Feasibility Of Augmented Reality-Based E-Modules On Seam Material To Increase Vocational Students' Interest In Learning

Kelayakan Modul Elektronik Berbasis Realitas Tertambah Pada Materi Jahitan Untuk Meningkatkan Minat Belajar Siswa Vokasi

Alfina Muzdalifah[1], Sri Endah Wahyuningsih[2]

Fashion Design Education Program, Faculty of Engineering, Semarang State University, Central Java[1,2,3]

Email: [1]alfinamuzdalifah01@students.unnes.ac.id, [2]s.endah32@mail.unnes.ac.id

*Corresponding Author

ABSTRACT

In vocational education, learning emphasizes the mastery of practical skills aligned with workforce demands. In the Basic Sewing Techniques subject, particularly the subtopic of seam types, students still struggle to understand seam characteristics and their proper application when learning relies mainly on textbooks and conventional teaching methods. This condition highlights the need for new, engaging learning tools that make educational content easier to understand. This study aims to create an e-module that uses Augmented Reality (AR) to assist in learning the Basic Sewing Techniques subject on seam types and to analyze its feasibility as a learning medium for vocational high school students. The study used a Research and Development (R&D) method based on the ADDIE model, which comprises five steps: analyzing, designing, building, implementing, and assessing. Information was gathered through interviews, observing lessons, reviewing expert feedback forms, and collecting student opinions. These data were collected from subject matter experts, media specialists, teachers, and students in the Fashion Design program. The results indicate that the developed AR-based e-module is highly feasible, with validation scores of 94.84% from subject matter experts and 97.37% from media experts. Practicality testing shows that the e-module is highly practical, achieving a score of 96.95%. Furthermore, students' learning interest is classified as high, with improvement scores of 0.71 based on student questionnaires and 0.80 based on teacher observations.

Keywords: E-module, Augmented Reality, Basic Sewing Techniques, Vocational School Students

ABSTRAK

In the context of vocational education, learning emphasizes the mastery of practical skills in line with the needs of the world of work. In the subject of Basic Sewing Techniques, particularly the sub-topic on fabric types, students still struggle to understand the characteristics and applications of fabric when learning relies solely on textbooks and conventional methods. This condition indicates that innovative and interactive learning media are needed to present the Material more clearly and realistically. This study aims to develop an Augmented Reality (AR)-assisted e-module for the Basic Sewing Techniques subject, specifically the sub-material on various types of fabric, and to analyze its suitability as a learning medium for vocational school students. The Research method used is Research and Development (R&D) with the ADDIE development model, which includes the stages of analysis, design, development, implementation, and evaluation. Data collection was conducted through interviews, observations, expert validation sheets, and student response questionnaires, involving subject matter experts, media experts, teachers, and students of the Fashion Design program. The study's results show that the AR-based e-module is highly feasible category with a validation

percentage of 94.84% from subject matter experts and 97.37% from media experts. The practicality test showed a very practical category with a percentage of 96.95%. In addition, the students' interest in learning was in the high category, with increases of 0.71 on the student questionnaire and 0.80 on the teacher observation.

Keywords: *E-module, Augmented Reality, Basic Sewing Techniques, Vocational High School Students*

1. Pendahuluan

Vocational High Schools (SMK) are official secondary education institutions equal to SMA/MA, as stated in Government Regulation (PP) Number 17 of 2020, Article 1, paragraph 15. These schools focus on teaching students the skills needed for specific jobs. Vocational education is important because it helps students gain practical knowledge and skills that align with industry needs. Because of this, learning in SMK is mostly hands-on and needs good learning tools to support it.

However, studies show that learning practical skills in SMK can be hard, especially when it comes to steps that require clear visual understanding. Suryani (2022) said that limited tools for practical learning can lead students not fully to understand the concept or to make mistakes in their skills. This is also true for Basic Sewing Techniques, which is a key part of the Fashion Design program. These skills are the foundation for students to make good-quality fashion items.

Basic sewing involves knowing the tools, understanding different types of stitches, and learning how to sew seams accurately. A study by Nurhazizah and Puspaneli (2024) found that while the basic sewing module is valid and useful, students need better tools that can clearly show how the techniques work. Clarisya et al. (2024) also found that two-dimensional visuals, such as pictures or videos, do not fully help students understand details, such as folding or the final shape of a seam.

At the same time, modern vocational learning needs to improve students' digital skills. Setiyawan et al. (2023) found that strong digital skills help students perform better in their studies. Anggana et al. (2024) noted that using technology in learning can improve the process and outcomes. This means there is a need for digital learning tools that are not just informative, but also interactive and easy to relate to.

E-modules are a type of digital teaching Material that is widely used because they let students learn on their own and at their own pace (Arsyad, 2019). However, most of these e-modules are still simple, relying mainly on text, images, and 2D videos, which are not enough to show sewing skills in a realistic and detailed way.

Advances in educational technology have introduced Augmented Reality (AR) as a new way to learn, blending virtual objects with the real world (Mantasia & Jaya, 2016). Many studies show that using AR-based materials helps vocational high school students learn better and feel more interested, especially in subjects like electronics (Nasution & Faiza, 2020), interactive media in high schools and vocational schools (Adwiya, 2024), and AR e-modules for TKJ skills (Putri & Hendriyani, 2022).

However, in the existing Research, some areas still need more attention. First, most AR studies in vocational schools focus on engineering and information technology. Second, in fashion design, the usual teaching tools are printed materials or simple digital images. Third, there has been no Research that develops and tests an AR-based e-module with video instructions specifically for learning about different types of fabrics. Nugraheni's (2020) study developed a basic fashion media tool that worked well, but it did not use AR to demonstrate sewing techniques visually.

A survey of fashion design teachers at SMK Ibu Kartini Semarang found that most students struggled to understand different types of hems and the steps to make them. The

materials they used were printed job sheets, which made it hard to see the details from different angles. Students also said they had trouble practicing on their own because there was no visual tool they could use repeatedly.

Because of these issues, this study created an e-module that uses Augmented Reality. It includes 3D views of different darts, examples of how they appear in finished clothes, and video guides on how to make darts. The new part of this Research is combining AR with video instructions into a single e-module for learning basic seam-related sewing skills. This helps students learn in a more hands-on, interactive way, which aligns well with the learning style of Generation Z. The hope is that this study will offer a new learning tool for vocational education and help develop digital media in fashion design.

2. Methodology

This study used the Research and Development (R&D) method with the ADDIE development model, comprising the Analysis, Design, Development, Implementation, and Evaluation stages. The ADDIE model was chosen because it provides a systematic development process suitable for technology-based learning media.

The analysis stage was carried out to identify learning needs, student characteristics, and problems in learning Basic Sewing Techniques. The analysis was conducted through observation of the learning process and interviews with teachers of the Fashion Design Program at SMK Ibu Kartini Semarang. The analysis showed that students still had difficulty understanding the types of sewing techniques when learning only with conventional media, so visual and interactive learning media were needed.

The design stage included designing the structure of the Augmented Reality (AR)-assisted e-module, compiling materials, designing the display, and designing Research instruments. The development stage involved developing the AR e-module according to the compiled design. The developed product was then validated by three media experts and three Material experts to assess the feasibility of its content, display, language, and AR technology. The validation results are used as the basis for product revision.

The implementation stage is carried out by applying the AR-assisted e-module in teaching Basic Sewing Techniques, sub-material Types of Sewing Techniques, to 28 students in class X Phase E of the Fashion Design Program at SMK Ibu Kartini Semarang in the odd semester of the 2025/2026 academic year. Students used the e-module directly during learning activities, then completed a practicality questionnaire to assess ease of use, clarity of the Material, and the attractiveness of the media.

The evaluation stage was conducted to determine the feasibility and practicality of the AR e-module based on expert validation results and student responses. The evaluation results served as the basis for product refinement to better suit learning needs and student characteristics.

The Research subjects comprised two groups: expert validators and students. The sampling technique used was saturated sampling, in which all students in one class were used as the Research sample. The students were 10th-graders in the early stages of vocational learning, with varying abilities.

The Research instruments were expert media validation questionnaires, expert Material validation questionnaires, and student practicality questionnaires compiled using a Likert scale. The validity of the instruments was determined through expert content validation to ensure the indicators were suitable for the learning objectives and materials. The reliability of the instruments was reviewed based on the consistency of the assessments given by the validators.

Data collection was conducted through observation, interviews, and questionnaires. The data obtained were analyzed descriptively and quantitatively to determine the level of

feasibility and practicality of the Augmented Reality-assisted e-module.

3. Literature Review

of Learning Media

Learning media is an important thing that helps improve the quality of the learning process. According to Newby, Stepich, Lehman, and Russel (2000:10), quoted in 2016, learning media is defined as anything used to convey messages so that learning objectives are achieved. Gagne & Briggs (1979:19) explain that learning media includes various physical tools used to deliver learning materials, such as books, tape recorders, cassettes, videos, television, films, slides, photos, pictures, graphics, and computers. In other words, media are part of learning resources or physical tools that contain learning materials and can motivate students to learn.

E-Module

E-modules are a type of learning media that uses computer technology in the learning process. According to the Directorate of Secondary School Development in 2017, e-modules are printed learning modules displayed in electronic format that can help increase students' interest and motivation to learn (Asmiyunda et al., 2018). According to L. Rahmi (2018), e-modules are independent learning media in digital format that aim to help students achieve the expected competencies. In addition, the use of e-modules can encourage student interaction during the learning process. According to Nisa (2020, cited in Fujiarti et al., 2024), e-modules are teaching materials that comprise a collection of materials and explanations to achieve learning objectives optimally.

Augmented Reality (AR)

Augmented Reality, or AR, is a technology that lets people add three-dimensional virtual objects into the real world in real time. This allows users to interact with these digital items directly. According to Azuma in 1997, AR combines the real and virtual worlds, is interactive, and operates in three dimensions. Guttentag (2010 says that AR enhances real-world views by adding layers of digital information generated by software.

Newer studies show that AR is becoming more popular in training and learning practical skills because it can show work processes in a visual, real-world, and interactive way. A recent international study by Radianti and others in 2024 found that AR helps students understand procedures and improve their practical skills in vocational education by clearly demonstrating complex tasks. Ibáñez and Delgado-Kloos also point out that AR provides a more authentic, hands-on learning experience than regular digital tools.

When it comes to learning sewing, AR lets students see sewing techniques in 3D, turn objects around, and watch how sewing is applied to finished clothes. Wang and others in 2025 found that using AR for skills training greatly increases practice accuracy and makes vocational students more confident in their learning procedures.

Fashion

Clothing sewing techniques have evolved since prehistoric times when humans first sewed animal skins together using hand-stitching with needles made from bone and natural fibers. Sewing techniques then advanced in the Middle Ages, marked by the use of stronger flat seams for work and military clothing, as noted: "Felled *seams were widely used in medieval garments due to their* durability" (Johnson, 2008, p. 57). A major development occurred in the 19th century with the invention of the sewing machine by Elias Howe in 1846, which was later perfected by Isaac Merritt Singer in 1851, so that "the invention of the sewing machine transformed seam construction, enabling consistent and stronger seams" (Thomas, 2015, p. 32).

In 1881, the Merrow Machine Company introduced the first overlock machine, which became the basis for modern overlock seams. Entering the industrial era, seams were

standardized into categories such as superimposed, lapped, and bound seams, enabling uniform use in the garment industry. Seams are the slack in the stitching or the excess fabric on cut pieces of clothing used to join two or more pieces of fabric; these are called seam allowances.

Learning Outcomes

Learning outcomes are changes in students' abilities resulting from participation in learning activities, encompassing cognitive, affective, and psychomotor aspects. These changes arise from student interaction with the Material and the learning environment. According to Anderson and Krathwohl (2001), learning outcomes describe the extent to which students can achieve learning objectives, including the ability to remember, understand, apply, analyze, evaluate, and create. This aligns with Ekowati (2019), who explains that learning outcomes are an indicator of learning success because they show the extent to which students have mastered competencies after the learning process.

Interest in learning

Interest in learning is a natural feeling that students have, where they enjoy, pay attention to, and take part in learning. Schiefele (2023) argues that this interest helps students stay motivated and become more deeply involved in their studies. New Research by Hidi and Renninger (2024) shows that when students are really interested in learning, they understand ideas better and are more likely to keep trying when learning skills.

In vocational education, what students find interesting depends a lot on how relevant the Material and the way it is taught are. Zhang and others (2024) found that using AR-based interactive tools can increase vocational students' interest in learning. This is because these tools provide a real, meaningful learning experience.

Multimedia Learning Theory and AR Pedagogy

The creation of AR-based e-modules in this study follows Mayer's Multimedia Learning Theory. This theory suggests that learning is more effective when information is presented through a mix of text, pictures, and moving images, as long as they are used in a way that makes sense. New Research by Mayer & Fiorella (2024) shows that using interactive multimedia can reduce the mental effort required to learn and help students better understand ideas.

The e-module feasibility theory is a conceptual framework used to assess the extent to which an electronic learning module meets the criteria for being declared feasible for learning. This theory covers various aspects to consider when developing and implementing e-modules, including content, design, technology, and their impact on learning.

Research Conceptual Framework

Based on this theory, the study's framework connects the features of the AR-based e-module, such as the 3D campus view and video lessons, with how students think and stay motivated. The AR visualization makes it easier for students to understand the campus in a clear, realistic way, which supports their thinking. Also, the interactive and flexible use of the e-modules makes learning more engaging and encourages students to learn more. This better understanding and higher interest lead to better results in learning basic sewing techniques.

3.   Results and Discussion

Results of the development
Analyze E-Module

Based on observations and interviews conducted during the learning process in the Grade X Fashion Design class, several findings regarding the learning conditions were obtained. In learning activities, teachers still predominantly use the lecture method with learning media

in the form of printed books and *job sheets*.

The observation results showed that students tended to be passive and less actively involved in learning. This was due to the monotonous presentation of Material and the limitations of learning media in clearly displaying visual examples, especially in the Material on kampuh making. Students had difficulty understanding the shape and application of kampuh in fashion because they only relied on verbal explanations and static images in books or *job sheets.*

Interviews with Fashion Design teachers showed that the teaching materials used so far were considered ineffective and inefficient in supporting students' understanding. Teachers said that students often had difficulty distinguishing between types of darts and their application in clothing, requiring repeated explanations and adequate direct examples.

Based on discussions and follow-up interviews with teachers, it was agreed that a need existed to develop learning media that present Material in a more engaging, interactive, and accessible way for students. The learning media developed is expected to help students visually and concretely understand the shape of the kampuh and its application in clothing. Therefore, the development of e-modules integrated with Augmented Reality (AR) technology allows students to access teaching materials anytime, anywhere, and to display more realistic and detailed visualizations of Kampuh objects, which is expected to increase students' understanding and interest in learning.

Design

The second stage in the ADDIE model development Research is *the design stage*. Broadly speaking, the e-module consists of three parts: introduction, main content, and conclusion. Each stage has its own content tailored to the Material. The e-module framework for various types of kampuh is shown in Figure 1.
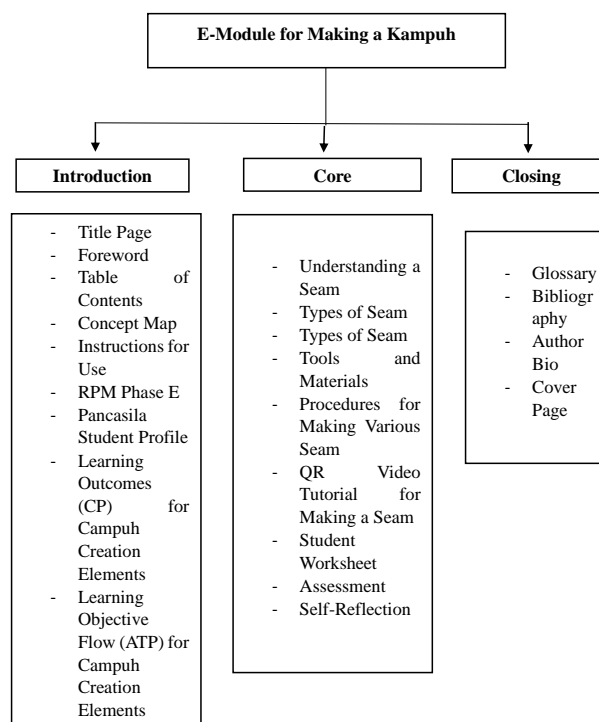

Figure 1. Framework of the Various Types of Farming E-Module

Develop*ment*

During the development stage, the AR e-module is designed for two 45-minute learning sessions. The first session introduces the Kampuh Material, covering its definition and application in fashion. The second session focuses on practical skills for making kampuh,

using AR visualization as a learning medium.

The Material analysis was carried out by aligning the e-module content with the vocational school curriculum for the Kampuh sub-material. The structure of the AR e-module consists of an introduction containing learning outcomes (CP), learning objectives (ATP), and in- depth learning plans (RPM). The content section covers the definition of kampuh, its types, functions, tools, and materials, and the procedure for making it, complete with QR video tutorials and examples of its application in fashion. LKPD/assessment, and self-reflection. The closing section contains a glossary, bibliography, and the author's biography. The Material was compiled systematically to suit the characteristics of vocational school students who require visual and practical experience.

Implementation

The fourth stage in the ADDIE model development Research is implementation. At this stage, the e-module product was tested for practicality and learning interest among 10th-grade Fashion Design students and Fashion Design teachers at SMK Ibu Kartini Semarang.

The assessment of practicality and learning interest among students and teachers was conducted on December 21, 2025, with 33 respondents: 28 students and 5 fashion design teachers. The collected data was then processed and analyzed to determine the practicality and learning interest of students towards the E-Module.

Evaluation

The evaluation stage is carried out to determine the quality of the Augmented Reality-based E-module, focusing on Material feasibility, practicality of use, and student interest in learning. This evaluation was conducted after the e-module was used in learning activities.

Feasibility evaluation was carried out through validation by subject matter experts and media experts to assess the suitability of the content, appearance, and completeness of the e-module. Furthermore, practicality testing was conducted by collecting responses from teachers and students, focusing on ease of use and clear presentation, as well as the benefits of the e-module for learning basic sewing techniques in the sub-subject of fashion design. In addition, an evaluation of students' learning interests was conducted to determine their responses and interest in the use of Augmented Reality-based e-modules for learning. The results of expert validation, practicality, and student learning interest were then presented and analyzed in the Research Results subsection.

Results of Expert Validation of Material and Media

Table 1. Summary of Media Feasibility Results

No.	Media Expert Name	Score
1.	Abdul Arif, S.Pd., M.Pd	75
2.	Ghodam Eko Saputro, B.A., M.A.	73
3.	Sri Sulistyowati, S.Pd. Gr., M.Si	74
Total Score		222
Maximum Score		228
Percentage		97.37%
Criteria		Highly Suitable

(Researcher Data Source, 2026)

Assessment Aspect	Percentage (%)	Criteria
Weight of Material	100%	Highly Suitable
Layout display	97%	Highly Suitable
Color scheme	97%	Highly Suitable
Use of fonts	97%	Highly Suitable
llustrations	97%	Highly Suitable
Illustration of Material	96%	Highly Suitable
Use of illustrations	97%	Highly Suitable
Average	**97%**	**Highly Suitable**

(Researcher Data Source, 2026

Table 2. Summary of Material Suitability Results

No	Name of Material Expert	Total Score
1.	Alif Imartini, S.Pd	79
2.	Anik Supriyati, S.Pd	82
3.	Umi Chasanah, S.Pd	78
Total Score		239
Maximum Score		252
Percentage		94.84%
Criteria		Highly Suitable

(Researcher Data Source, 2026)

Assessment Aspect	Percentage (%)	Criteria
Educational objectives	97%	Highly Suitable
Source Material	92%	Highly Suitable
Independence and innovation	92%	Highly Suitable
Self-development	94%	Highly Suitable
Unity	83%	Highly Suitable
Material presented in an engaging manner	92%	Highly Suitable
Presentation of critical thinking Material	94%	Highly Suitable
Contains contextual insights	96%	Highly Suitable
Average	**94%**	**Highly Suitable**

(Researcher Data Source, 2026)

The results of the Kampuh E-Module improvements, based on expert validators' criticisms and suggestions, are shown in Table 3.

Table 3. Results of the E-Module Kampuh Improvements

Criticism and Suggestions for Improvement from Expert Material Validators
Tutorial videos should use personal documentation and not be from YouTube sources. The size of the Kampuh flip-flap has been improved from 1cm to 0.5cm.

Before	After

The tutorial video before revision still used YouTube sources	The tutorial video, after revision, uses personal documentation

The result of the sliding hinge before revision was 1 cm	Final result of the shift after revision of 0.5 cm

(Source: Researcher Data, 2026)

Criticism and Suggestions for Improvement from Media Experts

The barcode layout should be improved by adopting a grid-based approach, adjusting the heading font size, and enlarging the QR barcode.

Before	**After**

The font size of the heading before revision was too small	The heading font size after revision is now large enough

The QR layout before revision was not neat and needed to be properly laid out.	The QR code layout after revision is neat and well-organized

The size of the QR code before revision was small	The size of the QR code after revision appears large

(Source: Researcher Data, 2026)

Results of the Learning Media Practicality Test

Based on the practicality data analysis, the practicality results are 96.21% for content feasibility, 96.97% for linguistic aspects, 96.88% for usefulness aspects, and 97.73% for graphic aspects. With these four percentages, and dividing them by the number of aspects. The average practicality result of the e-module is 96.95%, categorized as "Very Practical." The practicality test results are shown in Table 5.

Table 5. Practicality Test Results

Aspect	Number of Scores
Content Suitability	96.21
Linguistic Suitability	96.97
Usefulness Suitability	96.88
Graphic Suitability	97.73
Average Percentage	**96.95**
Criteria	**Very Practical**

(Researcher Data Source, 2026)

Student Learning Interest Results

Based on the N-gain test results, the increase in student learning interest reached a gain value of 0.71. According to the gain factor criteria, this value is classified as high. The N-gain test was also conducted on the results of teacher observations of student learning interest, which yielded a score of 0.8, classified as high. It can be concluded that the increase in students' learning interest after using the E-Modul Kampuh interactive learning media is high. The results of the assessment of students' learning interests are shown in Table 6.

Table 6. Results of Student Learning Interest Assessment

Aspect	Students	Teacher
Average Pretest	54.93	42
Posttest Average	87.09	82
Maximum Score	100	92
N-gain	0.71	0.8
Category	**High**	**High**

(Source: Researcher Data, 2026)

Discussion

The educational media development product for students in the Fashion Design Phase E program in this study is the E-Module for Kampuh Development. The E-Module for Kampuh Creation is integrated with the applicable curriculum, namely the *Deep Learning* Curriculum. The E-Module is intended for students in the Fashion Design Phase E program at SMK Ibu Kartini Semarang and is tailored to their needs. The elements of various types of kampuh and their production have learning outcomes that are expected to enable students to understand and practice the procedures for making kampuh and to know the appropriate use of kampuh in fashion.

The development of the E-Module for Making Various Types of Seams in this study uses the stages *of development, implementation,* and *evaluation*. The analysis stage includes: using the ADDIE model with five stages, namely analysis, design, content/Material for making seams; (4) analysis of interactive media device requirements.

(1) learning observation: (2) problem identification, (3) needs analysis (*hardware*) in the form of laptops and *smartphones,* and software in the form of a design platform, namely Canva, and an application for accessing *augmented reality* E-Modules. The design stage includes: (1) creating an e-module framework that explains the content of each part of the e-module; (2) designing the structure of the Material divided into an introduction, main discussion, and conclusion; (3) creating an initial framework for e-module assessment instruments in the form of feasibility and practicality questionnaires, then conducting content validity and ICC reliability tests. The development stage includes: (1) building content with valid and credible reference sources; (2) developing supporting media in the form of RPM, course materials, *LKPD/assessments,* coursework, and its application in fashion in the form of designs and video tutorials; (3) creating e- modules through a design platform (Canva): (4) assessing the feasibility of e-modules by subject matter experts and media experts: (5) making improvements based on criticism and suggestions from expert validators. The implementation stage involves assessing students' practicality of e-modules. The *evaluation* stage involves assessing students' learning interests to determine the effectiveness of the interactive media developed.

The feasibility assessment of e-modules is evaluated by subject matter experts and media experts using an assessment instrument in the form of a questionnaire. The assessment instrument is developed based on assessment indicators in accordance with Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 8 of 2016. Experts have tested the instrument. The results ofs the content expert instrument validity test were

0.873015873, with a very high validity category; the rehabilitation expert instrument validity test was 0.968, with an *excellent* category; and the media expert instrument reliability was 0.879, with *an excellent* category. Meanwhile, students' assessment of the e-module's practicality modified the Research instrument of Ega et al. (2023) to include four assessment aspects: content feasibility, linguistic feasibility, usefulness feasibility, and graphic feasibility.

The feasibility assessment results for the e-module by subject matter experts showed a 94.84% rating in the highly feasible category, and the feasibility assessment of the e-module and media experts by media experts showed a 97.37% rating. The high feasibility assessment results by subject matter experts and media experts were due to several important factors. First, the Material in the e-module was designed based on the learning outcomes structure and in accordance with the relevant curriculum, namely the *deep learning* curriculum, which enables the preparation of contextual and applicable content/Material tailored to the needs of students in the Fashion Design Program. Second, the presentation of the Material uses communicative and systematic language, making it easier to understand, especially in the process of making patterns. Meanwhile, in terms of media, the AR e-module features a consistent visual design, neat layout, and multimedia integration (text, images, QR codes, and video tutorials, as well as AR application of patterns on clothing) that supports learning engagement. This makes the e-module more attractive and interactive.

The results of the e-module feasibility assessment are also in line with previous studies, such as Lasaret & Suryawati (2022), who developed an e-module with a feasibility percentage of 88.04% among subject matter experts and 82.4% among media experts. Based on these percentages, the e-module is categorized as highly feasible and can be used for learning. Another study by Waidah & Sawitri (2020) developed an electronic module with a feasibility of 90.69% among subject matter experts and 84% among media experts. The electronic module was deemed feasible for student use. Research by Farihah *et al.* (2024) developed an e-module with a feasibility of 92.15% among subject matter experts and 92% among media experts. The e-module was categorized as very feasible for learning.

The practicality assessment was conducted by students of the Fashion Expertise Program Phase E Class X Fashion Design at SMK Ibu Kartini Semarang, comprising 28 students and 5 fashion design program teachers. The students' evaluation of the e-module's practicality showed that the content-suitability aspect scored 96.21% and was categorized as very practical. The language aspect scored 96.97% with the same category. The usability aspect scored 96.88% and was also categorized as very practical. The visual aspect scored 97.73%. The e-module's average practicality was 96.95%, which was categorized as very practical. The e-module was categorized as very practical because it was easily accessible to students via *smartphones.* In addition, the presentation of the pattern-making procedure was sequential, complete with illustrations, images, and QR codes that provided easy access to tutorial videos, and the application of patterns to clothing with AR made it easier for students to understand the process independently. Furthermore, the content's relevance to students shows that the e-module bridges the gap between theory and practice through an attractive presentation, and the direct benefits in practice support students' learning. The results of this practicality assessment are also relevant to previous studies, such as the study by Jannah *et al.* (2022), which developed an e-module with practicality percentages of 88.00% for the appearance aspect, 92.44% for the Material presentation aspect, and 85.18% for the benefit aspect. The practicality test achieved an average of 88.54% in the very practical category, indicating that students can use it. Another study by Nisa *et al.* (2023), who developed an e-module, obtained a practicality percentage of 93.81% in the very practical category. Research by Zulharfi *et al*. (2022), who developed an e-module, reported a practicality percentage of 88% in the very practical category.

After going through the validation stage, the interactive learning media were implemented on December 21, 2025, for 28 students in the 10th-grade Fashion Design Phase E at SMK Ibu Kartini.

Semarang and five fashion design teachers used a one-group pretest-posttest design, in which a pretest was administered before the treatment, followed by a posttest after the treatment. Based on the implementation results, the average pretest score for students before using the interactive learning media for Making Various Types of Campuses was 54.93. In contrast, the average posttest score increased to 87.09 after using the media. In addition, according to the teachers' questionnaire results, students' interest in learning before using interactive learning media was 56, but after using the media, it increased to 82.

Based on the N-gain test results, the increase in student learning interest reached a gain score of 0.71, which is in the high category according to the gain factor criteria. The N-gain test was also conducted on teacher observations of student learning interest, which yielded a score of 0.8, also considered high. This shows that the increase in students' interest in learning after using the interactive learning media "Macam-Macam Kampuh" was quite high. Based on the N-gain test results, the interactive learning media "Macam-Macam Kampuh" developed in this study was found to increase students' interest in learning in the classroom, enabling learning activities to run smoothly and effectively. This aligns with Usman's (2003: 27) view that effective teaching and learning conditions occur when students are interested and attentive in learning. Interest is a relatively stable trait in a person. Interest has a very strong Influence on learning because when someone is interested in something, they will do it. Conversely, without interest, someone cannot do something.

Augmented Reality (AR) in e-modules lets students view a garment's 3D structure and interact with it. This helps them better understand the shape of folds, the direction of stitches, and the order of steps in making a garment. The ability to rotate objects and view them from different angles provides a visual experience that print materials or 2D images cannot. This is especially important for learning sewing skills, which rely on understanding space and following the right steps. Also, combining AR with video tutorials in the e-module helps students connect what they see with real-world practice. They can watch how a seam is made step by step, not just see the finished product. This helps them make fewer mistakes when they try sewing on their own. These results align with multimedia learning theory, which holds that using visuals, text, and animation together helps people understand and remember concepts better, especially when learning practical skills. This study also found that AR increases students' interest in learning. Interactive, context-based media engage students more, making the learning process more meaningful. So, using AR in education is not just about adding visuals; it is also a teaching tool that helps students truly grasp the structure and steps involved in sewing.

The findings of this study align with earlier Research showing that using Augmented Reality (AR) in vocational learning helps students better understand visual and step-by-step content. Radianti et al. (2024) noted that AR can clearly display objects and work steps, making it easier for students to grasp the structure and process of practical tasks. This matches the results of this study, where using AR in the e-module on kampuh helped students see the shape and steps of making kampuh more clearly. Ibáñez and Delgado-Kloos (2024) also found that using AR in skill-based learning improves student involvement and performance. These results support this study's findings, which showed that students became more interested in learning and achieved a high N-gain score after using AR e-modules. Zhang et al. (2024) reported similar results, stating that adding AR to vocational learning increases students' motivation and interest in practical topics. So, the results of this study support earlier Research showing that AR-based learning tools are useful for helping students learn practical skills in vocational education, especially in basic sewing techniques.

4. Conclusion

The results from developing Augmented Reality (AR) e-modules were based on the ADDIE model, which has five steps: analysis, design, development, implementation, and

evaluation. The creation of AR e-modules focused on different types of fabric was carefully planned to ensure the learning materials meet the needs of vocational school students and support their sewing practice. To assess whether the AR e-module was effective, experts reviewed it, and a small group of students tested it. The experts gave it a feasibility score of 95% and 97%, which means it is very good. This means the e-module is suitable for use as a learning tool in the Basic Sewing Techniques course because it is strong in terms of content, presentation, language, and screen appearance. Twenty-eight 10th-grade students from the Fashion Design Program at SMK Ibu Kartini Semarang tried the e-module. The results showed that it was very practical, with a score of 96%. This was based on how well the Material was presented, the language, its usefulness, and the graphics. The students found it easy to use, fun, and helpful for understanding the subject visually and interactively. A survey about student interest in learning showed an N-gain score of 0.71, which is high. Teacher observations also showed an N-gain score of 0.80, which is also high. This means that using the AR e-module increased students' interest in learning, though the result is based on a small test and cannot be generalized. Overall, the AR e-module is both feasible and practical for use as a learning tool. However, the study had some limitations, including the small number of students tested and the Research design. Therefore, more Research is needed using a more detailed approach, such as experimental or quasi-experimental methods, to understand the full impact of AR e-modules on learning results, sewing skills, and the practical abilities of vocational high school students, as well as how they can be used for other subjects or skills.

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