practical category, indicating that the time spent using the E-Module is extremely efficient. Measures for data display and centralization. The benefit aspect obtained received a percentage result value of 95.83% in the very practical category, this shows that the design of the E-Module is good, appropriate, consistent and attractive. The final practicality score for the E-Module based on problem-based learning was 85.56% in the very practical category. The results of the small group evaluation of 6 students showed that the e'module based on problem-based learning on data presentation material and data concentration measures was 79.51% in the practical category. From the interview results, information was also obtained that students think that by using E-Modules they can learn anywhere and anytime. Based on the results of one to one and small group evaluations, it shows that E-Module learning media based on problem-based learning is practically used as one of the learning media in the material. data presentation and data centralization measures.

DISCUSSION

The aim of this research is to produce a Problem Based Learning-based E'Module that is valid and practical in data presentation material and data concentration measures that are suitable for use as teaching material for class X high school students. E'Modules or electronic modules are one of the teaching materials that follow technology, so that students can learn independently using technology whenever and wherever they are. The e'Module developed uses flip pdf media. Flip PDF

Professional is E-Book creation software in flipbook form that utilizes various media such as audio, video and flash. This software also has features for adding images, tables of contents, and buttons. The validation results from material experts and media experts state that the E'module has been declared very valid. This means that E'modul can be trusted as a teaching material. The results of the practicality carried out on teachers and students also show that the E'module can also be declared very practical. Thus, the E'Module based on Problem Based Learning for data presentation material and concentration measures is suitable for use for class X students at SMA N 13 Padang.

ACKNOWLEDGMENT

The e-module, which was created on the basis of problem-based learning, is appropriate for use as teaching material for students in terms of data presentation and concentration metrics. Because this research was only conducted up to the prototyping phase, it is recommended that researchers proceed to the assessment phase to determine the effectiveness of the product being created, and given that this e-module is a digital teaching material, its impact will undoubtedly influence the way students learn.

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