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Development of Sigil-Assisted Interactive E-Modules on Basic PBO Concepts In Python

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Abstract

The learning problem identified by researchers in the 11th grade RPL class at SMK Semen Gresik was the lack of textbooks or handbooks for students, making it difficult for both teachers and students to learn Object-Oriented Programming (OOP), particularly the basic concepts of OOP. The purpose of this study was to determine whether the Sigil-assisted Interactive E-Module was suitable for 11th grade students and whether it was effective. The development used ADDIE, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The results were based on validation data from material experts (85%), media experts (92%), and small group trials (81%) and large group trials (82%). The N-Gain Test value of the study was 0.7, indicating an increase in learning outcomes. The assessment results indicated that the developed E-Module was highly feasible and effective for use during learning.

Keywords: Electronic Module, ADDIE, Sigil, Object-Oriented Programming

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INTRODUCTION

Information technology (IT) is currently experiencing rapid development. This is influencing the transformation of the current teaching and learning system in Indonesia. Increasing internet usage will enable the digitalization of all provided facilities, aimed at educational institutions such as engineering schools, which need to adapt to the various needs of the information technology provided. Vocational educational institutions that conduct teaching and learning activities and other supporting activities encompass several elements, such as students, teachers, and learning materials included in the school curriculum.

According to Berry in Oktavia (2021), predicting the things teachers will face in 2030 are: first, knowledge and skills that teachers have never previously learned will not be sufficient for students. Second, virtual resources and networks have enabled students of all ages to learn anything, anywhere, anytime. Third, policymakers and professional education specialists will seek approaches to eliminate cumbersome procedures that can hinder the learning of talented individuals. Fourth, teachers will be required to possess complex professional competencies. Fifth, intelligent and ambitious students and teachers will be valued in the educational community because they can advance their careers and personal identities.

Therefore, teachers, as educational facilitators, must be able to use and even develop technological products to enhance the learning process. By showcasing creative, collaborative work and enhancing the learning experience, teachers must strive to advance their professional competence. To enhance teacher professionalism and competence, several things can be developed. One such approach is the development of teaching materials that can inspire students to be more proactive, using specific software that enables the creation of independent learning media, such as e-modules. An e-module is defined as a learning tool or tool that includes materials, procedures, limitations, and evaluation methods, designed systematically and engagingly to achieve required skills electronically, according to their level of difficulty.

The use and enhancement of e-modules to support learning is necessary not only to improve the effectiveness and quality of learning, but primarily to enhance teacher and student mastery of the material. Electronic modules, also known as e-modules, are learning media that use computers to display text, graphics, images, audio, animation, and video as part of the learning process. E-Modules can modify the presentation of each lesson according to student needs and the learning environment, making them as engaging and effective as possible, thereby increasing student motivation, understanding, and enthusiasm for learning. (Oktavia, 2021)

Based on observations from Teaching Assistance activities in the 11th grade RPL class at Semen Gresik Vocational School and interviews with the Deputy Head of Curriculum who teaches Object-Oriented Programming, Mr. Krisnanto Andri Prayugo, S.Kom., it was revealed that during the lesson, students did not fully understand Object-Oriented Programming, despite having adequate facilities. Furthermore, teachers and students lacked textbooks or learning aids, so the entire material provided by teachers consisted of learning materials extracted from journals and YouTube videos. Meanwhile, for Object-Oriented Programming, the scheduled learning hours were only once every two weeks, requiring students to be able to independently handle the available material.

The first study, conducted by Angkati Permani et al. (2019), entitled "Development of an Object-Oriented Programming Electronic Module for Grade XI StudentsSoftware Engineering with the Four-D Model," aimed to explain the feasibility of the e-learning module "Creating Object-Oriented Programs with Classes." This study used a Research and Development (R&D) approach with the Four-D development model. Based on the scores of the object-oriented programming electronic module verified by each feasibility test instrument, the qualifications presented on the Subject Expert instrument were categorized as very feasible. .18, Feasibility Presented at 78.57%, and Overall Feasibility of

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Respondents rated the Aspect Average at 3.36, making it ideal for use as teaching material for Grade XI RPL students at SMK Negeri 1 Rembang Purbalingga.

The second previous study was conducted by Andre Diofanu et al. (2020) with the title "Development of E-Modules Assisted by Electronic Publications (EPUB) Using the ADDIE Development Model in Basic Programming Subjects at SMK Negeri 4 Malang". This study only focused on one material, namely the concept of repetition which is difficult to convey in lectures or static media, but is expected to provide benefits in the form of increased student understanding. In this study, the results obtained from the analysis process indicate that the lack of supporting learning media indicates that the development of E-Modules is very necessary to be implemented. The results of the design process are wireframes and learning designs. The results of the development process are the results of video content, electronic modules, and verification of materials, media and instruments as well as the average valid results. The results of the implementation process are the results of the pre-test and post-test of students. The average student answer rate is 82.77%, and the assessment process shows high effectiveness and efficiency.

Based on the results of interviews and previous research, a more interesting learning module is needed and makes it easier for students to learn about the Object Oriented Programming module with the main topic being the Basic Concepts of Object Oriented Programming. This study aims to develop a new learning module that helps students improve the quality of their learning so that their grades increase. This study is entitled "Development of Sigil-Assisted Interactive E-Modules on the Basic Concepts of Object Oriented Programming Material with Python Language" The resulting module is expected to support the implementation of Object Oriented Learning (OOP) subject learning in the Software Engineering (RPL) department.

METHOD

A. Research Procedure

The research and development model used in developing this e-module is the ADDIE model. The ADDIE model consists of five interrelated and systematically structured components. The development stages used in this paradigm are Analysis, Design, Development, Implementation, and Evaluation. In this study, a questionnaire was used to collect necessary data regarding details about learning resources, student characteristics, assess the validity of the resulting e-module, and assess teacher and student reactions to it. (Rosmiati, 2019)

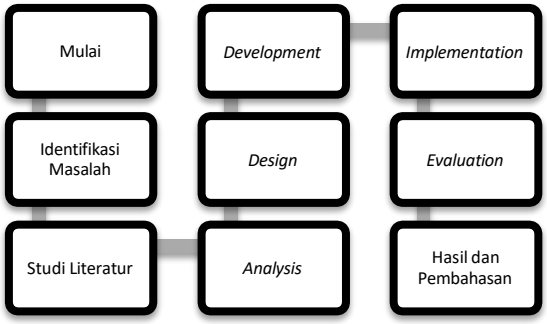


Figure 1 ADDIE Design Stages (Diofanu et al., 2020)

1. Problem Identification

   At this stage, an initial analysis of existing problems is conducted. Due to the lack of supporting learning resources, the development of e-modules is crucial.

2. Literature Review

   The literature review involves collecting references, reading references, taking notes, and processing reference materials. Researchers use books and scientific journals as references.

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3. Analysis

The analysis stage explains the learning material. This step is carried out by observing classroom conditions and assisting teachers in needs analysis and task analysis. The analysis stage is carried out to identify needs so that appropriate solutions can be implemented through the development of e-modules.

4. Design

The planning or design stage is carried out using the results obtained in the analysis stage. Improvements are made if discrepancies are found between user needs and developer needs. The planning process will involve preparing a plan in the form of a Teaching Module in accordance with the curriculum being used.

5. Development

The development stage is carried out using the results obtained in the previous stage. This phase must also align with learning objectives. The development process will include creating videos and e-modules, validating the included materials, the media displayed, and the tools used.

6. Implementation

The implementation stage takes place through the direct application of the developed media. The media is used directly by teachers and students. Access to the media is via students' computers and laptops. The implementation process also includes pre-test and post-test functions.

7. Evaluation

The evaluation stage is the process of evaluating data obtained from the implementation process. The data obtained are the results of pre-test and post-test activities to determine the effectiveness of the media and the results of student surveys to determine its level of effectiveness.

B. Data Analysis Techniques

In developing this e-module, the process of assessing and evaluating the questionnaire responses from media experts, material experts, and test subjects was carried out in two ways: qualitative data analysis and quantitative data analysis.

1. Qualitative Data Analysis

The data obtained from the questionnaires from media experts, material experts, and student test subjects contained a section containing responses in the form of suggestions, criticisms, or comments. The data obtained will be used as input for revising or evaluating the developed media. These suggestions and criticisms will be explained in detail, using understandable sentences.

2. Quantitative Data Analysis

The data obtained from the survey responses from media experts, material experts, and test subjects were processed using quantitative data analysis techniques. This analysis resulted in percentages of the data tested. To determine the level of e-module development acquisition based on the percentage calculation, criteria are determined according to the acquisition level table as shown in the table 1.

Table 1. Eligibility Criteria (Ernawati, 2017)

Achievement Level	Qualification	Description
81%-100%	Very Good	no need to revise
61%-80%	Good	no need to revise
41%-60%	pretty good	revision
21-40%	Not Good	revision
0-20%	very not good	revision

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The data analysis technique conducted through research related to the effectiveness of the use of Interactive E-Modules was obtained through pre-tests and post-tests given before and after the use of Interactive E-Modules to students during PBO learning. The results of the calculation of the pre-test and post-test of students when using the development product in the form of Interactive E-Modules that have been developed will be used to measure the level of effectiveness in improving learning outcomes in PBO learning by using the normalized gain test Widyastutik (2018)

$$\text{N gain} : \frac{Spost - Spre}{SM - Spre}$$

Description:
$N - Gain$: Normalized gain score
S_{post}: Post test score
S_{pre} : Pre test score
SM : Maximum score

RESULTS AND DISCUSSION

A. Results and Data Analysis

The results of this research produced electronic module teaching materials using the Sigil application. This research used the ADDIE model, with a development flow of Analysis, Design, Development, Implementation, and Evaluation. The following are the results of the development and research, compiled by the researcher based on the research and development procedure.

1. Analysis

Subject analysis was the first step. Based on a direct interview with the PBO teacher on March 10, 2023, as listed in Appendix 3, during the learning process, the modules provided only contained practical exercises without any explanation of the material to the students, resulting in no notes on the PBO subject itself. Observations during the Teaching Assistance program conducted by the researcher from July 2022 to October 2022 with grade XI RPL students at SMK Semen Gresik revealed that the students lacked enthusiasm for PBO learning due to the lack of books or modules provided by the school. Furthermore, the lack of variety in the use of learning media resulted in a seemingly ordinary learning experience.



Figure 2 Flowchart of Material Analysis in the Independent Curriculum

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e-ISSN 2528-7303

The next stage is material analysis. This activity aims to gather information regarding the curriculum, Learning Objectives (ATP), and Learning Outcomes (CP) related to the material developed in the electronic module for the object-oriented programming subject for grade 11 RPL. Figure 2 is a flowchart for material analysis based on the Merdeka Curriculum.

2. Design

This stage begins with selecting materials, then designing the placement of images and videos, and then compiling the overall requirements for the electronic module. The analysis conducted includes a subject analysis, including the results of interviews with object-oriented programming teachers and observations of students during. Teaching Assistance activities. Therefore, this stage is structured according to the analysis results, namely:

a) Included Material

The material is structured based on the Learning Objectives Flow, Learning Outcomes, and several references used. Figure 3 show references were used by the researcher to develop this e-module

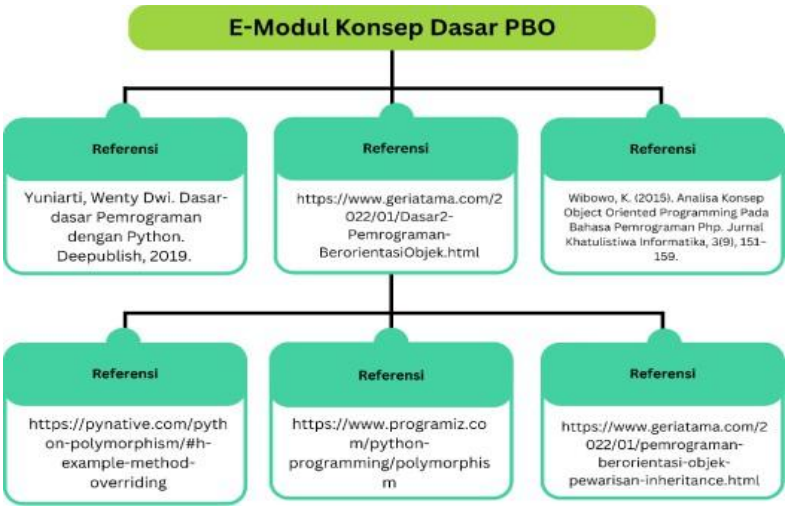


Figure 3. E-Module Reference

b) Compiling media elements.

1. Cover design

The cover will display the title of the e-module being developed, the subjects covered, the grade level, and the author's name.

2. Self-paced learning videos

Containing introductory videos and explanations of basic concepts and types of PBO, as well as how to implement them in Visual Studio Code. Each video will be embedded within the material on basic concepts and types of PBO.

c) Compiling the content of the e-module to be developed, such as the material section, videos, practical assignments, and quizzes.

3. Development

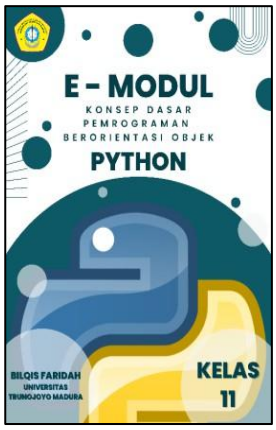
a. Design Development

At this stage, all required components are assembled according to their functions. Development is carried out based on the previously planned design phase. The product developed in this research is a sigil-assisted e-module.

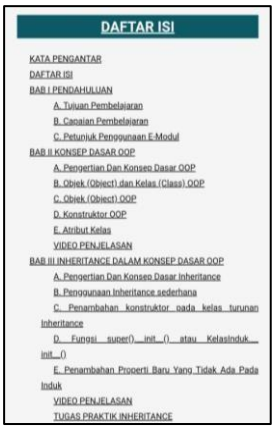
p-ISSN 2407-4489
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The resulting product is expected to serve as a learning medium for students in schools and as teaching material for teachers in the classroom. The final product consists of several sections, including a cover, table of contents, chapter pages, several explanatory videos, practical assignments, evaluations, and a bibliography. Figure 4 show the result of e-module the researcher developed

Figure 4. The Result of E-Module



Cover



List of Contents



Chapter 1



Video



Video Display



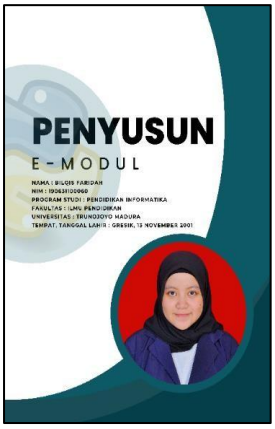
Practical Assignments



Evaluation



Reference



Bibliography

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b. Expert Validation

This stage includes the validation assessment of the product developed by the researcher and the presentation of the results of the trials conducted by the researcher on the selected subjects. Product validation was conducted with media experts and material experts.

1) Media Expert Validation

Media expert validation covered aspects of graphic feasibility, including module size, module cover design, and module content design (BSNP, 2008). Media expert validation was conducted offline on Friday, June 16, 2023, by Mr. Ahmad Ali Fikri A.Md., Head of the Software Engineering Department at SMK Semen Gresik. Quantitative data from the media expert was obtained from the percentage of the overall media validator scores and categorized according to the level of validity.

Based on the analysis, the media expert validation resulted in a final score of 92% for the graphic feasibility aspect, categorizing this e-module as very feasible, or usable without revision.

2) Material Expert Validation

Material expert validation covers aspects of content suitability, including suitability of the material to learning objectives, accuracy, up-to-dateness, curiosity-stimulating, practical applications, enrichment, and language appropriateness, including clarity, communication, interactivity, adherence to Indonesian language rules, and punctuation (BSNP, 2008).

Material expert validation 1 was conducted offline on Friday, June 16, 2023, by Mr. Krisnanto Andri Prayugo, S.Kom., a teacher of Object-Oriented Programming XI RPL at SMK Semen Gresik. Material expert validation 2 was conducted offline on Monday, June 19, 2023, by Ms. Laili Cahyani, S.Kom., M.Kom., a lecturer in Informatics Education at Trunojoyo University, Madura. Quantitative data from these media experts was obtained from the percentage of the total media validator scores and categorized according to their level of validity.

Based on the analysis carried out, there were several differences between validator 1 and validator 2, where validator 1 gave a score of 83 for the aspect of content suitability, and 80 for the aspect of language suitability, while validator 2 gave a score of 88 for all aspects assessed. The average of the overall value is 85% which makes this e-module categorized as very suitable or can be used without revision.

4. Implementation

At this stage, the researcher has revised and validated the product. The next stage is to implement the developed product in the classroom to determine its impact on the effectiveness of the developed e-module. The e-module was implemented in several groups: a small group of 6 students and a large group of 20 students from grade XI RPL at SMK Semen Gresik.

a. Small Group Trial

This small group trial was conducted to determine student responses to the material, language, and presentation of the e-module the researcher developed. It was also to determine whether students could understand and easily access the e-module. This small group trial involved 6 randomly selected students and was conducted at SMK Semen Gresik on Thursday, June 22, 2023.

Based on the analysis, the average percentage score of the overall score obtained was 81%. This categorizes this e-module as very feasible, meaning it can be used without revision.

b. Large Group Trial

This large group trial was conducted to determine the effectiveness of the e-module the researchers developed when used during learning. It also aimed to determine whether students understood the material, language, and display, and whether the module was easily accessible. This large group trial involved 20 randomly selected students from the 11th grade RPL class at Semen Gresik Vocational School. The large group trial was conducted at Semen Gresik Vocational School on Friday, June 23, 2023.

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Based on the analysis, the average percentage of the overall score obtained was 82%. This categorizes the e-module as feasible, allowing it to be used without revision.

The results of the pre-test and post-test calculations of students using the developed Interactive E-Module will be used to measure the effectiveness of PBO learning using formula 3. The N-Gain test result obtained from the large group trial was 0.7, indicating that this e-module is highly effective in improving learning outcomes.

5. Evaluation

Based on the results of the previous stage, namely the implementation of the developed product, the evaluation stage aims to determine whether the developed product is successful and suitable for use. The results obtained after examining the various stages of implementation indicate that the distribution of questionnaires to students in small and large group trials and the effectiveness test for the developed e-module are suitable for use and effective for use in learning activities. The following are details of the product revisions made:

a. Media Expert Revision

Based on the analysis, the media expert validation results showed a final score of 92% for the graphic feasibility aspect, categorizing this e-module as very suitable, or usable without revision. However, there was input for improvement regarding the uneven margins.

b. Material Expert Revision

Based on the analysis, the final score of the material expert validation was 85%, categorizing this e-module as very feasible, or usable without revision. However, there were suggestions for improvements in the writing style of the summary, the explanation of polymorphism, and the addition of a scoring rubric for the essay questions.

c. Small Group Test Revision:

Based on the analysis, the average percentage of the overall score was 81%. This categorizes this e-module as very feasible, or usable without revision. However, there were suggestions for improvements in the use of excessively large fonts, which made reading the material difficult, the video often crashed, and the images after the video did not appear.

d. Large Group Test Revision:

Based on the analysis, the average percentage of the overall score was 82%. This categorizes this e-module as very feasible, or usable without revision, but there were suggestions for improvements in the use of several sentences and language.

CONCLUSIONS

The conclusions from the research and discussion related to the development of the electronic module are as follows:

1. The product developed in this research is a sigil-assisted E-Module containing the basic concepts of Object-Oriented Programming in the Object-Oriented Programming subject taught to 11th grade RPL SMK students. The development of this E-Module uses the ADDIE research model, which includes Analysis, Design, Development, Implementation, and Evaluation.
2. In the development phase, the researchers conducted two tests: a validity test with validators, including a material expert validator with an overall average score of 85%, indicating that the e-module is highly feasible and can be used without revision. A media expert validator with an overall average score of 92%, indicating that the e-module is highly feasible and can be used without revision. A small group test with an overall average score of 81%, indicating that the e-module is highly feasible for use in learning and can be used without revision. A large group test with an average score of 82%, indicating that the e-module is highly feasible and can be used without revision.

3. In the implementation phase, a pretest and posttest were conducted on the large group test to determine the e-module's effectiveness. An effectiveness analysis using the N-Gain formula yielded a score of 0.7, indicating that the e-module is highly effective for improving learning outcomes.

Based on the results and discussions obtained in the e-module development research that has been tested on several subjects, namely media experts, material experts, and students, as well as reviewing several responses given by students. The results of the assessment conducted obtained a fairly high percentage, so it can be concluded that the developed e-module has achieved very suitable results and is effective for use during learning.

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REFERENCES

BSNP. (2008). Standar Penilaian Buku Teks Pelajaran. In *13 Oktober 2008*. http://telaga.cs.ui.ac.id/~heru/bsnp/13oktober08/Bahan Sosialisasi Standar Penilaian Buku Teks Pelajaran TIK.ppt.

Diana Kusuma Widyastutik. (2018). Pengembangan E-Book Interaktif Berbasis Creative Problem Solving Menggunakan Model Addie Untuk Kelas X Sma (Sekolah Menengah Atas). In *Repository Universitas Jemberepository Universitas Jember* (Issue 2019, pp. 1–130). https://repository.unej.ac.id/handle/123456789/90027

Diofanu, A., Wijoyo, S. H., & Wicaksono, S. A. (2020). Pengembangan E-Modul Berbasis Electronic Publication (EPUB) Menggunakan Model Pengembangan ADDIE Pada Mata Pelajaran Pemrograman Dasar di SMK Negeri 4 Malang. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, *4*(7), 2204–2211.

Ernawati, I. (2017). Uji Kelayakan Media Pembelajaran Interaktif Pada Mata Pelajaran Administrasi Server.

Elinvo (Electronics, Informatics, and Vocational Education), *2*(2), 204–210. https://doi.org/10.21831/elinvo.v2i2.17315

Firdaus, M. Y. (2022). *Pengembangan Elektronik Modul Menggunakan Pendekatan Kontekstual Berbasis Sigil Software Pada Mata Pelajaran Komputer Jaringan Dasar Kelas X TKJ*. *1*, 1–14.

Oktavia, A. S., Djumingin, S., & Munirah. (2021). Pengembangan E-Modul Bahasa Indonesia Berbasis Web di SMK Negeri 2 Wajo. *Jurnal Universitas Negeri Makasar*, *1*(1), 1–14.

p-ISSN 2407-4489
e-ISSN 2528-7303

Permani, A., & Priyanto, P. (2019). Pengembangan Modul Elektronik Pemrograman Berorientasi Objek untuk Siswa Kelas XI Rekayasa Perangkat Lunak dengan Model Four-D. *Elinvo (Electronics, Informatics, and Vocational Education)*, *4*(1), 12–16. https://doi.org/10.21831/elinvo.v4i1.28260

Rosmiati, M. (2019). Animasi Interaktif Sebagai Media Pembelajaran Bahasa Inggris Menggunakan Metode ADDIE. *Paradigma - Jurnal Komputer Dan Informatika*, *21*(2), 261–268. https://doi.org/10.31294/p.v21i2.6019

Sugiyono. (2016). Metode Penelitian & Pengembangan. Bandung: Penerbit Alfabeta

Standar, K. B., Kurikulum, K., Pendidikan, A., & Kementerian Pendidikan, Kebudayaan, Riset, dan teknologi. (2022). *Keputusan Kepala Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan teknologi No. 033/H/KR/2022* (p. 1822).