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Development Of E-Modules for Science Subjects to Improve Learning Outcomes of Class Vii Students of SMPN 2 North Galesong Takalar District

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Abstract: *Good quality education is important to create a generation that is critical, knowledgeable, skilled, creative and highly competitive, so it is necessary to provide the facilities needed to interact in the learning process. This research aims to 1) identify the need for an E-Module, 2) Design an E-Module, 3) Measure the level of validity, practicality and effectiveness of the Science E-Module to improve the learning outcomes of class VII students at North Galesong 2 Middle School . This research was conducted using an R&D (Research & Development) approach. This research was developed using the ADDIE model. This research was conducted at SMPN 2 Galesong Utara. The subjects of this research were 2 validators consisting of material experts and media experts, 30 students, and 1 science subject teacher. Data collection uses needs identification questionnaires, material expert validation questionnaires, media expert questionnaires, individual questionnaires, small group questionnaires, subject teacher response questionnaires, pretest and posttest distribution. Data analysis techniques are qualitative and quantitative descriptive. The research results show that the identification of student needs is in the required qualifications. The E-Module development design is designed in accordance with ATP which is designed using Canva, Flip PDF Professional, and Website 2 Apk Builder. The results of the E-Module validity level from the assessment of material and media expert validators are at the very valid qualification stage. The practicality level results obtained from the questionnaire analysis of individual student responses, small groups, and science subject teacher responses were stated to be in the very practical criteria. The level of effectiveness of the Science E-Module was measured by pretest and posttest which showed an increase in student learning outcomes so that it was declared very effective. Based on the analysis results, it was concluded that the Science E-Module could be used in the learning process in class VII at SMPN 2 Galesong Utara.*

Keywords: *Development, E-Module, Natural Sciences (IPA)*

Abstrak: Kualitas pendidikan yang baik penting untuk menciptakan generasi yang kritis, berpengetahuan, terampil, kreatif, dan berdaya saing tinggi sehingga perlu menyediakan fasilitas yang diperlukan untuk berinteraksi dalam proses pembelajaran. Penelitian ini bertujuan untuk 1) mengidentifikasi kebutuhan E-Modul, 2) Mendesain E-Modul, 3) Mengukur tingkat kevalidan, kepraktisan, keefektifan E-Modul IPA untuk meningkatkan hasil belajar siswa kelas VII SMPN 2 Galesong Utara. Penelitian ini dilakukan menggunakan pendekatan R&D (Research & Development). Penelitian ini dikembangkan menggunakan model ADDIE. Penelitian ini dilakukan di SMPN 2 Galesong Utara. Subjek dari penelitian ini 2 validator yang terdiri dari ahli materi dan ahli media, Siswa berjumlah 30 orang, dan 1 Guru mata pelajaran IPA. Pengumpulan data menggunakan angket identifikasi kebutuhan, angket validasi ahli materi, angket ahli media, angket perorangan, angket kelompok kecil, angket tanggapan guru mata pelajaran, pembagian pretest dan posttest. Teknik analisis data secara deskriftif kualitatif dan kuantitatif. Hasil penelitian menunjukkan bahwa identifikasi kebutuhan siswa berada pada kualifikasi dibutuhkan. Desain pengembangan E-Modul didesain sesuai dengan ATP yang dirancang menggunakan canva, flip pdf professional, dan Website 2 Apk Builder. Hasil tingkat kevalidan E-Modul dari penilaian

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validator ahli materi dan media berada pada tahap kualifikasi sangat valid. Hasil tingkat kepraktisan diperoleh dari analisis angket respon siswa perorangan, kelompok kecil, dan respon guru mata pelajaran IPA dinyatakan berada pada kriteria sangat praktis. Tingkat keefektifan E-Modul IPA diukur dengan pretest dan posttest yang menunjukkan peningkatan hasil belajar siswa sehingga dinyatakan sangat efektif. Berdasarkan perolehan hasil analisis disimpulkan bahwa E-Modul IPA dapat digunakan dalam proses pembelajaran di kelas VII SMPN 2 Galesong Utara.

Kata Kunci: Pengembangan, E-Modul, Ilmu Pengetahuan Alam (IPA)

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INTRODUCTION

Quality education is crucial in creating a generation that is critical, knowledgeable, skilled, creative, and highly competitive. Teachers play a key role in achieving quality education. In fulfilling their role, teachers must be provided with the necessary facilities to interact effectively in the teaching and learning process. Under the independent curriculum, teachers are given the freedom to design learning as a guide to achieving Learning Outcomes (LO). As leaders in the learning process, teachers are expected to maximize learning activities in the classroom by preparing learning tools such as curricula, lesson plans, teaching methods, and relevant media that align with current trends. Technology serves as a significant tool in modern learning, especially in enhancing the quality of teaching and learning activities (Hakim & Nurhikmah, 2019) . According to Uno & Lamatenggo (2014), technology impacts future education by making it more open, diverse, multidisciplinary, and varied. Technology provides a new paradigm, where teachers are not just instructors but also managers of learning.

SMPN 2 Galesong Utara is one of the leading schools that has implemented the independent curriculum. The curriculum provides opportunities and freedom for teachers to plan learning as a guide to achieving Learning Outcomes (LO). However, based on data collection, it is known that the primary learning resource used in science classes is printed books published by the Ministry of Education, Culture, Research, and Technology. These printed books are very limited in number and insufficient to meet the needs of all students. For example, there are 192 students in the 7th grade divided into 6 classes, with 30 students per class, but the available printed books in the library cannot adequately accommodate all students.

Based on interviews with a science teacher at SMPN 2 Galesong Utara, it was revealed that the main learning references provided to students are teaching modules and printed science books published by the Ministry of Education, Culture, Research, and Technology as a guide for teachers. The teacher also mentioned that the teaching modules used are still limited and do not cover the complete science material. Meanwhile, the independent curriculum requires freedom in developing the curriculum, thus there is a need for learning resources that students can access independently. In this context, E-Modules become an alternative solution because they can be accessed anytime and anywhere. Science is a compulsory subject for all students from elementary to high school levels. According to the national curriculum, science plays a crucial role in shaping students' understanding of basic scientific principles, technology, and the environment. It also builds critical thinking skills and enhances students' scientific literacy.

Modules are independent learning packages designed systematically to help students achieve learning objectives. According to Wijayanto (Belanisa et al ., 2022), E-Modules are learning materials in electronic book form that can be accessed through digital devices. E-Modules have characteristics of

self-instructional, self-contained, stand-alone, adaptive, and user-friendly, allowing students to study independently. (Wirganata et al ., 2019) said that electronic module can defined as A form presentation material Study independently organized in a way systematic to in learning units smallest For reach objective learning particular , which is presented in electronic format , where every activity learning smallest For reach objective learning certain . E-Module also has other characteristics according to Triyono (2020) explain that module learning in form electronic own characteristic features or characteristic as 1) self instructional , 2) Self contained , 3) Stand alone, 4) Adaptive Because development of appropriate E-Modules with characteristics students , 5) Used friendly meaning suitable with user module that , because characteristics module This Already designed in accordance with need user .

The development of E-Modules is supported by previous research, such as Basri et al, (2023), who developed digital modules for Geography subjects at MA Al Qamar Takalar, demonstrating that digital modules can improve student learning outcomes. Another study by Gusrianto & Rahmi, (2022) with title E-Module Development in Informatics Subjects based Independent Learning Curriculum For Class VII of Middle School. Types of research This using the 4D model, this E-Module designed follow channel activity case-based learning and project-based learning. Result of analysis need show that For implementation curriculum independent specifically eye lesson informatics , required supporting teaching materials Study independent. Lidayni et al., (2022) also highlighted the benefits of E-Modules as alternative teaching materials in their study on sex education.

The theoretical foundations of this study include the constructivist and holistic approaches. According to Woolfolk (Private , 2023) the constructivist approach emphasizes the role of students in actively building their understanding. The holistic education approach, on the other hand, provides students with an understanding of global issues such as human rights, social justice, diversity, and peace (Primarni & Khairunnas , 2016) .

Chomsin & Jasmadi (Sugiarni , 2021) teaching materials are set means that contain material learning , methods , limitations , and methods evaluate what is designed in a way systematic and interesting in frame reach the intended goal , namely look for competencies and subcompetencies with all his competence. Ecology is science that studies organism in place his life or in other words learn reciprocal relationship between organism with the environment. (Fajar, 2021) . Diversity biological is diversity within creature life from all sources , incl including land , oceans and ecosystems other waters as well complexes ecology which is part from diversity : encompassing diversity within kind , inter types and ecosystems (Akmal, 2022) . Solar system is gathering object the sky is composed on A stars , sun , as well all an object bound by a force its gravity (Siregar, 2017) .

Thus, the E-Module based on Flip PDF Professional is an ideal choice, as it can be enriched with interactive features such as animations, videos, and audio, enhancing students' interest and making learning more engaging process (La Aba et al ., 2022).

RESEARCH METHODS

This study employs a Research and Development approach aimed at producing new products, technologies, or innovations by enhancing and improving existing ones. The focus of this research is the development of an E-Module using the ADDIE model. The process begins with the analysis stage, which involves identifying needs and existing challenges at SMPN 2 Galesong Utara through teacher interviews, student questionnaires, material analysis, and assessments of student characteristics. In the

design stage, the E-Module is created using applications such as Canva, Flip PDF Professional, and Web 2 Builder. The development stage follows, where the validity of the product is assessed through expert evaluations involving content/material validators and media/design validators. After validation, the implementation stage involves applying the E-Module in a learning environment and evaluating its practicality based on feedback from teachers and students. Finally, the evaluation stage measures the effectiveness of the E-Module through a large group trial, providing insights into its impact on learning outcomes. This structured approach ensures that the resulting E-Module is valid, practical, and effective for educational use.

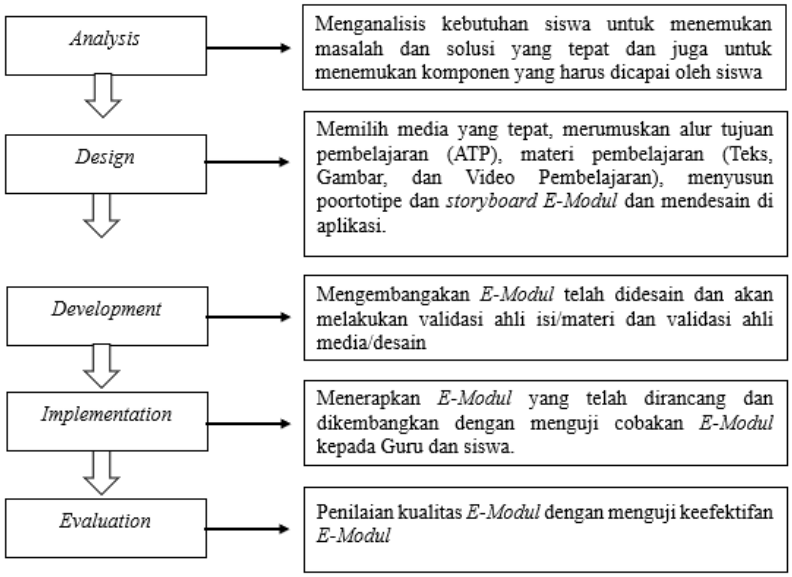

Figure 1 Development flow *E-Module*

The subjects of this research were 30 seventh-grade students from SMPN 2 North Galesong in the 2023/2024 academic year, along with science subject teachers and two validators—one for material validation and one for media validation. The research employed a purposive sampling technique. Data collection methods included observation, interviews, questionnaires (needs analysis questionnaire, material validation questionnaire, media validation questionnaire, practicality questionnaires for students and teachers), learning outcome tests, and documentation. The instruments used in this study were: 1) validation sheets for research tools and instruments, which were used to assess the validity of the research instruments and tools; 2) student response questionnaires, which provided supporting data on the practicality of the E-Module; 3) teacher response questionnaires, which served as additional data to evaluate the practicality of the E-Module; and 4) learning outcome tests, which were used as a criterion to measure the effectiveness of the E-Module.

RESULTS AND DISCUSSION

The analysis of the need for E-Module development in science lessons was conducted to enhance the learning outcomes of seventh-grade students at SMPN 2 North Galesong. Based on the results, it can be concluded that both teachers and students recognize the importance of developing E-Modules to support the learning process, particularly in science subjects. This initiative is expected to

increase the effectiveness of science learning in the classroom, enrich students' learning experiences, and support the achievement of learning objectives.

Development Design for Class VII Science Subjects at SMPN 2 North Galesong. The first step in the development design is selecting appropriate media. Media selection is carried out to identify tools that align with students' characteristics, ensuring they effectively support the achievement of learning objectives. The second step involves preparing science lesson materials aligned with the learning objectives for seventh-grade students during the second semester at SMPN 2 North Galesong. This step also includes incorporating images, photos, and educational videos to reinforce the learning process. The third step is creating an initial prototype or design draft. This early-stage draft will serve as the prototype for the E-Module to be developed during subsequent stages. The fourth step involves designing the E-Module using the Canva application. The design is based on the previously prepared prototype and incorporates creative features and design tools available in Canva. This process ensures that the layout, graphics, and other visual elements align with the initial prototype and storyboard, resulting in an engaging and functional E-Module.

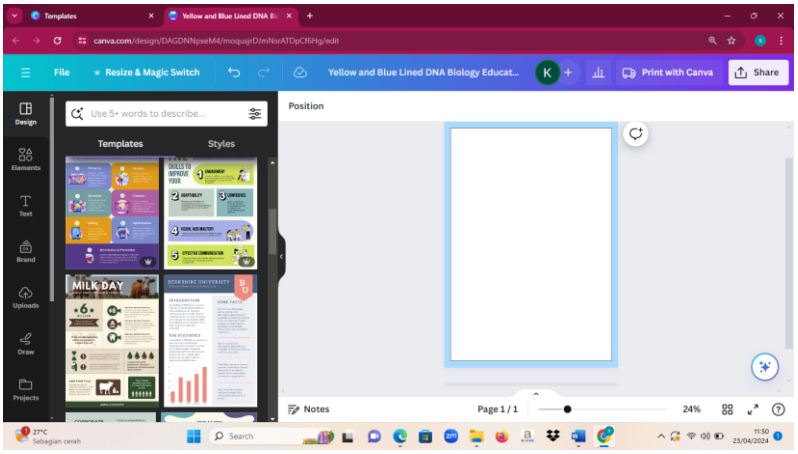

Figure 1. Initial display of E-Modules

The fifth step involves publishing the completed design using professional applications such as Flip PDF Professional and Web 2 Builder. The Flip PDF Professional application enhances the E-Module by incorporating features like hyperlinks, making the module more interactive and user-friendly.

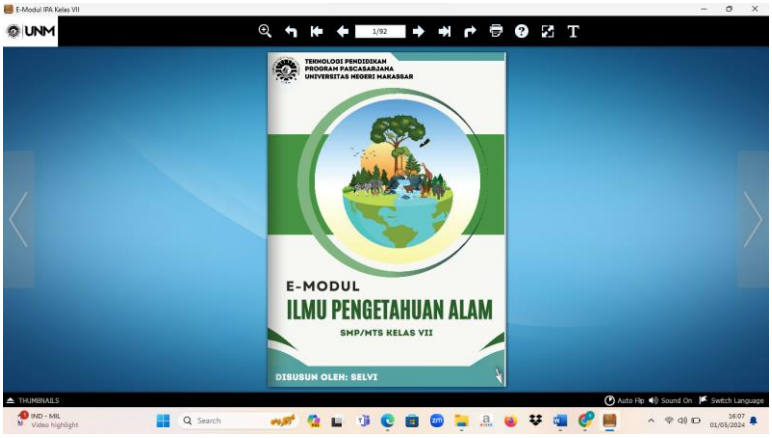

Figure 2. E-Module inserted to in a professional pdf flip that can accessed on a computer

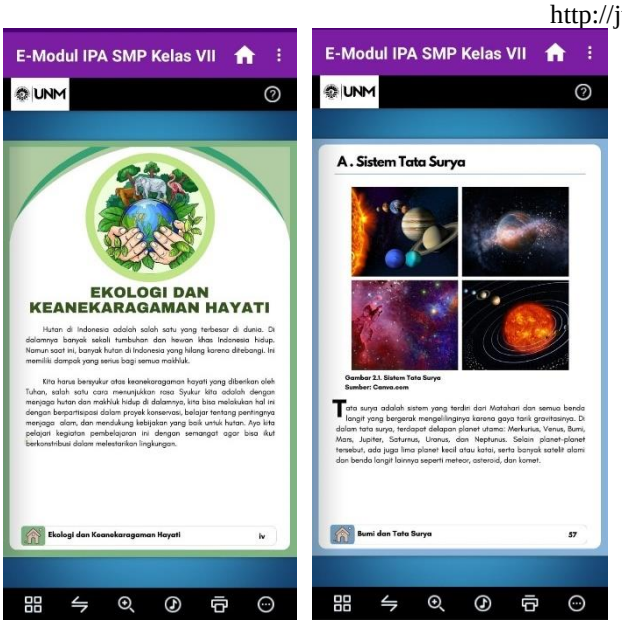

Figure 3. Display of the E-Module that has been published application

Validity Results E-Module for Class VII Science Subjects at SMPN 2 North Galesong Material Validation

Table 1. Material and Content Validation

No	Item Evaluation	Percentage
1.	Aspect Learning	84%
2.	Content Aspect	90%
3.	Aspect completeness, accuracy, and meaningfulness	100%
	Total Percentage	90%

Based on the results of the expert validator assessment of the material in Table 1, the learning aspect received a percentage score of 84%, categorized as very valid. The content aspect achieved a percentage of 90%, also categorized as very valid. For completeness, accuracy, and meaningfulness, a perfect percentage score of 100% was obtained, indicating a very valid category. Overall, the four aspects yielded a total percentage score of 90%, which falls into the very valid category. These results indicate that the E-Module developed by the researchers is suitable for testing in the learning process.

Table 2. Media Validation

No	Item Evaluation	Percentage
1.	Media Aspect	93%
2.	Design Aspects	96%
3.	Aspect Use	95%
4.	Aspect Utilization	100%
	Total Percentage	96%

Based on the results of the media and design expert validators' assessment in Table 2, the media aspect received a percentage score of 93%, categorized as very valid. The design aspect achieved a percentage of 96%, also categorized as very valid. For usability, a percentage score of 95% was obtained, indicating a very valid category, while the aspect of utility achieved a perfect score of 100%, also in the very valid category. Overall, the four aspects yielded a total percentage of 96%, indicating a very valid category. These results demonstrate that the E-Module developed by the researchers is suitable for testing in the learning process. The practical results of the E-Module for seventh-grade science subjects at SMPN 2 Galesong Utara indicate a high level of practicality and readiness for implementation.

Table 3. Questionnaire Results Response Students and Teachers

Questionnaire	Average Percentage	Criteria
Questionnaire Response Individual	92%	Very Practical
Questionnaire Response Small Group	97%	Very Practical
Questionnaire Teacher Response	95%	Very Practical

Based on results evaluation from questionnaire response students and teachers listed in table 3, average percentage questionnaire response individual reached 92%, avg percentage questionnaire response group small reached 97%, and the average percentage questionnaire teacher response reached 95%. From third average percentage show level practicality is in the very practical category , meaning that use of the E-Module can be support the learning process .

Effectiveness Results Class VII Science Subject E-Module at SMPN 2 North Galesong Level of Effectiveness.

Table 4. Learning Results Test

Learning Results Test	Average Score	Criteria
Pretest	66	Currently
Posttest	93	Tall

Based on Table 4, the data from the pretest and posttest activities reveal that the students' average pretest score, recorded before using the E-Module, was 66%, while the average posttest score, recorded after using the E-Module, increased to 93%. This indicates a 27% improvement in learning outcomes, with the posttest score of 93% falling into the "very effective" category. These results demonstrate that the use of the E-Module in seventh-grade science lessons at SMPN 2 North Galesong has been proven effective and is ready for implementation in the learning process.

The development of the E-Module followed all necessary stages and procedures, requiring significant ideas and innovations to ensure its ease of use and that the content is easily understood by students. Factors supporting the development of the E-Module were identified through interviews with subject teachers, need identification questionnaires, analysis of student characteristics, and material analysis.

This research was conducted as a development study aimed at producing a product capable of improving student learning outcomes at SMPN 2 Galesong Utara by measuring the validity, practicality, and effectiveness of the E-Module. The development utilized the ADDIE model, consisting of the stages of analysis, design, development, implementation, and evaluation. This approach ensured that the E-Module was designed systematically and effectively.

The E-Module, as defined by Gunadharma (Wirganata et al ., 2019) is an electronic version of a learning module presented in software form that can be accessed via computers or online platforms. It allows independent and systematic learning by integrating various elements such as text, images, instructional videos, and interactive features. The developed E-Module possesses characteristics like self-paced learning, self-instruction, self-contained content, modular chunking, and engaging learning activities, which are designed to motivate students, facilitate better understanding, and enhance student engagement in the learning process.

The validation results indicated that the E-Module is both valid and effective, aligning with previous research that emphasizes the importance of integrating technology into learning modules (Gunadharma, 2019). Additionally, the practicality tests demonstrated that the E-Module is user-friendly and suitable for students at SMPN 2 Galesong Utara. As a result, the E-Module can effectively improve student learning outcomes, particularly in enhancing their understanding of scientific concepts. In conclusion, this research demonstrates that the developed E-Module not only meets the criteria for validity, practicality, and effectiveness but also contributes significantly to student engagement and learning outcomes. The implications of this study suggest that the E-Module can be applied in other schools or subjects, serving as a valuable tool in developing independent learning materials that accommodate diverse student needs.

CONCLUSIONS AND RECOMMENDATIONS

The results of the needs analysis reveal that students require an E-Module to support their learning process. The E-Module was designed to align with the learning objectives (ATP) and developed using the Canva application, then published on Flip PDF Professional and Web 2 Builder platforms. The module incorporates text, images/photos, and instructional videos, which are accessible through the internet on smartphones, tablets, laptops, or computers. Validation results indicate that both the material and media aspects of the E-Module were rated as "very valid." In terms of practicality, feedback from students and teachers showed that the E-Module is highly practical. Additionally, its effectiveness was demonstrated through significant improvements in student learning outcomes, as evidenced by pre-test and post-test scores, placing it in the "very effective" category.

These findings confirm that the use of the E-Module for science lessons is effective at SMPN 2 Galesong Utara. It is recommended that educators utilize this E-Module as a teaching resource to enhance student comprehension and engagement in the learning process. For students, the E-Module serves as a valuable supplementary resource to help them achieve their learning objectives in science. Finally, future researchers can use this E-Module as a reference for developing more advanced modules or for further improving the current Science E-Module.

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