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Development of a medicinal chemistry e-module using a team-based learning strategy

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Abstract

Many pharmacy students consider Medicinal Chemistry a complex subject due to its abstract concepts and highly technical content. This study aimed to develop a digital e-module tailored to the characteristics and needs of vocational pharmacy students and to implement it using a Team-Based Learning (TBL) strategy to enhance engagement and motivation. The development process adopted the Rowntree model, consisting of planning, writing, and evaluation phases. Subject matter and media experts designed and validated six thematic submodules. The readability score was computed using the Gunning Fog Index, while additional evaluations were performed through usability testing (face-to-face) and field implementation. Expert and student assessments indicated that this e-module was rated "Very Good" in terms of content, design, and visual aspects. The mean readability score of 9.8 suggested appropriate textual complexity for the undergraduate level. By engaging students further through TBL, motivation, participation, and comprehension increased, as demonstrated by perception scores across four learning domains. Both the structured e-modules and collaborative learning worked in unison to transform what is traditionally perceived as a hard-to-teach subject into an interactive and enjoyable experience. Future studies should include multimedia enhancements and investigate broader implementation across other complex pharmaceutical courses.

Keywords: E-Module; Medicinal Chemistry; Pharmacy Education; Team-Based Learning; Instructional Design.

INTRODUCTION

In recent years, several approaches have been taken to emphasize the clinical importance of topics associated with drug structure–activity relationship assessment, which is commonly referred to as Medicinal Chemistry. This domain symbolizes a critical aspect of determining how distinct atoms or functional groupings impact biochemical or biological activity, laying the groundwork for reasoned therapeutic decisions (Alsharif & Faulkner, 2020; Sumanasekera et al., 2020). To fully comprehend Medicinal Chemistry, students must first master fundamental concepts in organic chemistry, biochemistry, pharmacology, and

pharmacokinetics. However, this subject remains a considerable challenge in vocational pharmacy education.

So, the issues experienced by students learning Medicinal Chemistry are both subjective and structural. Medicinal Chemistry is often viewed as a dry and abstract discipline by students, which can lead to a lack of interest and quality of engagement (Ardakani & Basheti, 2018). Furthermore, 40.3% of students exhibit poor attitude towards the course due to unclear learning objectives. Moreover, the broad scope of the curriculum (up to 50 drug categories) can be overwhelming (Li et al., 2022). Traditional teaching models do not fit all students' backgrounds, leading to the call for deployment of novel teaching paradigms including student-centered and team-based practices (Li et al., 2022). In addition, although textbooks and online sources are abundant, there is a lack of concise, exam-oriented materials that facilitate effective learning (Katiyar & Bairagi, 2021). There is also an ongoing concern regarding regular updates to reflect the current developments in the field of pharmacy (Guchhait, 2024).

To address these challenges, novel pedagogical strategies such as Team-Based Learning (TBL) have increasingly been adopted across diverse health professions education contexts. The use of TBL, which was initiated in the medical education setting at the Baylor College of Medicine, has been shown to promote collaboration, accountability, and deeper learning in students. It has been widely incorporated in nursing, business, dental and veterinary medicine, but is increasingly being used in pharmacy education (Grady, 2011). TBL engages students through individual preparation, team discussion, and immediate feedback. These structured group activities have demonstrated strong potential to enhance student learning outcomes and engagement, particularly in large-class environments (Arumugam et al., 2024; Parmelee et al., 2012).

Alongside pedagogical strategies, the role of instructional materials such as e-modules is equally vital. E-modules offer flexibility, accessibility, and personalization, enabling students to learn at their own pace and from various locations (Manggala et al., 2024). In line with this, a recent meta-analysis of e-module use for physics learning outcomes reported a huge effect size of e-module use with physics learning outcomes of d = 18.45 (Fadillah et al., 2024), adding to the list of the transformative potential of e-module. Yet, these same advantages are dependent on the quality of content, pedagogical alignment, and adequate technological readiness (Agustian et al., 2024). Instructors also play a central role in preparing effective e-modules tailored to students' characteristics, facilitating both independent and collaborative learning (Nugroho et al., 2019).

Although the previous studies mostly looked either at e-modules or at TBL, the number of studies incorporating both into an overall instructional design is scarce. Therefore, this study addresses that gap by design in e-module specifically to facilitate TBL in Medicinal Chemistry. It is anticipated that this innovation will contribute to academic success as well as critical thinking and teamwork competencies, which represent important needs of vocational pharmacy education nowadays.

METHODS

This research was conducted at the Applied Pharmacy Undergraduate Program, Poltekkes Kemenkes Makassar. The study employed the Rowntree development model, which was selected due to its practicality, flexibility, and suitability for developing self-instructional learning materials such as e-modules. This model consists of three steps (planning, writing and assessing) not only allowing this aspect of development to occur in parallel, but also allows iterative development and quality improvement by expert review and learner feedback (Rowntree, 1994). Rowntree's model has similarly become popular in instructional development for vocational education, predominantly for its flexibility, and attunement to student-centric learning environments (Arif, 2011; Nugroho et al., 2019). The steps in developing a learning module package for the Medicinal Chemistry course with reference to the Rowntree development model can be seen in the Figure 1 below:

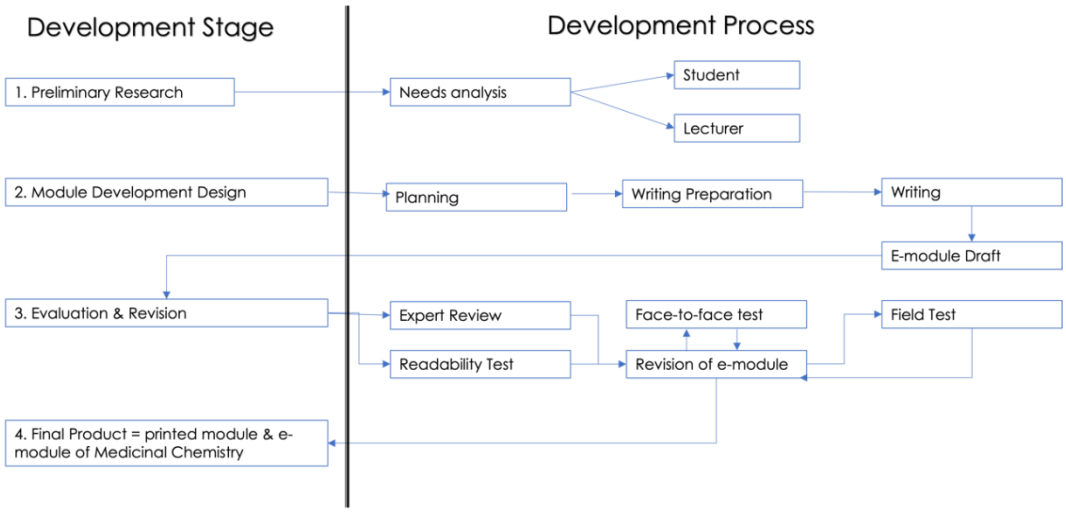

Figure 1. E-module Development Flow (Adapted from Nugroho et al. (2019))

The development of the e-module followed four main stages:

1. Preliminary Research
   This phase involved conducting a needs analysis through observations and surveys to identify learning difficulties, student preferences, and instructional media requirements related to the Medicinal Chemistry course. Respondents included both students and lecturers, aiming to gather qualitative and quantitative input for module planning.

2. Planning and Design
   Based on the needs analysis, six thematic e-modules were developed. Each module included learning objectives, structured content, formative exercises, and self-assessment tasks. The six main topics included:
   a) Functional Groups
   b) pH and pKa
   c) Salts and Solubility

d) Drug-Binding Interactions
e) Stereochemistry and Drug Action
f) Drug Metabolism

The content was aligned with the course syllabus and designed to support the implementation of the Team-Based Learning (TBL) approach.

3. Validation and Evaluation

The validation process was conducted through several stages:

Expert Review: The modules were assessed by two subject matter experts (Lecturers in Medicinal Chemistry with at least a Master's degree (M.Farm), responsible for evaluating content relevance, scientific accuracy, and pedagogical alignment) and one media design experts (A professional in instructional media design with experience in e-learning development, responsible for evaluating layout, visual structure, and interface usability). Ssing a structured evaluation instrument based on a Likert scale (Table 1). The instrument covered three aspects: content quality, instructional design, and visual appearance.

Table 1. Five level Likert Scale

Score Interval	Interpretation
0 - 19,99 %	Very poor
20 - 39,99%	Poor
40 - 59,99%	Fair
60 - 79,99 %	Good
80 - 100 %	Very Good

Readability Test: The Gunning Fog Index (GFI) was used to assess the readability of the text in each module. This test helps ensure that the content is appropriate for the target student reading level.

Face-to-Face Testing: A limited face-to-face trial was conducted with 30 students. Participants reviewed the modules and provided feedback on clarity, attractiveness, and ease of use through a perception questionnaire. Their input informed further revisions.

Field Testing: The final version of the e-modules was implemented in a real instructional setting with 50 students enrolled in the Medicinal Chemistry course. Feedback was collected using the same structured instrument, and results were analyzed to assess practical usability and student response.

4. Implementation

The final e-modules were used within a Team-Based Learning (TBL) instructional format. Students were required to study the modules before class. In class, TBL stages included:

a) Individual Readiness Assurance Tests (IRAT)
b) Group Readiness Assurance Tests (GRAT)
c) Application Exercises and Peer Feedback

To evaluate student perceptions, a combination of closed-ended Likert-scale questionnaires and open-ended reflections were used. Data were analyzed descriptively and interpreted using the same Likert scale as the expert review.

RESULT AND DISCUSSION

Preliminary Needs Analysis

The preliminary stage of this research involved a needs analysis to explore both student and lecturer perspectives on the use of printed and digital learning modules in the Medicinal Chemistry course. This analysis was conducted in the odd semester of the 2020/2021 academic year and included 52 students who had completed the course and 2 lecturers who taught the subject in the Applied Pharmacy Undergraduate Program. The needs analysis aimed to assess students' preferred learning resources, previous experiences with multimedia, and their openness to alternative forms of instruction. The results of the student survey are presented in Table 2.

Table 2. Student Needs Analysis Results (n=52)

Statement	Yes (%)	No (%)
Medicinal Chemistry material is difficult to understand	66.7	33.3
I enjoy learning only through printed books or modules	23.3	76.7
I have used other media (audio, visual, or audiovisual) in learning	96.7	3.3
I would enjoy learning if Medicinal Chemistry is presented with varied learning resources	96.7	3.3
I have seen Medicinal Chemistry material visualized through animations or simulations	86.7	13.3
Media that visually shows mechanisms, diagrams, or detailed explanations is interesting to me	96.7	3.3

Students clearly expressed a strong preference for varied and multimedia-based learning. Although familiar with printed resources, only 23.3% preferred using them exclusively. A vast majority (96.7%) had prior experience with or were interested in using audio, visual, or audiovisual learning tools. Most students indicated that such media made learning more engaging and easier to understand.

Table 3. Lecturer Feedback Summary (n=2)

Evaluation Aspect	Summary of Lecturer Response
Student reactions to Medicinal Chemistry	Majority find the course difficult and abstract
Student learning outcomes	Mixed; some good, many low
Preferred teaching strategies	Discussions with incentives for active participation
Recommended media	Video-based learning materials
Related courses that support this subject	Organic Chemistry and Pharmacology
Preferred independent learning resources	Textbooks and journal articles

Lecturers observed (Table 3) that students often struggled with the abstract nature of Medicinal Chemistry and that their learning outcomes varied significantly. To

boost motivation, they used discussion-based strategies and rewarded active participation. Both lecturers emphasized the need for visual and video-based materials to enhance comprehension.

These findings highlight the urgent need for multimedia-based instructional innovation, in line with the objective of this study to develop a digital e-module tailored to student learning characteristics. The student responses emphasize the importance of instructional variety, particularly in using visual and interactive learning tools that help demystify complex scientific content.

The results resonate with findings from Ardakani & Basheti (2018) and Li et al. (2022), who reported that Medicinal Chemistry is often perceived as difficult due to abstract content and lack of engaging instructional methods (Ardakani & Basheti, 2018; Li et al., 2022). Furthermore, Rusiadi (2020) argues that student passivity in the classroom is often a result of monotonous teaching techniques and limited media use (Rusiadi, 2020).). Students become disengaged when instructional media/methods are not varied.

The needs analysis conducted as part of this study confirms that both students and lecturers acknowledge benefits from the integration of digital and visual learning tools especially in courses where a complex understanding of chemical structures and mechanisms is required. Thus, a digital module designed with various visual aids and which incorporates a Team-Based Learning methodology is well justified and responsive to the learner's needs.

Planning and Development

The roles in the planning stage was the design of digital e-modules which was tailored based on the characteristics and needs of the Medicinal Chemistry students based on the results of the preliminary needs analysis findings. The e-modules were written following the Rowntree development model, especially the planning and writing stages that focus on setting learning objectives, defining the structure of the information and preparation of the learning activities. The e-module comprised six thematic submodules, each focusing on a key concept of Medicinal Chemistry (Each module was developed and exported into digital format (PDF), making it accessible via smartphones or computers. Visuals, infographics, and guided examples were included to improve comprehension and reduce cognitive overload.

The design of the e-modules was directly informed by the student and lecturer feedback collected during the needs analysis phase. The high demand for multimedia-rich and visually supported materials encouraged the development team to incorporate infographics, diagrams, and real-world examples into each submodule. The Rowntree model (1994) recommends that effective self-learning materials be organized in a modular format with clear objectives, concise explanations, and regular self-assessment opportunities. This method is consistent with a study by Agustian et al. (2024) and Manggala et al. (2024), which found that structured e-modules greatly influence learning autonomy and understanding, especially in science-related courses.

Table 4). The selection of topics was based on the syllabus and lecturer input. Each submodule was structured to include:

a) Learning objectives
b) Core theory explained with visuals and examples
c) Interactive questions
d) Summary points
e) Formative assessment or self-quiz

Each module was developed and exported into digital format (PDF), making it accessible via smartphones or computers. Visuals, infographics, and guided examples were included to improve comprehension and reduce cognitive overload. The design of the e-modules was directly informed by the student and lecturer feedback collected during the needs analysis phase. The high demand for multimedia-rich and visually supported materials encouraged the development team to incorporate infographics, diagrams, and real-world examples into each submodule. The Rowntree model (1994) recommends that effective self-learning materials be organized in a modular format with clear objectives, concise explanations, and regular self-assessment opportunities. This method is consistent with a study by Agustian et al. (2024) and Manggala et al. (2024), which found that structured e-modules greatly influence learning autonomy and understanding, especially in science-related courses.

Table 4. Structure and Content of the developed E-modules

Submodule Number	Title	Key Topics Covered
1	Functional Groups	Identification of functional groups in drug molecules, chemical properties, acidic and basic groups, functional groups in amino acids, DNA/RNA, classification of drugs into acids, bases, amphoteric, electrolytes, and non-electrolytes
2	pH and pKa	Definition of pH and pKa, Henderson-Hasselbalch equation, qualitative and quantitative problems related to pH/pKa, clinical relevance of pH and pKa
3	Salts and Solubility	Inorganic and organic drug salts, drug naming, solubility and partition coefficients, solubility evaluation, water/lipid solubility equilibrium, solubility strategies, and its influence on metabolism
4	Drug-Binding Interactions	Covalent and non-covalent interactions
5	Stereochemistry and Drug Action	Chirality, asymmetric carbon, enantiomers, diastereomers, geometric and conformational isomers
6	Drug Metabolism	General concept of drug metabolism, Phase I (oxidation, reduction, hydrolysis) and Phase II (conjugation) processes, summary of drug biotransformation

Furthermore, each module was intentionally designed to support the Team-Based Learning (TBL) strategy. Moreover, each module was specifically structured to align with the Team-Based Learning (TBL) strategy. The modular layout allows students

to pre-class self-learn and allows the lecturers to promote higher critical thinking skills during in-class group sessions, a learning model that has been shown to be impactful in pharmacy education (Arumugam et al., 2024).

Validation and Evaluation

The validation and evaluation stage were designed to ensure that the developed e-module was of high quality, accessible, and suitable for use in the Medicinal Chemistry course. This process involved expert validation, a readability test (Gunning Fog Index), face-to-face testing, and field testing.

a. Expert Review

To assess the e-module's quality, a validation was conducted by:

1) Two content experts, focusing on material relevance and instructional effectiveness.
2) One media expert, assessing layout and visual presentation.

Each expert used a 12-item rubric to evaluate specific aspects. The results are summarized in Table 5 below:

Table 5. Expert Validation Results

Aspect	Score (%)	Category
Content/Material	83.3	Very Good
Instructional Design	85.3	Very Good
Visual Appearance (Media)	80.8	Very Good
Average	83.1	Very Good

These results indicate that the module met high-quality standards in both content and design, with all scores falling within the "Very Good" category. The feedback from experts led to several revisions, including improving image clarity, reorganizing topic flow, and simplifying terminology.

b. Face-to-Face Test

A limited face-to-face trial involving 30 students was conducted to evaluate user experience and usability (
Table **6**).

Table 6. Face-to-Face Student Evaluation Results

Aspect	Score (%)	Category
Content/Material	94.4	Very Good
Instructional Design	94.3	Very Good
Visual Appearance (Media)	94.5	Very Good
Average	94.4	Very Good

Student responses indicated high satisfaction with the e-module. Several students suggested enriching the material with video content or animations, which was considered in later revisions.

c. Readability Test (Gunning Fog Index)

To ensure the text's accessibility, a Gunning Fog Index (GFI) calculation was conducted on each e-module chapter (
Table 7). The method included determining sentence length and word complexity.

Table 7. Gunning Fox Index Scores

Subtopic	Fog Index
Functional Groups	10.1
pH and pKa	11.3
Salts and Solubility	10.6
Drug-Binding Interactions	8.5
Stereochemistry and Drug Action	10.4
Drug Metabolism	7.8
Average	9.8

The overall average GFI score of 9.8 indicates that the e-module is appropriate for undergraduate-level readers. Although scores did not fall below 8 (as per universal text standards), they are well within acceptable limits for academic materials, particularly in health sciences where complex terminology is common. This aligns with Yaffe (2022), who reported that GFI scores between 9 and 12 are suitable for higher education (Yaffe, 2022). Similar observations were made by Świeczkowski & Kułacz (2021) regarding low readability scores in pharmaceutical materials due to technical jargon (Świeczkowski & Kułacz, 2021).

d. Field Testing

Following expert validation and face-to-face testing, a field test was conducted with 50 students in the 2021/2022 academic year (
Table 8). The revised module was implemented during the Medicinal Chemistry course, and students evaluated it based on the same three aspects.

Table 8. Field Test Evaluation Results

Aspect	**Score (%)**	**Category**
Content/Material	90.8	Very Good
Instructional Design	91.1	Very Good
Visual Appearance (Media)	92.8	Very Good
Average	91.6	Very Good

The high average score in the field test confirmed that the module was ready for full implementation in regular classroom settings.

The multi-level evaluation process reinforced the validity and effectiveness of the e-module. All validation stages—expert, student-based, and readability analysis—placed the module in the "Very Good" category. These findings reflect the importance of comprehensive instructional design, as suggested by Rowntree (1994) and supported by Nugroho et al. (2019). The GFI score, though slightly above universal thresholds, was still acceptable for the target audience and mirrored challenges commonly found in pharmaceutical education materials (Świeczkowski & Kułacz, 2021). The findings also support those of

Fadillah et al. (2024) and Manggala et al. (2024), who found that validated, readable e-modules positively impact learner engagement and understanding. Revisions based on expert and student feedback significantly enhanced the instructional quality, confirming that iterative evaluation improves both content delivery and learner satisfaction.

Implementation

The implementation phase involved the use of the validated e-module in an actual learning environment using the Team-Based Learning (TBL) approach. This was conducted in the 2021/2022 academic year with 50 students enrolled in the Medicinal Chemistry course. Students accessed the e-module prior to in-class sessions and were required to complete the content independently. The TBL model used consisted of the following stages:

1. Preparation Stage; Students read and reviewed the e-module at home to prepare for class.
2. Readiness Assurance Process consist of Individual Readiness Assurance Test (IRAT) and Group Readiness Assurance Test (GRAT). These tests were used to assess students' understanding of the e-module content both individually and collaboratively.
3. Application and Feedback; Students worked in small teams to solve complex application problems. Teams used answer cards to respond and justify their answers, followed by class discussion and feedback.

To evaluate the impact of the implementation, a student perception questionnaire was distributed. The questionnaire included four main domains:

a) Domain 1: Content of the e-module
b) Domain 2: Implementation of TBL
c) Domain 3: Effectiveness of each TBL stage
d) Domain 4: Impact on learning outcomes and motivation

Table 9. Student Perception on TBL

Domain	Average Score (%)	Category
E-module content	88.9	Very Good
Implementation of TBL	84.4	Very Good
Effectiveness of each TBL stage	82.1	Very Good
Impact on learning outcomes and motivation	83.9	Very Good

The results from

Table ***9*** show that students had a positive perception across all domains, particularly appreciating the collaborative nature and structured flow of TBL, as well as the clarity and usefulness of the e-modules.

Open-ended responses also highlighted the following:

"*The module is interactive, simple, and easy to understand. I especially liked the team discussions because they helped me think more critically*."

"*The activities using color-coded cards were fun and made the session more engaging*."

"*Some topics are hard to visualize. It would be great to have videos for metabolism and stereochemistry*."

The implementation of e-modules within the TBL framework proved effective in increasing student engagement and comprehension. The structured approach allowed students to actively construct knowledge, while the modular design enabled self-paced pre-class preparation. This structured approach allowed students to engage in an active construction of knowledge, while the modular curricular design permitted pre-class preparation at a pace that suited each student. The results are consistent with the work of Arumugam et al. (2024) and Methaneethorn & Methaneethorn (2022), emphasized the advantages of TBL in medical and pharmaceutical education, particularly in fostering collaborative skills and critical thinking (Arumugam et al., 2024; Methaneethorn & Methaneethorn, 2022). Moreover, the positive reception of the e-module content reinforces the importance of designing instructional media that is not only scientifically accurate but also accessible, visual, and student-centered**.** The feedback regarding the inclusion of video or animated content may serve as a valuable input for future revisions and multimedia integration.

The addition of a e-module within the TBL framework was particularly successful in enhancing student motivation and engagement**.** This effectiveness can be attributed to the complementary design between the modular content and the TBL instructional approach**.**

E-Module Features That Enhance Motivation

Several features of the e-module directly contributed to improving students' interest in the subject:

1. Interactive Structure; Each module begins with clear learning objectives, followed by short, visually supported theoretical explanations. This structure helped students understand *what they were expected to learn* and *why it matters*, a key principle in goal-setting theory of motivation (Locke & Latham, 2002).
2. Contextual Examples and Visuals; The modules included drug structure diagrams, metabolic pathways, and clinical correlations, making the content more relatable and less abstract. This aligns with Cognitive Theory of Multimedia Learning (Mayer, 2009), which emphasizes that visual explanations enhance mental model formation.
3. Self-Assessment Activities; Embedded quizzes and reflective questions in each submodule allowed students to monitor their own learning, promoting self-efficacy, which is a critical component of intrinsic motivation (Bandura, 1997).
4. Concise Segmentation; Each submodule was divided into short, focused sections, reducing cognitive overload. This "chunking" of information has been shown to improve learner persistence and engagement (Clark & Mayer, 2011).

These features collectively supported a more student-centered learning experience, providing autonomy and control over learning pace, which is key to promoting autonomous motivation as described in Self-Determination Theory (Deci & Ryan, 2000).

Role of TBL Syntax in Enhancing Engagement

The effectiveness of the e-module was further amplified by the integration of TBL, which offers a collaborative and structured learning environment that complements individual pre-class preparation. The TBL method applied in this study followed the standard syntax:

1. Pre-Class Preparation; Students were required to study the e-modules before class. This encouraged accountability and ownership of learning, which in turn increases engagement during in-class activities.
2. Readiness Assurance Process (IRAT & GRAT); These assessments ensured students reviewed the material and were ready to apply it. The peer discussions during GRAT fostered social interaction and reinforced understanding through explanation and argumentation.
3. Application Exercises; Students worked in teams to solve real-world clinical scenarios related to the material. This relevance to future professional roles increased perceived task value, an important driver of motivation according to Expectancy-Value Theory (Wigfield & Eccles, 2000).
4. Immediate Feedback and Team Competition; The use of colored answer cards, scoreboards, and structured feedback added a game-like element, increasing extrinsic and intrinsic motivation through challenge, recognition, and fun.

By combining individual responsibility (e-module) with **c**ollaborative application (TBL), this approach effectively addressed multiple motivational dimensions—including autonomy, relatedness, competence, and relevance—resulting in sustained attention and deeper engagement.

CONCLUSION

This study successfully developed and implemented a digital e-module for the Medicinal Chemistry course using the Rowntree development model integrated within a Team-Based Learning (TBL) framework. The preliminary needs analysis confirmed that students and lecturers required more engaging, multimedia-based resources to overcome the perceived complexity of the subject. The resulting e-module, composed of six well-structured submodules, underwent comprehensive validation through expert reviews, readability assessments, face-to-face testing, and field trials. All evaluations categorized the module as "Very Good" in content, instructional design, and visual presentation. The readability analysis further confirmed the suitability of the text for undergraduate-level students.

When implemented through TBL, the e-module demonstrated its effectiveness not only in improving comprehension but also in significantly enhancing student motivation and participation. The integration of the self-driven, visual, and interactive formats of the e-module with the TBL's team-based group dynamics created a participative, scaffold-based learning environment that led to improved engagement and overall learning satisfaction among students. As the e-module demonstrates solid validation results and students' positive reception, it is encouraged for a wider application also in similar scienced-based courses. Further studies could investigate the incorporation of multimedia enhancements like video

and simulations or longitudinal studies on learning retention and professional application.

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Development of iSpring Suite 11 to train students' numeracy literacy through problem posing

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Abstract

Learning of direct and indirect proportions continues to face significant challenges, as many students struggle to grasp the fundamental concepts and their applications. A lack of relevant interactive learning media is one factor that affects students' conceptual understanding and numerical literacy skills. This study aims to develop iSpring Suite 11 learning media, focusing on the validity and practicality of the media while identifying students' numerical literacy categories and stages of problem posing. Validity and practicality are prioritized to ensure that the media meet academic and pedagogical standards and are easy to implement. Initial feedback is essential for improvement before evaluating the media's effectiveness. The research employs a Research and Development (R&D) methodology using the PPE model. Subject matter experts and media specialists conducted media validation, supplementing it with small- and large-scale trials to assess practicality. The results indicate that iSpring Suite 11 learning media demonstrate high validity and practicality, as evaluated by material and media experts. Among the 70 participating seventh-grade students, 21 exhibited high numeracy literacy, 31 were categorized as medium, and 18 were identified as low. An analysis of problem-posing stages revealed that 71.42% of students were in the pre-solution posing stage, 15.71% were in the within-solution posing stage, and only 12.85% achieved the post-solution posing stage. These findings suggest that, although the media have been validated as both valid and practical, further research is necessary to measure their effectiveness in enhancing students' numeracy literacy through pre- and post-test evaluations.

Keywords: ISpring Suite; Learning Media; Numeracy Literacy; Problem Posing.

INTRODUCTION

In an era marked by rapid changes and high complexity, education plays a vital role in preparing young generations to face the challenges of the 21st century. In today's world, where information changes quickly (Najah et al., 2024) and global situations are becoming more complicated, being good with numbers has gone from just a basic skill to an important ability that greatly affects how competitive a person is in the global market.

Literacy today is no longer confined to reading and writing skills (Najah et al., 2024). It also encompasses deeper abilities such as understanding, analyzing, and communicating information in various formats and contexts (Maslihah et al., 2020; Mukhlis et al., 2023). This expanded concept of literacy highlights the importance of critical thinking skills, enabling individuals to process information wisely and effectively share their insights, thus fostering collaboration and innovation. Meanwhile, numeracy serves as a foundational skill to equip individuals with logical, systematic, and analytical thinking abilities (Cababat & Pespeñan, 2023). Numeracy not only facilitates the translation of reality into mathematical concepts but also requires structured problem-solving and decision-making based on valid data and facts. These competencies are key to addressing various complex situations in the real world, ranging from solving everyday problems to conducting in-depth data analysis in professional contexts. The ability to read, write, and calculate are essential skills that significantly impact a person's competitiveness in today's modern world (Gloriani et al., 2023). Literacy involves understanding, analyzing, and communicating information across various formats and contexts, closely tied to critical thinking and the ability to process data wisely. Numeracy involves logical, systematic, and analytical thinking to translate real-world situations into mathematical concepts. This empowers individuals to solve problems methodically and make informed decisions based on reliable data. Unfortunately, there is a gap between the competencies demanded and the current state of mathematics education. For example, the Program for International Student Assessment (PISA) reported that Indonesian students' numerical literacy remains below the international average (OECD, 2023). This report highlights that many students in Indonesia still struggle to understand and apply basic mathematical concepts, impacting their ability to compete globally.

The results of the initial observation also indicate that the numeracy literacy of seventh-grade students at MTs PUI Talaga, West Java, is low. They face difficulties in analyzing basic mathematical concepts and applying them in various situations, including topics related to everyday life, such as the material on direct and inverse proportions. This material is part of the mathematics curriculum for seventh-grade students and often presents challenges, especially in its application to practical contexts. One of the reasons for low numeracy literacy among seventh-grade students at MTs PUI Talaga is the lack of availability of interactive learning media that are relevant to real-life contexts.

To solve this problem, this study aims to create and use effective learning tools with iSpring Suite 11 to improve seventh-grade students' understanding of numeracy, especially regarding direct and inverse proportions. Similar research conducted previously has largely focused on the development of iSpring Suite learning media (Huda & Mulyani, 2024; Isnaniah & Imamuddin, 2020; Pradja et al., 2024; Sari et al., 2023) to train students' abilities in mathematical representation, creative thinking, and critical thinking (Adhalia & Susianna, 2021; Cai & Leikin, 2020; Gustiana et al., 2024) regarding algebraic function derivatives (Samudro et al., 2022).

The findings from various studies indicate that technology-based learning media, particularly those using the Android platform and iSpring Suite, have proven to be effective and suitable for use in mathematics education. For example, the research results of Huda & Mulyani (2024) show that the learning media developed for the topic of lines and angles have a high level of validity and are engaging for students. Isnaniah & Imamuddin (2020) proved that the use of manipulative media can enhance students' understanding of mathematical concepts at the elementary school level. Pradja et al. (2024) concluded that interactive teaching materials based on the Realistic Mathematics Education (RME) approach are capable of developing students' creative thinking skills. Sari et al. (2023) found that the use of iSpring Suite is quite effective in improving the mathematics skills of MTs-level students. Furthermore, Adhalia & Susianna (2021) emphasize that the use of visual media can enhance students' problem-solving abilities, creative thinking, and reasoning. Meanwhile, Cai & Leikin (2020) highlight the importance of the affective aspect in the process of formulating mathematical problems. The research by Gustiana et al. (2024) and Samudro et al. (2022) also demonstrates success in developing Android-based learning media with high levels of validity and practicality, which are effective in training mathematical representation skills and understanding the concept of algebraic function derivatives.

Overall, the results of the research indicate that iSpring Suite-based learning media are proven to be valid, practical, and effective in enhancing various mathematical abilities of students, such as conceptual understanding, mathematical representation, creative thinking, critical thinking, and problem-solving. This media also received positive responses from students and was deemed highly suitable by experts. The use of iSpring Suite has been applied to various subject topics, ranging from lines and angles and operations with fractional numbers to derivatives of algebraic functions, and has proven to support an interactive and contextual learning process.

However, no one has used iSpring Suite 11 media for the material on proportional and inverse ratios to train students' numeracy literacy. Previously, researchers explored numeracy skills and mathematical connections using iSpring Suite 11 (Marliani et al., 2024). This research offers a solution by developing valid and practical learning media based on iSpring Suite 11 and integrating it with the problem-posing method. The integration of the problem-posing method into media based on iSpring Suite 11 technology has not been extensively explored before. With this approach, it is hoped that students will not only learn to understand mathematics but also be able to apply it in various real-life contexts. The contribution of this research is to provide practical guidelines for educators and media developers to enhance numeracy literacy through interactive technology. Additionally, this research can serve as a reference for education policymakers in promoting the adoption of technology in the classroom.

METHODS

The method used in this research is research-and-development (R&D). Nurhayati et al. (2023) define R&D as a series of stages in developing new products and improving existing products, the results of which can be measured and accounted for. One of the development models Applied in this study is the PPE (*Planning, Production, and Evaluation*) model proposed by Richey et al. (2011). The PPE model is very suitable for the development of learning media because of its simple stages but still includes the process of product testing and revision (Nurhayati et al., 2024). Figure 1 shows the stages of the PPE model adopted from Richey et al. (2011).

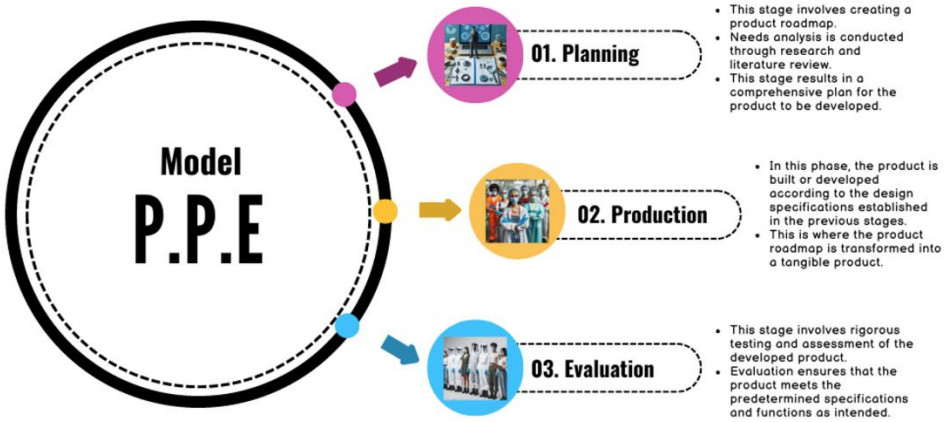

Figure 1. Stages of P.P.E

The data collected at the planning stage was obtained through a needs analysis after initial observations at MTs PUI Talaga. This observation involved in-depth interviews with all math teachers for grade VII and the principal, with the aim of identifying urgent learning needs. The results of this analysis became the basis for developing an appropriate intervention program, tailored to the needs of teachers and students, as well as the relevance of the curriculum applied at school.

At the production stage, interactive learning media based on iSpring Suite 11 is developed according to the results of the needs analysis at the planning stage. This production process includes the creation of media equipped with interactive elements such as videos, quizzes, and numerical simulations, designed to train the numeracy literacy of grade VII students through problem posing.

The evaluation stage was conducted to (1) implement the media that had been validated by experts to determine the level of practicality and (2) train students' numeracy literacy with the problem-posing method using iSpring Suite 11. We carried out the implementation in two groups: a small group with 10 participants and a large group with 25 participants. The participants were seventh-grade students from MTs PUI Talaga, West Java. The criteria for selecting these students included their current performance in mathematics and their availability to participate in the study. The small group consisted of students who demonstrated varied levels of numeracy literacy, ensuring a representative sample for initial testing. The large group included a broader range of students to further validate the findings.

The implementation followed a structured procedure. In the small group trial, the interactive learning media was first introduced to the students, followed by guided usage sessions where students interacted with the media under the supervision of the researchers. Feedback and performance data were collected through questionnaires and direct observations. This process helped identify any issues and gather initial insights into the media's practicality. For the large group trial, the procedure was similar but scaled up to accommodate more participants. This group was also composed of seventh-grade students from the same school, selected based on similar criteria as the small group. The larger trial aimed to validate the findings from the small group and provide a more comprehensive assessment of the media's effectiveness. We then analyzed the data collected from the small group trial. The results of this analysis will be the benchmark to determine whether the learning media is suitable for testing in large groups or still requires improvement before being tested again in small groups.

This study used instruments in the form of validation sheets, student response questionnaires, and essay questions related to comparable and inverse value materials. Two expert lecturers carried out the validation, using the average formula score to assess the feasibility of media learning. The formula to calculate the average validation score is as follows:

$$V = \frac{\sum \quad X}{N} \times 100\%$$

Description:
V = value
X = score obtained
N = maximum score

The main purpose of this learning media validation is to ensure that the developed media is suitable for use in the learning process or requires improvement before it is applied. In this validation process, assessment criteria are used that have been modified from the assessment model proposed by Sugiyono (2017). The modification was made to update the assessment categories to better suit the context and needs of the research. The original assessment model by Sugiyono includes criteria such as content validity, construct validity, and usability. These criteria were adapted to fit the specific context of this study, which focuses on the development and practicality of interactive learning media. The modified assessment criteria are as follows:

1. Content Validity: Evaluates the relevance and accuracy of the learning material content in relation to the curriculum objectives.
2. Construct Validity: Assesses the alignment of the interactive media with the theoretical constructs it aims to measure, such as numeracy literacy and problem-posing skills.
3. Usability: Measures the ease of use and practicality of the learning media for both students and teachers.

These modifications were necessary to align the assessment with the unique characteristics of iSpring Suite 11 and the specific educational goals of the study.

In addition, the percentage results of the assessment given by material experts and media experts will be interpreted in accordance with the learning media feasibility criteria adapted from Dewi & Izzati (2020). These criteria provide an overview of the level of feasibility of the learning media tested so that it can be used as a reference in determining whether the media is feasible to be applied in the learning process. Table 1 shows the score criteria used by media experts and material experts in assessing the validity of the media.

Table 1. Media and material expert score criteria and feasibility criteria media

Student Score Criteria		Media Practicality Criteria	
Score	Criteria	Score	Criteria
5	Very Good	$80\% < x \leq 100\%$	Very Valid
4	Good	$60\% < x \leq 80\%$	Feasible
3	Fair	$40\% < x \leq 60\%$	Decent Enough
2	Less	$20\% < x \leq 40\%$	Not Feasible
1	Not Good	$0\% < x \leq 20\%$	Very Unfit

The "Student Score Criteria" in Table 1 refers to the assessment categories used to evaluate students' understanding and responses to the developed learning media. These scores reflect the level of acceptance and ease with which students use the media. A score of 5 (Very Good) indicates that students fully understand and can optimally use the media, while a score of 4 (Good) indicates that students understand and use the media well, although there may still be minor issues. A score of 3 (sufficient) implies that students have an adequate understanding but still require further guidance. Meanwhile, a score of 2 (Poor) indicates that students have trouble understanding or using the media, and a score of 1 (Very Poor) denotes that students do not understand or cannot use the learning media well. This assessment serves as the basis for evaluating the effectiveness of the learning media and determining whether improvements are needed before wider implementation. Similarly, the media practicality criteria in this table include five levels: Very Suitable ($80\% < x \leq 100\%$), Suitable ($60\% < x \leq 80\%$), Suitable ($40\% < x \leq 60\%$), Unsuitable ($20\% < x \leq 40\%$), and Very Unsuitable ($0\% < x \leq 20\%$). This evaluation helps in assessing how suitable the media is for use and whether further improvements are necessary based on the percentage of suitability.

After validation, if the media is not valid, improvements are made according to the validator's suggestions, then retested until it meets the valid criteria. The assessment of student responses to the use of iSpring Suite 11 media is used to assess the practicality of learning media. The media is considered practical if student responses are in the range of $\mathbf{60}\% \leq \boldsymbol{x} \leq \mathbf{80}\%$. Data were collected through a questionnaire adapted from Dewi & Izzati (2020), then converted into quantitative data for statistical analysis. Table 2 presents

the criteria for student response questionnaire scores as well as the criteria for the practicality of the learning media used in this study.

Table 2. Response questionnaire score criteria and media practicality criteria

Student Score Criteria		Media Practicality Criteria	
Score	Criteria	Score	Criteria
4	Strongly Agree	$80\% < x \leq 100\%$	Very Practical
3	Agree	$60\% < x \leq 80\%$	Practical
2	Disagree	$40\% < x \leq 60\%$	Moderately Practical
1	Strongly Disagree	$20\% < x \leq 40\%$	Not Practical
		$0\% < x \leq 20\%$	Very Not Practical

The results of this analysis help evaluate the practicality of the media and are used as the basis for further development.

The essay questions were used to train numeracy literacy skills and concept understanding through iSpring Suite 11 interactive learning media. They were also used to evaluate learners' numeracy literacy skills, which were then categorized as high, medium, or low. The numeracy literacy score is calculated using the formula:

$$NP = \frac{R}{SM} \times 100$$

Description:

NP : value

R : score obtained

SM : maximum score

100 : fixed number

The mean score and standard deviation were calculated using the formula:

$$\underline{X} = \frac{Total}{Score\ Maksimum} \times 100\%$$

The classification of numeracy literacy levels follows the criteria from Fadillah & Ni'mah (2019) and is shown in Table 3.

Table 3. Classification of numeracy literacy level

Formula	Category
$x \geq (\mu + 1\sigma)$	High
$(\mu - 1\sigma) \leq x < (\mu + 1\sigma)$	Medium
$x < (\mu - 1\sigma)$	Lower

Description:

x : student score

μ : distribution mean

σ : standard deviation

RESULT AND DISCUSSION

The results of the analysis of this media development are explained based on the PPE development steps taken, namely the planning, production, and evaluation stages. The results obtained at each stage are described as follows:

Planning

The planning stage aims to identify and analyze the needs to overcome the problems found during the initial observation. The steps in this stage include needs analysis, curriculum analysis, and analysis of teaching materials that have been used.

Data for needs analysis was obtained through questionnaires and interviews with teachers at MTs PUI Talaga, Majalengka Regency, West Java. The results of the analysis show that students need media or teaching aids that are equipped with educational and interactive games. The media aims to explain abstract concepts more concretely. The results of this analysis are in line with the research of Winkel & Zipperle (2023), which shows that students' limited working memory can be an obstacle in understanding complex mathematical concepts. Therefore, teachers are advised to ensure that teaching materials or learning media provide concrete representations of abstract concepts. These representations can be realized through physical or virtual manipulatives so that students can relate new information to existing knowledge.

The results of the curriculum analysis show that MTs PUI Talaga has implemented the Merdeka Curriculum. In the Merdeka Curriculum, especially in Phase D (grades VII-IX), one of the mathematics learning outcomes states that students can understand and use ratios and proportions to solve problems in various contexts of everyday life. Direct and indirect proportion are a major part of the concept of ratio and proportion, so it has a direct link to these learning outcomes. Based on these learning outcomes, more operational learning objectives are formulated. By analyzing the Merdeka Curriculum, it can be seen how this material is integrated and contributes to the achievement of learning objectives. In addition, the Merdeka Curriculum emphasizes student-centered contextual learning, making this material very relevant, especially to strengthen numeracy skills.

This is in line with the opinion of Sasmita et al. (2024), which emphasizes the importance of effective and aligned planning, implementation, and evaluation of learning with the Merdeka Curriculum. Optimal implementation requires teaching materials that align with curriculum objectives and adequate technological support for teachers. Additionally, teaching materials must support problem-posing activities to sharpen students' numerical literacy and maximize the use of technology, such as iSpring Suite 11. Currently, many grade VII students are still limited in their use of interactive technology other than PowerPoint, making the integration of more advanced technology an urgent need to improve the quality of learning.

This research's findings align with previous studies showing that low numerical literacy among students is caused by a lack of interactive and contextual learning media (Isnaniah & Imamuddin, 2020; Marliani et al., 2024). However, this study

offers a more innovative approach by integrating the problem-posing method into the iSpring Suite 11 learning media, an approach that has not been extensively explored in previous research.

The uniqueness of this approach is supported by research from Cai & Leikin (2020) and Erdoğan & Gül (2020), which shows that problem-posing can enhance students' conceptual understanding and critical thinking skills. Thus, this research contributes to new developments in technology-based learning media with the problem posing approach to improve students' numerical literacy.

Production

After the data regarding the needs, curriculum, and teaching materials were analyzed and collected, the next step was to design the iSpring Suite 11 learning media. In the process of developing this media, the developer utilized hardware in the form of a dual-core processor with a speed of more than 2.0 GHz, as well as 4 GB of memory (RAM). This step is in line with the minimum specification recommendation from iSpring Solutions (2024), which mentions the requirements to run iSpring Suite optimally, including a processor with a minimum specification of Dual-Core 2.0 GHz, 4 GB of RAM, and a Windows 7, 8, 10, or 11 operating system. In addition, iSpring Suite supports content playback on mobile devices based on Android version 7 and above, including Android version 11 used in this development. By meeting these specifications, the designed interactive learning media is expected to function optimally and be compatible with various user devices.

The navigation flow and flowchart of this learning media start from the opening page to the main menu, which offers four main options: learning outcomes and objectives, learning, games, and reflection. In addition, there are additional buttons for information and guidance. Each section has a specific function to guide users in this interactive learning process. The statement is presented in Figure 2.

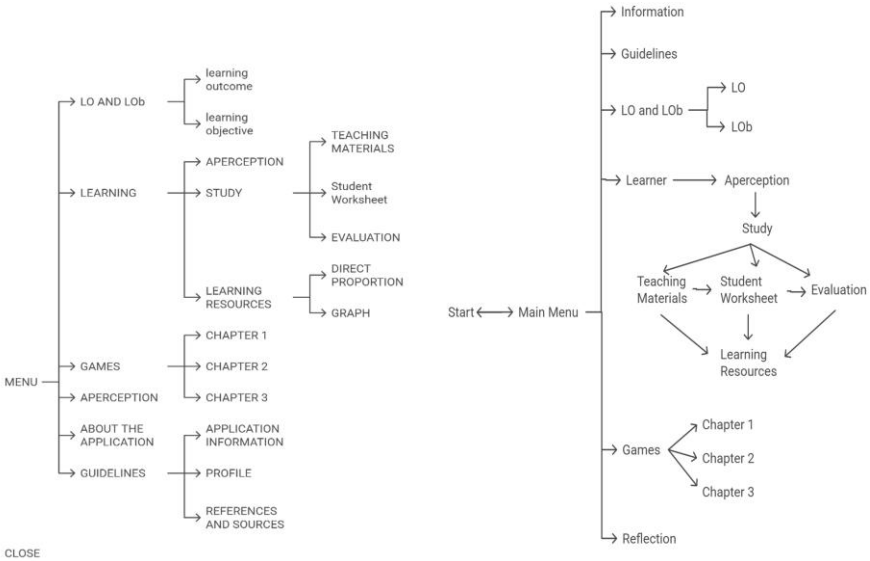

Figure 2. Navigation structure and process flowchart

Each page in this learning media has an important role that supports the other to create a systematic learning flow that is easy for users to follow. The main menu is the starting point, followed by the learning outcomes and objectives pages that display the learning outcomes and objectives, especially the comparative value material. The Learning menu includes three sub-menus: Apperception, Learning, and Learning Resources. The Apperception section is designed to prepare students to understand the basic concepts of ratio and cross-multiplication of fractions, while Learning guides students through contextual problems related to equal comparison. Learning Resources provides additional supporting materials. The learning process continues with contextual simulations on the Games page that reinforce understanding through interactive games. Afterwards, students do an individual evaluation to measure their understanding of the material. The Reflection page ends the learning by giving students the opportunity to provide feedback and assess their learning experience through a questionnaire.

After creating the navigation structure, flowchart, page content, and teaching materials, the next step is to design a storyboard as a guide in developing interactive learning media assisted by iSpring Suite 11 called MathFarm. The storyboard includes various important elements, such as the home page, main menu, information, profile, reference, and instructions, as well as pages related to the learning process and evaluation. After the initial design, revisions were made based on learning content expert input to add an apperception menu. Next, prepare the learning media by collecting elements such as images (through Canva), animated videos, audio (sound effects and background), and learning materials. This learning media was designed using iSpring Suite 11, integrated with PowerPoint, then exported into HTML5 format and converted to application format (.apk) using Website 2 APK Builder. Each element is arranged according to the storyboard and presented on several slides.

The learning menu uses the problem-posing method, where students work on quizzes that include teaching materials, student worksheet, and evaluations, with feedback and scores sent to the developer's email. The initial product of this learning media was validated by material and media experts. The important parts of the learning media product that has been produced are presented in Figure 3.

Figure 3. Main components of Ispring Suite 11 learning media

Figure 3 including:

1. Home Page: Displays a description of the application and buttons to start and exit.
2. Main Menu Page: Contains buttons, instructions for use, and menu options such as learning outcomes and objectives, learning, games, and reflection.
3. Information Menu Page: Contains application information, developer profile, and references.
4. Learning Page: Provides teaching materials, student worksheet, evaluations, and learning resources.
5. Assessment Page: Displays the scores obtained by students after completing the quiz.
6. Games Page: Menu of games that students can access after learning.
7. Reflection Page: Contains a questionnaire as a reflection material at the end of learning.

After the learning media is prepared based on the storyboard and flowchart, the media is submitted to the validator to be assessed for its feasibility aspects. Diagram 1 is the result of the assessment from the validator along with suggestions for improvement.

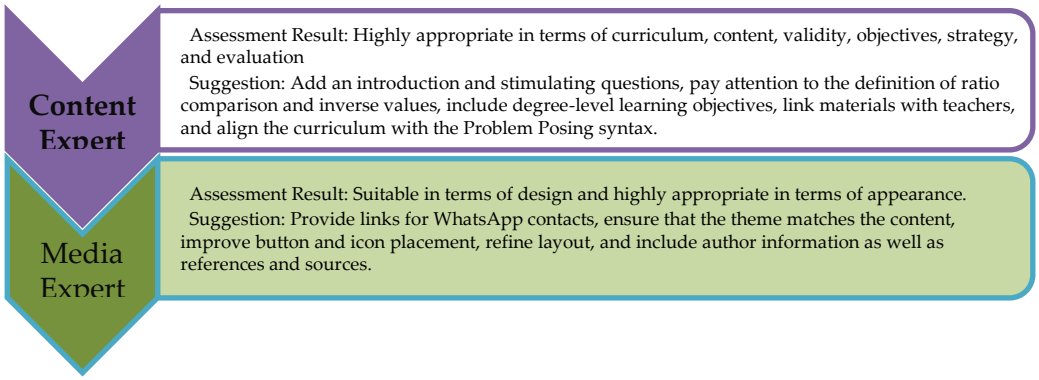

Diagram 1. Main components of iSpring Suite 11 learning media

Diagram 1 above illustrates the evaluation of the learning media by two validators—content experts and media experts. Content experts assessed that the iSpring Suite 11 media is highly suitable for use because it aligns with the curriculum, is relevant to the content, supports the achievement of learning objectives, employs appropriate strategies, and provides assessments in the form of questions tailored to the needs of MTs PUI Talaga students. This media is also considered strategic in assisting the teaching and learning process. The evaluation includes recommendations for improvement, such as adding an engaging introduction, providing clearer explanations of the concepts of ratio and inverse value, and aligning with the Problem Posing syntax to enhance students' numeracy literacy.

Media expert evaluated that iSpring Suite 11 has an appropriate design and excellent visual appearance; however, several suggestions for improvement were made. These improvements include providing a WhatsApp contact link to facilitate communication, ensuring that the visual theme is consistent with the

content for better integration, and improving the layout of buttons and icons to enhance navigation. Additionally, the overall layout of the media is recommended to be neater and more professional. Adding information about the author, such as identity and credentials, is also considered important to enhance credibility. Finally, the media should include references and sources for the content to strengthen the validity of the presented material. These suggestions aim to improve the functionality and appeal of the learning media.

Diagram 1 is the shape of the product before and after revision. The revised media was returned to the validator to be assessed. If the results get a score that falls into the 'valid' category, then the media can be tested. This is consistent with Hartell & Strimel (2019), who found that iterative feedback significantly enhances the usability of educational tools. Similarly, Purbasari & Khabibah (2019) highlighted the critical role of validation in refining media content. Our findings are also in line with Sumarsono et al. (2023), who emphasized that thorough evaluation and adjustments based on feedback improve the effectiveness of educational media. However, unlike previous studies that primarily focused on initial validation, our study extended the validation process by incorporating multiple cycles of feedback and refinement, which may explain the higher levels of student engagement and satisfaction observed in our results. This iterative approach highlights the dynamic nature of media development and the importance of continuous improvement. Good validation ensures that the media meets the quality and effectiveness standards needed to support learning so that its use in trials can provide optimal results in accordance with the desired educational objectives.

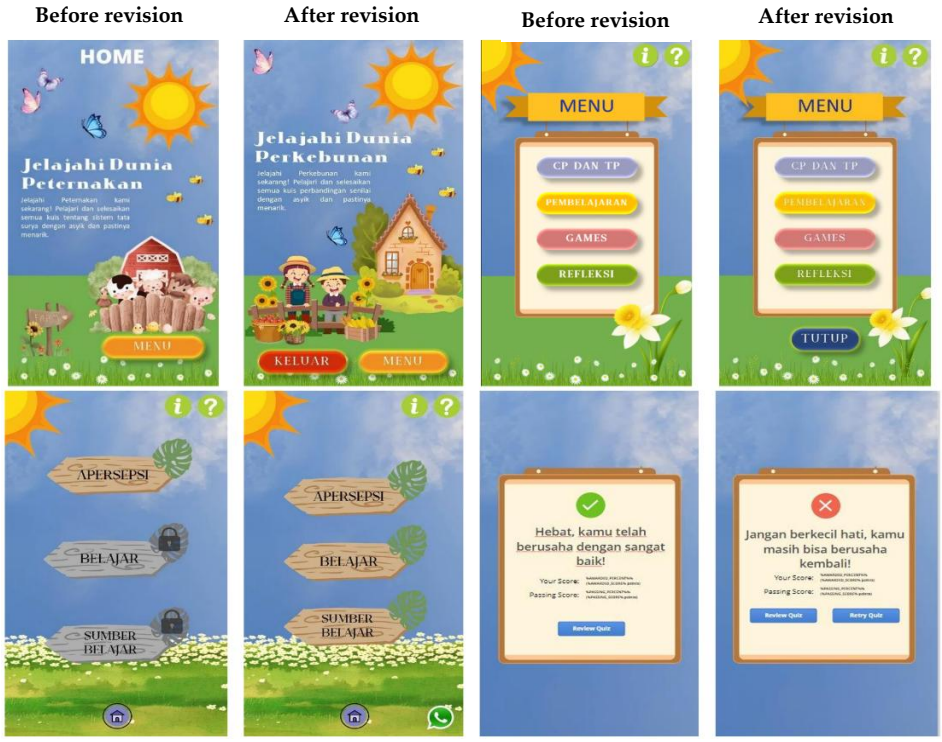

Figure 4. Media before and after revision

Figure 4 above explains home screen. In the initial home screen design, the theme displayed was "explore the world of farming," featuring images of barns and livestock. This design conveyed a rather simple impression, especially with the orange-colored "menu" button. However, after revision, the app theme changed to "explore the world of plantations," which is more relevant to the content presented. The images of farmers and gardens introduced a fresher atmosphere. Additionally, the inclusion of orange-colored "exit" and "menu" buttons provided clearer and more intuitive navigation options for users.

Menu Screen. Before the revision, the menu screen featured a blue background with buttons such as "learning outcomes and objectives," "learning," "games," and "reflection," creating a monotonous appearance. Although the "close" button was positioned at the bottom, the overall design felt less engaging. After revision, the menu design became brighter with the addition of flower icons, giving it a fresher and more appealing look. Although the buttons remained the same, the improved visual design enhanced the app's appeal and user experience.

Content Navigation. In the initial content navigation screen, three options were displayed: "aperception," "learning," and "learning resources," accompanied by lock icons indicating locked features. This could confuse users, especially those wanting to explore all content. However, after revision, the design became more attractive with the addition of leaf icons, and "learning resources" were now unlocked, providing better access for users. These changes not only improved aesthetics but also facilitated navigation within the app.

Feedback Screen. In the initial feedback screen, the app displayed negative messages if the user failed, along with a "retry quiz" button that could discourage learning. This might make users feel less motivated to continue. After revision, the feedback screen became more positive, with encouraging messages when users succeeded. The newly added "review quiz" button offered users the opportunity to learn further, thereby enhancing motivation and the overall learning experience.

Evaluation

Products or media that have been improved at the production stage are then implemented to 10 students of class VII C MTs Putri PUI Talaga. The aim is to determine its practicality and train students' numeracy literacy by using the MathFarm application as a learning tool and resource in the problem-posing model. Figure 5 shows the results of student responses collected through questionnaires, along with input and suggestions from students.

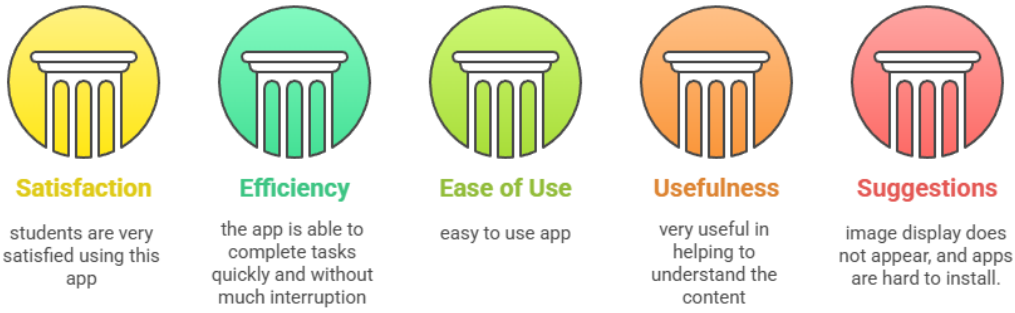

Figure 5. Student responses and suggestions on iSpring Suite 11 media

Feedback from the students was used for the second-stage revision, including the addition of application installation steps to make it easier for students. This second stage revision was immediately tested on a large group (field trial) with 25 participants. Students who participated in the field trial were given a questionnaire to measure the level of practicality of the media used. The result shows that iSpring Suite 11 learning media is very practical to use. This means that the learning media developed using iSpring Suite 11 is easy and efficient to use. This statement is in accordance with the opinion of Ananda et al. (2023), Bhakti et al. (2024), Satiti et al. (2023) that well-designed interactive learning media can increase the efficiency of the teaching and learning process and make it easier for students to understand the material. Our findings support this view, as the implementation of the iSpring Suite 11 media showed a significant increase in student engagement and comprehension. This is consistent with Ananda et al. (2023), who found that Android-based learning media enhances the learning experience in vocational courses. Similarly, Bhakti et al. (2024) highlighted that e-pocket books created with iSpring Suite 11 software improved students' understanding and retention of the material. Our results also align with Satiti et al. (2023), who demonstrated that mobile learning apps developed with iSpring Suite 11 facilitated better comprehension of mathematical concepts among students. However, unlike previous studies that primarily focused on specific educational settings, our research extended the application of iSpring Suite 11 across various contexts and subject areas, revealing broader implications for its effectiveness in diverse learning environments. This broader application underscores the versatility of the media and its potential to enhance educational outcomes across different disciplines. In addition, the level of practicality of a learning media depends not only on its ease of use but also on how effectively it helps students achieve learning objectives.

The iSpring Suite 11 learning media that was declared practical was then re-implemented to all 70 seventh-grade students to determine the number of students with numeracy literacy who were in the high, medium, and low groups. In addition, this implementation also aims to identify how many students are in the category of problem-posing ability at the pre-solution, within-solution posing, and post-solution posing stages. The numeracy literacy test results of 70 students (general numeracy literacy test results) showed that many students were in the moderate category based on the numeracy literacy level classification in Table 3, with an average score of 67.071 and a mode of 85.5. This means that some students have quite high scores, although the average score is still below the “good” category. These test results are in line with the OECD (2023) that students are already quite good at using numbers and analyzing information but still have difficulty in interpreting the results of the analysis, which is a higher-level thinking ability. The widespread of scores, indicated by the standard deviation of 23.12, indicate that there is a large variation in students' ability levels. This variation can be caused by different numeracy backgrounds, learning motivation, or even familiarity in dealing with problem-posing type problems. This is in line with the research results of Amanda et al. (2024) that learning motivation is positively

correlated with students' numeracy skills. This means that the higher the motivation of students is learning, the greater their tendency to have better numeracy skills. This shows that learning motivation is one of the important factors that influence students' numeracy literacy achievement.

More specifically, the categorization of numeracy literacy skills shows that there are three categories of learners based on the scores obtained: (1) high category, which includes 21 learners with scores ≥ 90.19; (2) medium category, which includes 31 learners with scores in the range 43.95 - 90.19; and (3) low category, which includes 18 learners with scores < 43.95. Based on ability indicators, the average numeracy literacy ability of learners shows a good level of understanding in using numbers to solve practical problems (71.79%) and analyzing information in various forms (71.07%). However, students still have weaknesses in interpreting the results of the analysis, with an achievement of only 60%. This finding is in line with the results of Dewi & Izzati (2020) research that the aspect of 'interpreting the results of the analysis' will be the indicator with the lowest achievement if students are unable to understand the basic concepts that are an important requirement for interpreting the results of the analysis. This is also reflected in the needs analysis conducted at MTs PUI Talaga. The average numeracy literacy skills of each group are presented in Figure 6.

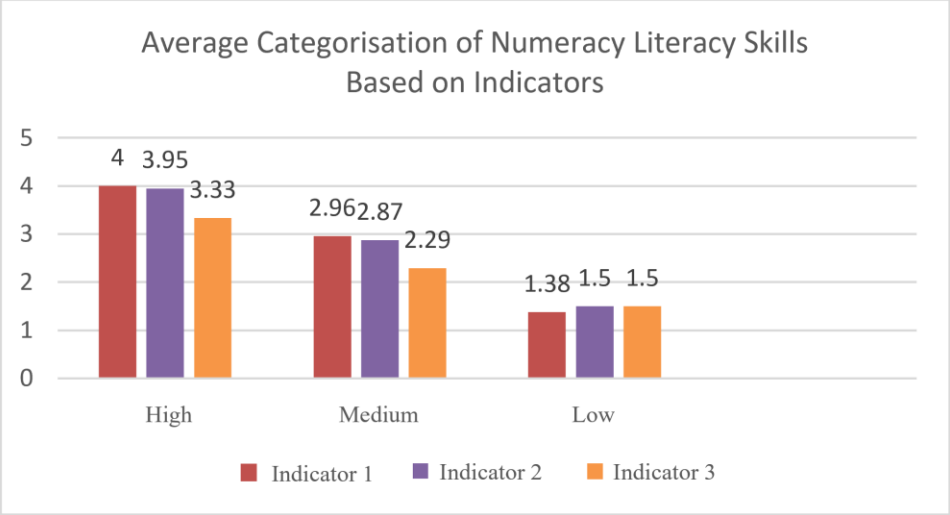

Figure 6. Average numeracy literacy scores for each group

The categorization of problem-posing ability displayed in Figure 6 shows that 71.42% of learners are at the pre-solution-posing stage, where they can describe the information in the problem. A total of 15.71% of learners are at the within-solution posing stage, where they can develop relevant problems from the information presented. Meanwhile, 12.85% of learners were at the post-solution posing stage, where they were able to modify the problems that had been solved to produce new, more challenging problems.

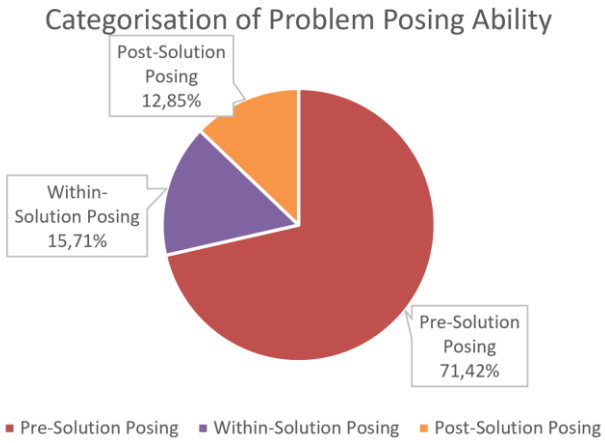

Figure 7. Problem posing categories

Figure 7 presents a pie chart categorizing problem-posing abilities into three types: pre-solution posing, within-solution posing, and post-solution posing. The data in the chart indicates that many participants, 71.42%, fall into the pre-solution posing category, meaning they tend to formulate problems before beginning the problem-solving process. Meanwhile, 15.71% of participants belong to the within-solution posing category, where they formulate problems while working through the solution. The post-solution posing category has the smallest percentage, 12.85%, indicating that only a few participants can formulate problems after completing a solution.

From this data distribution, it can be concluded that most participants feel more comfortable formulating problems before they begin solving them. Conversely, only a small portion can generate problems during or after the problem-solving process. This finding suggests that in the learning process, a more structured approach to encouraging students to pose problems at different stages of problem-solving still needs to be developed. Teachers and educators can use this data to design more effective teaching strategies, such as fostering students' critical and reflective thinking skills at every stage of problem-solving.

CONCLUSION

The development of interactive learning media based on iSpring Suite 11 for seventh-grade students at MTs PUI Talaga was carried out through three main stages: planning, production, and evaluation. During the planning stage, it was found that students experienced difficulties in understanding and applying mathematical concepts, particularly in the topics of direct and inverse proportion. In the production stage, the developed learning media was validated by one subject matter expert, resulting in a “suitable” category, and by one media expert, resulting in a “highly suitable” category. The evaluation stage showed that the interactive learning media based on iSpring Suite 11 was very easy for students to use (practical) and that they became more enthusiastic in learning about direct and inverse proportions. The trial results indicated that the majority of students had a high level of numeracy literacy. A total of 50 students were categorized under the

pre-solution posing type of problem posing, meaning they were able to understand the problem information but were not yet able to solve it.

This study has several limitations. First, due to time and resource constraints, it only addresses the validity and practicality of the developed learning media without testing its effectiveness in improving students' numeracy literacy on a broader scale. Second, the study was conducted with a relatively small sample size and was limited to a single school, MTs PUI Talaga, making the results less generalizable to a wider population. Third, the learning media developed using iSpring Suite 11 may have limitations in terms of compatibility with certain hardware and software owned by students or schools. Fourth, media validation was carried out by experts who may hold subjective views, as well as student responses that could be influenced by personal perceptions of the learning media. For future research, it is recommended to test the effectiveness of the iSpring Suite 11 learning media in improving students' numeracy literacy through pre-test and post-test evaluations. Future studies should also involve more schools with diverse backgrounds to obtain more comprehensive and generalizable results. Furthermore, continued development is needed to ensure the media is compatible with various types of hardware and software used in schools. Teachers also need training to optimize the use of this media in the learning process, thereby making it more effective in enhancing students' numeracy literacy.

The implementation of iSpring Suite 11 learning media integrated with the problem-posing method has the potential to significantly contribute to the improvement of students' numeracy literacy, particularly in understanding and applying mathematical concepts in various real-life contexts. This study demonstrates that interactive and contextual learning technology can serve as an effective solution to challenges in mathematics education and encourage broader adoption of technology in the education system. In addition, this study provides practical guidance for learning media developers on the importance of validity and practicality as indicators of successful media development, while also emphasizing the value of user feedback for continuous improvement.

The findings of this study can serve as a reference for policymakers in formulating more effective educational strategies, particularly in enhancing students' numeracy literacy competencies through the integration of technology and innovative learning methods.

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Development oF liveworksheets assisted by everycircuit to improve higher-order thinking skills of prospective elementary teacher

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Abstract
Liveworksheets are an option for educators who teach subjects that involve practical activities, but learning that involves abstract concepts involving Higher-Order Thinking Skills (HOTS), such as electricity, requires another platform, such as Liveworksheets. The research aims were to develop digital learning media in the form of Liveworksheets assisted by the Android EveryCircuit application to improve Higher-Order Thinking Skills (HOTS) for prospective elementary school teacher students. This research and development use a 4D model consisting of define, design, develop, and disseminate. Data analysis was performed using quantitative descriptive methods. The results found that the Liveworksheet assisted by the Android EveryCircuit application was categorized as valid, with an average V-Aiken of 1.20. Liveworksheets were categorised as practical with a total average of 3.44 or 86%, statistically effective in improving students' higher-order thinking skills (HOTS) with the gain value of the experimental class in the medium category and the control class in the low category. Thus, the Liveworksheet Student Activity Sheet assisted by the Android EveryCircuit application developed is valid, practical, and effective in improving students' Higher-Order Thinking Skills (HOTS) in the subject matter of electricity in Elementary School Science Education courses.
Keywords: Liveworksheets; Android; EveryCircuit; HOTS

INTRODUCTION

The concept of series and parallel circuits is an electrical concept presented in elementary school science education or science education lectures. The process of learning concepts regarding electrical circuits generally involves students arranging and measuring current in series and parallel circuits. However, during online learning, student activities about the concepts of series circuits and parallel circuits are only carried out by providing material through lectures that convey electrical concepts in a narrative manner.

Conveying concepts directly through narrative has advantages and disadvantages. The advantage of delivering concept material through Direct Instruction or lectures is that it is more practical and completed quickly, while the disadvantage is that the

explanation of abstract material can give rise to indications of conceptual errors or misconceptions (Mukhlisa, 2021; Widiastuti & Purwanto, 2019). As material regarding electrical circuits is prone to misconceptions (Adhim et al., 2021; Azzarkasyi et al., 2019; Halim et al., 2019; Huda et al., 2022; Susanti, 2021; Widodo et al., 2018), students assume that a series circuit is a circuit where loads or resistances are connected in parallel and a parallel circuit where loads or resistances are connected sequentially (Mellu & Baok, 2020). Series circuits and parallel circuits can actually be seen based on the flow of electric current and the voltage difference or potential difference from the ends of the poles of each resistance (Ashari & Faisol, 2020; Chou et al., 2016; Koklu et al., 2015; Minich, 2005; Zuhdi & Busyairi, 2021). This is what often makes students have difficulties and confusing about the concepts.

The activity of analyzing series circuits and parallel circuits can be categorized into efforts or processes that involve high-order thinking abilities (HOTS) in the C4 (analysis). In the cognitive level of analysis (C4) students must be able to identify special characteristics of circuit components such as resistance or load functions which can cause potential differences in every circuit, students must also be able to differentiate between one type of circuit and another and finally, students must be able to organize several electrical components and assembling them into a functional electrical circuit.

Educators or lecturers could make something that students can continue to carry out series and parallel circuit activities is to use Android applications that can simulate electrical circuits. One of Android application that can simulate this circuit is EveryCircuit (Ratu & Erfan, 2017). EveryCircuit developed by Muse Maze can simulate various electrical circuits virtually, both analog circuits and digital circuits. By integrating Liveworksheets as a platform where students get direction and instructions as well as evaluations which become Student worksheets in assembling series and parallel circuits, and EveryCircuit as an application that provides a place for simulation, it is hoped that it will trigger or stimulate higher order thinking skills (HOTS) of students in cognitive level of analytical skills (C4) in analyzing series and parallel circuits.

Especially in the elementary school teacher education study program, faculty of teacher training and education, University of Mataram, there has been no specific development regarding the integration between Liveworksheets as a Student Worksheet platform with EveryCircuit as a tool to assemble various circuits virtually. Specifically, there has also been no student worksheet on electrical circuit material that is oriented to improving students' abilities at the Analysis cognitive level (C4) which is included in one of the taxonomies of high-level thinking skills (HOTS). Given the importance of mastering high-level thinking skills for prospective teacher students that can be improved by teaching electrical circuit analysis through student worksheets, researchers are interested in developing Liveworksheets assisted by the EveryCircuit Android application to improve high-level thinking skills for prospective elementary school teacher students. Therefore, this study aims to develop interactive Liveworksheets assisted by the EveryCircuit Android application and to examine their effectiveness in improving the high-level

thinking skills. The increased high-level thinking skills of prospective elementary school teacher students will certainly help improve elementary school students' abilities in high-level thinking.

METHODS

This kind of Research and Development (R&D) with the development model used is 4-D which consists of four main stages, namely definition, design, development and dissemination (Khair et al., 2022; Kusumah et al., 2020; Sugiyarto et al., 2018; Thiagarajan et al., 1974). The Define stage aims to identify and define the necessary requirements and will be presented in the Liveworksheet assisted by the EveryCircuit in the development process. The instruments used in the define stage are observation sheets, interview sheets, and studies.

The Design stage, which is the next stage of the Define stage, is more focused on designing the Liveworksheet with the help of the EveryCircuit based on the initial study that was carried out at the Define stage. The Develop stage, which is a development stage, aims to produce a Liveworksheet assisted by the Android EveryCircuit application which can improve students' higher order thinking skills (HOTS) in the cognitive level of analysis (C4) which is effective and suitable for the next stage (dissemination). The instrument used to test the effectiveness of the Liveworksheet assisted by the EveryCircuit Android application was a test carried out twice, namely pretest and posttest in the class that used the Liveworksheet assisted by the EveryCircuit Android application as an experimental class and the class that studied electrical circuits without using the Liveworksheet assisted by the Android application EveryCircuit.

The Disseminate stage is the final stage carried out through seminars, publication of research articles, submission of intellectual property rights (IPR), and dissemination of products to study programs. The instrument used in data collection activities in this research was an expert validation sheet questionnaire.

The expert validation sheet is used to determine the validity of Liveworksheet assisted by the EveryCircuit Android application developed. After the Liveworksheet assisted by the EveryCircuit Android application has been declared feasible and valid by experts, it is then tested in the field. The trial was carried out on several students who had previously received elementary science education courses on the main topic of electricity.

The research data was analyzed descriptively quantitatively. The validity criterion used in this research and development is content validity. Content validity was obtained by giving questionnaires to four experts, namely experts in learning assessment in elementary schools, experts who are experts in learning activities, experts who are experts in developing learning media, and experts in the content presented in the Liveworksheet assisted by the EveryCircuit Android application developed. The validity criteria used are based on the content-validity coefficient by Aiken's V. This research uses 4 rating categories and 4 raters. Based on the standards set by Aiken, Aiken's minimum V standard for this research is 0.92 with a probability of 0.020. Apart from testing the validity of the Liveworksheet assisted by the EveryCircuit Android application, a practicality test was also carried out on

using the Student Worksheets in teaching and learning activities. The practicality criteria used are presented in Table 1.

Table 1. Media Practicality Criteria

Score	Criteria
3,5 < SR ≤ 4,0	Very Practical
2,5 < SR ≤ 3,5	Practical
1,5 < SR ≤ 2,5	Impractical
1,0 < SR ≤ 1,5	Very Impractical

To determine whether there is an increase in student learning outcomes, a test is given before (pre-test) and after (post-test) the learning activities are carried out. The level of effectiveness of Liveworksheets assisted by the EveryCiruit Android Application in increasing the number of students who understand the concept of series and parallel electrical circuits, the gain score calculation is used. The score gain values obtained are further divided into three categories as shown in Table 2.

Table 2. Gain criteria

Criteria for Increasing Gain Value	Normalized Gain Value
high	g ≥ 0,7
middle	0,3 ≤ g < 0,7
low	g < 0,3

RESULT AND DISCUSSION

Preliminary study

Based on preliminary studies at the define stage, it is known that most of the prospective school teacher students taking elementary science education courses have smartphones with mostly Android-based operating systems. In studying electrical material, students want to learn with real practical work, but due to inadequate basic education laboratories, practical and learning activities, especially electrical material, are carried out virtually using platforms such as PhET and EveryCircuit.

Development Results

The product resulting from this research is in the form of a Worksheet or Student Activity Sheet on the lecture material on electrical circuits. This LKM is online based using Liveworksheets assisted by the EveryCircuits Android Application.

Figure 1. Display of Liveworksheets with the help of the EveryCircuit Android Application

EveryCircuits is used to simulate various circuits in series, parallel or mixed resistance circuits which are a combination of both series and parallel circuits. Based on Figure 1, it can be seen that one of the advantages of Liveworksheets is that it can integrate videos from the Youtube platform into student worksheets. In creating instructions for making electrical circuits, a teacher can record the screen and upload it to a video sharing platform and integrate it into Liveworksheets.

Define Stage

The define stage aims to find out and define the needs in the learning process and collect various information related to what or what components must be included in the worksheet or student activity sheet. The student worksheet on circuit analysis aims to enable students to differentiate and provide special characteristics of series circuits, parallel circuits and mixed circuits.

At the define stage, the analysis activities that have been carried out consist of two main steps, namely problem analysis and concept analysis. To obtain this various information, literature studies were used regarding circuits in particular and important concepts that must be conveyed in a student activity sheet. In this define stage, what competencies are designed in line with the high-level thinking abilities that students must master when studying or when analyzing various types of electrical circuits.

Design Stages

The Design stage is carried out to accommodate various information that was previously obtained at the define stage. At the define stage, the layout of the display of activity sheets or student worksheets is also carried out. Student Worksheets layout design aims to attract the attention of worksheets readers regarding the information presented in the worksheets, apart from that, good layout design can also clarify the information presented so that analytical skills which are included in the realm of high-level thinking abilities can be achieved.

At the design stage, multimedia resolution adjustments are made, namely video simulations or video tutorials for assembling several electrical circuits, both series and parallel electrical circuits. The video tutorial included in the worksheets is taken

from the video sharing site such as YouTube, the link or links from the video are included in the Student Activity Sheet, from the video tutorial, students can do practicum virtually without using fees and the results of the practicum can be seen directly. Videos regarding simulations or tutorials on assembling various electrical circuits, including series circuits, parallel circuits and mixed circuits, are uploaded or posted on a YouTube channel.

The design or layout of student activity sheets or student worksheets is carried out using image processing software, namely Corel Draw. Corel Draw is used as the main software in designing layouts because users can freely manipulate design expressions, colors, images and components that must be present in student worksheets, especially worksheets for circuits.

The presentation of several electrical components in the EveryCircuit Android Application is carried out using screenshots on an Android smartphone. These screenshots are then edited using simple image editing software such as Paint on a Personal Computer with the Windows Operating System.

The general result of the design stage is that the LKM has a cover page and then a Course Learning Outcomes. On learning outcome page, indicators of learning achievement are also added, one of which is prioritizing students' higher order thinking skills (HOTS) in analyzing (C4) electrical circuits.

Development Stages

The develop stage aims to produce worksheets or student activity sheets on the lecture material on electrical circuits. This worksheets is online based using Liveworksheets assisted by Android Application EveryCircuit. The Student worksheets that was developed was then tested limited to 7th (seventh) semester students who had previously completed the Elementary School Science Education course, where in the lecture activities there was material about electrical circuits.

Validity Test Results

The process of validating worksheets for the lecture material on circuits involves four experts, namely expert validators in learning assessments in elementary schools, expert validators in learning activities, expert validators in developing learning media or teaching materials, and validators who are experts in content. which is presented on the developed worksheets. The instrument used by each validator is an assessment rubric. The scores obtained from the scoring rubric were analyzed using V-Aiken validity analysis. The results of the analysis can be categorized as valid if they meet the V-Aiken coefficient limit for 4 scales with 4 raters, which is 0,92 with a probability of 0,020. The aspects assessed by each validator are media suitability aspects, display quality aspects, technical quality aspects, and media attractiveness aspects. The average V-Aiken score for the scoring rubric is presented in Table 3.

Table 3. V-Aiken average score for each aspect of learning media

Assessment Aspects	V-Aiken mean	Category
Suitability	1,21	Valid
Display quality	1,20	Valid
Technical quality	1,21	Valid
Attractiveness	1,19	Valid

Based on Table 3, it is known that most of the average V-Aiken scores are in the Valid category with the combined average for the four aspects being 1.2025. The combined average for these four aspects is in the valid category because it exceeds the V-Aiken coefficient limit for 4 scales with 4 raters so that the Liveworksheet Student Activity Sheet assisted by the EveryCircuit Android application is generally categorized as valid.

User Test Results

User trials were carried out to determine the level of practicality of using Worksheets or Student Activity Sheets in lecture material on electrical circuits which was carried out on 5 (five) students of the Faculty of Teacher Training and Education Universitas Mataram elementary school teacher education study program. These five students were selected on the basis of trials in small groups where these five students had previously received elementary science education lectures which included electricity material. The average score of the trial results in the small group is presented in Table 4.

Based on Table 4, it is known that from the five users in the small group, the total mean was 3.44 or the overall percentage was 86.00%. Based on the practicality criteria for the Liveworksheet assisted by the Android EveryCircuit application which was previously presented in Table 1, it was found that with a percentage of 86.00%, the Liveworksheet LKM assisted by the Android EveryCircuit application developed was categorized as practical for use as teaching material in elementary school science education lectures on the subject electricity discussion.

Table 4. Average results of media practicality test assessments in small groups

User	Mean	Percentage	Category
Person 1	3,3	83%	Practical
Person 2	3,4	85%	Practical
Person 3	3,6	90%	Very Practical
Person 4	3,4	85%	Practical
Person 5	3,5	88%	Practical

Effectiveness of worksheet in Increasing Student HOTS

The effectiveness test of the Liveworksheet assisted by the EveryCircuit Android application aims to find out whether the Liveworksheet assisted by the EveryCircuit Android application developed has an impact or effect on students' higher order thinking abilities (HOTS), especially in the cognitive level of analysis (C4). The cognitive level of analytical skills which is included in the cognitive level of high-

level thinking skills is the student's ability to analyze various circuits, especially series, parallel, and mixed circuits.

Increasing students' abilities in analyzing electrical circuits is analyzed from the results of the students' initial and final tests. After carrying out the initial test, students were given treatment by learning various electrical circuits using the Liveworksheet with the help of the EveryCircuit Android application. Apart from that, a control class is also used, namely a class where the main subject of electricity is studied without using the Liveworksheet or using conventional lecture methods as usual. Descriptive statistical results between the initial test and final test of students using the Liveworksheet assisted by the EveryCircuit Android application in the experimental class and control class are shown in Table 5.

Based on Table 5, it is known that the average pre-test score of students is not much different in both the experimental class and the control class. To find out more about the absence of a significant difference between the pre-test mean scores in the experimental class and the control class, an independent sample t-test was carried out. Before carrying out the independent sample t test, an analysis prerequisite test is first carried out which includes testing for normality and homogeneity of pre-test data for the experimental class and control class.

Table 5. Descriptive statistics of pre-test and post-test for both classes

Descriptive statistics	Experiment Class		Control Class	
	Pre-test	Post-test	Pre-test	Post-test
Mean	54,92	80,00	48,8	59,3
Median	56,25	81,25	48,75	59,25
Mode	55	80	50	60,5
Max	75	100	72,5	83
Min	30,00	55,00	22,5	33
Variance	152,92	155,85	129,68	129,68
Std. Dev	12,56	12,68	11,56	11,56

Based on the normality test of the pretest data in both classes, it was found that both classes had a normal distribution where the Shapiro-Wilk significance value for the experimental class was 0.133 and the significance value for the control class was 0.857, both of which were above 0.05. The results of the data homogeneity test between the experimental class and the control class showed that the significance value of the score based on the average value was 0.537 which was much greater than 0.05, which means that both classes had the same data variance or both classes were equally homogeneous.

The post-test mean difference significance test was carried out using the independent sample t-test. The results of the independent sample t test for post-test data are presented in Table 6.

Table 6. Independent sample t test results

	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	6,811	62	,000	20,67188	3,03496

Based on Table 6, it is known that the calculated t-value obtained is 6.811 with degrees of freedom (df) 62. The t table value for 2-tailed with degrees of freedom (df) 62 is 2.2971. The calculated t value is much greater than the t table value so that it can be concluded that there is a significant difference between the post-test mean of the experimental class and the post-test mean of the control class.
To find out which treatment is better, a test of the average gain of both classes was carried out. The results of the normalized gain test on post-test data for the experimental class and control class are presented in Table 7.

Table 7. Normalized Gain Test Results for experimental class and control class

Class	<g>	Category
Experiment	0,56	Midle
Control	0,21	Low

Based on Table 7, it is known that the gain value in the experimental class is in the midle gain category which is still higher than the control class which has a gain in the low category. This shows that the Liveworksheet assisted by the EveryCircuit Android application has proven to be effective in improving students' higher order thinking skills (HOTS), especially in the cognitive level of analytical skills (C4).
This research is development research with R&D design with a 4-D development model (Define, Design, Develop, and Disseminate). The Define process as the initial activity in developing the Liveworksheet assisted by the EveryCircuit Android application looks at the final competency in the form of important concepts that must be mastered relating to various electrical circuits. Usually for the main topic of electricity, students are asked to bring various electrical components that are suitable for assembling in class. This of course will impose costs on students and require a relatively long time for learning conditioning. Therefore, educators (lecturers) try to bring a different approach, namely by using the smartphone that each student has as a means to simulate electrical circuits. Learning that involves virtual simulations can increase students' motivation and interest, as well as increase students' ability to think at a higher level (Kageyama et al., 2022; Pelaccia & Jaffrelot, 2019; Prima et al., 2018; Rochmawati et al., 2021; Supurwoko et al., 2017; Varutharaju & Ratnavadivel, 2014).
The Design Process focuses on the process of designing the components that must be included in the Liveworksheet with the help of the EveryCircuit Android application. The design process includes designing a layout that is made as attractive as possible using graphic design software, namely CorelDraw. This layout

design process is based on the principles of visual media. The attractiveness of the Liveworksheet display with the help of the EveryCircuit Android application also takes into account its interactivity. The display of Liveworksheet assisted by the attractive and interactive EveryCircuit Android application can certainly also increase students' motivation and interest in learning (Yasa et al., 2021; Sari & Harjono, 2021; Waruwu & Sitinjak, 2022; Wulandari, 2020).

The Develop or development stage aims to make the blue-print at the design stage a reality (Khair et al., 2022; Kusumah et al., 2020). At the development stage, apart from the process of printing Liveworksheet with the help of the Android EveryCircuit application, the process of uploading developed worksheets to Liveworksheets platform was also carried out from a pdf extension to a more interactive pdf.

In the development stage, researchers also asked for expert opinions. There are four experts involved, namely expert validators in learning assessments in elementary schools, expert validators in learning activities, expert validators in developing learning media or teaching materials, and validators who are experts in the content presented on the worksheets that is developed. Validation results by experts are generally above the validity threshold or most of the validation results are in the valid category. Additional input from validators, especially for high-level thinking skills (HOTS), is that they must use operational verbs (KKO) that are more varied, not only in the realm of providing special characteristics but also in other sub-domains. The main input from the media validator is that it would be better to add a quiz on guessing electrical circuits in the form of a video that is embedded in the pdf file displayed in Liveworksheets.

The Dissemnimate stage focuses on disseminating the development product, namely the dissemination of worksheets to student classes in the elementary school teacher education study program in elementary school science education lecture activities on the main subject of electricity. The Liveworksheet with the help of the EveryCircuit Android application developed can not only be accessed by students in the primary school teacher education study program, Faculty of Teacher Training and Education, Mataram University but also by anyone from various circles because it has been distributed on the Liveworksheets website. The easy process of accessing the Liveworksheet Student Activity Sheet with the help of the EveryCircuit Android application certainly supports teaching and learning activities anytime, anywhere and by anyone.

The consistent use of Liveworksheets has been reported to have a positive impact on the quality of learning that requires high-level thinking skills. Penggunaan Liveworksheets argumentatif dengan model Discovery Learning terbukti mampu meningkatkan skor HOTS siswa secara signifikan (Hasnunidah et al., 2024). Other studies report valid and effective improvements in students' critical thinking skills (HOTS components) (Argarini & Najibah, 2023; Apriani et al., 2024) as well as increased engagement and application of learning concepts (Madden et al., 2023; Maharani & Hamid, 2024).

Although most studies focus on junior high/high school levels, qualitative results at the college level also show positive perceptions of students towards Liveworksheets

(Madden et al., 2023). Overall, current literature shows that Liveworksheets are an effective interactive learning medium in stimulating HOTS, both through improving conceptual understanding, analytical skills, and learning motivation of students (Hasnunidah et al., 2024; Apriani et al., 2024). Considering these findings, the integration of Liveworksheets in college can be considered as a strategy to develop students' critical and creative thinking skills and ultimately improve students' higher-order thinking skills at the elementary school level.

CONCLUSION

The Liveworksheet assisted by the EveryCircuit Android application which has been developed is declared valid, practical and effective in improving students' higher order thinking skills (HOTS) in the cognitive level of analysis and the Liveworksheet assisted by the EveryCircuit Android application is suitable for use in learning elementary science education courses about electricity material. Because it requires a smoothly available internet infrastructure, a preliminary study on the availability of a smooth internet network must have been conducted. Further development can be done by integrating artificial intelligence into various student worksheets.

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Learning innovation through developing interpreter book: a classroom interpreting practice

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Abstract
In today's rapidly evolving educational landscape, innovative approaches are increasingly needed to enhance learning and address specific challenges, such as the effective teaching of interpreting skills for students studying translation and interpreting. This research aims to enhance the quality of an interpreter book for classroom use by employing a qualitative R&D approach using the ADDIE model, focusing on interpreting practice among sixth-semester students at the English Education Department. The research results show that the initial design of the interpreter book focused on offering students interpreting study and practice, developed from three resource books. Students evaluated the book using a 1-4 rating scale, and a need analysis was conducted with fourth-semester students to gather additional insights. The redesign phase added descriptions of proper and inverse interpreting based on evaluation and need analysis data. This reevaluation led to the inclusion of new features like illustrations, YouTube links, and texts in the book. The research applied the ADDIE model in seven steps, including two rounds of design and development. The initial design focused on developing interpreting skills like listening, note-taking, and clear expression, with sequential instruction in various interpreting modes. The second round of design and development further refined these aspects.
Keywords: Interpreter Book; Interpreting Practice; Learning Innovation.

INTRODUCTION

When English is taught in many educational institutions in many different countries as a foreign language to achieve mutual understanding among different countries and cultures, it does not automatically guarantee that all people in the world will also be good at English. It was caused by some

reasons, like the lack of access to English lessons and their persistence to maintain their native languages (Aswirna & Ritonga, 2020; Mertayasa et al., 2022; Yuan et al., 2023). At State Islamic University in Indonesia, English is primarily taught in the first two semesters of all study programs, with a strong focus on the English Education Study Program. Based on classroom observations held in 2022, the English Education Department of the State Islamic University of Sultan Maulana Hasanuddin Banten faces challenges in communication across multiple languages due to its cultural and linguistic diversity. A solution is needed to address these challenges, as students struggle with interpreting practice due to the lack of a reference book to guide their tasks.

At State Islamic University in Indonesia, the English Education Department faces significant challenges due to the cultural and linguistic diversity of its students. This diversity not only complicates language acquisition but also impacts effective communication. Just as interpreters play a crucial role in bridging communication gaps between speakers of different languages and cultures, the need for a comprehensive reference book becomes evident. Such a resource would serve as a mediator in the learning process, guiding students in their interpretation practices and enhancing their ability to navigate interlingual communication effectively

If there is a person who is not able to communicate with other people in different languages within different cultures, there must be a mediator, also called an interpreter, to ask for help since an interpreter is needed for interlingual communication (Katan & Taibi, 2021; Munday et al., 2022; Pöchhacker, 2022). The interpreter usually works in two directions, i.e., 'back and forth' among more than one language included, depending on the turn-taking of the primary parties (Pöchhacker, 2022; Robinson, 2019). The interpreter's job within a particular communicative situation is characterized as combining two different activities: listening and speaking. Comprehending what has been said in a source language and saying the ideas that are got, i.e., the 'message', in another language so that the interpreter would 'make sense' to the target audience appeared as the main pillars of the interpreter's work. Beyond the interpreter's mediation in concrete situations of interactive discourse and in cross-cultural communication in general, the fact that interpreters ideally represent two cultural systems can be used to view them as points of cultural interface (Filladsen, 2020; Pöchhacker, 2022).

In the sixth semester at UIN SMH Banten's English Education Study Program, students are trained to become proficient interpreters, with the course tailored to their cultural background where English is the primary language of instruction. The interpreting practice involves multiple languages: English, Bahasa Indonesia, Javanese, and Sundanese. Students primarily interpret English into one of the three other languages, while when interpreting from these languages, they translate exclusively into English.

The interpreting practice course is a three-credit semester activity, but there was no specific material tailored to Bantenese culture for classroom use. To address this, researchers first designed a lesson plan using various interpreting reference books and then developed these materials into a classroom-compatible book, which was later published by Madani Publishing Company. The book is needed for guiding learning activities in the classroom. For book improvement, this research aims to know how to develop the Classroom Interpreting Practice Book (Brown & Green, 2019; Chan, 2021; Ngui et al., 2020).

According to Merriam-Webster, America's leading provider of language information, an interpreter means one who translates orally for parties conversing in different languages. The interpreter is to limit his or her activities strictly to the practice of interpreting. Especially, he or she is not pleased to recommend or fulfill any of the attorney's responsibilities. Interpreters often face difficult situations to follow the rule (Katan & Taibi, 2021). The interpreter's working principle of commitment emphasizes the need to continually improve his knowledge and skills and preserve good relations with his clients. The judicial interpreter is pleased to devise thoroughly for interpreting tasks and to keep abeam of new developments in any fields needed in interpreting. Court interpreters are even required by some administrations to complete continuing education credits (Pöchhacker, 2022). Furthermore, an increasing number of nations have enacted legislation mandating that court interpreters demonstrate their interpreting abilities and comprehension of the code of ethics by passing written and oral certification exams, even in spite of the explicit guidelines for interpreter etiquette that are currently in place (Pöchhacker, 2022).

Recent research has addressed a number of pertinent topics in translator and interpretation education, including: A thorough investigation of translator and interpreter training was carried out by (Yan et al., 2023), who emphasized the necessity for pedagogical innovation in interpretation education, particularly through the creation of specialized teaching materials and tools. This is in line with the idea of using interpretation books as instructional resources. (Li, 2019) examined a number of translation and interpreting textbooks, emphasizing the value of curriculum design and the requirement for learning materials that are sensitive to students' real-world learning demands. These points are relevant to the creation of interpretation books. Following up on their reflections on note-taking textbooks, (Luo & Ma, 2019) talked about how these resources might be optimized for effective learning. This idea is similar to the idea of developing innovative teaching materials, such as an interpreter book for classroom practice.

Then Erisafitri's study on developing business translation materials for English Education Department students at the University of Muhammadiyah Gresik begins with instructional design, need analysis, and material development. However, the final product does not fully meet the research's goal of creating effective business translation materials. The study concludes

that students need content focused on improving vocabulary and translation skills while providing a basic understanding of business letters (Erisafitri, 2017). Next (Safriyanti, 2021) study, "English Listening Material Development of Listening Materials Production for University Students," focused on creating content for college students. However, the study only addressed the selection, adaptation, and validation stages of developing English listening materials, neglecting the implementation and evaluation phases.

Unlike previous research that may focus on traditional material development, this study introduces innovative features within the interpreter book, such as the inclusion of multimedia elements (e.g., YouTube links, illustrations) and practical exercises tailored to classroom settings. This modern approach caters to the evolving educational landscape and enhances student engagement. Then this study used full ADDIE model, particularly the implementation and evaluation phases, provides a more robust framework for developing educational materials. This ensures that the interpreter book is not only theoretically sound but also practically effective in enhancing students' interpreting skills.

The literature on interpreter training primarily focuses on three types of interpreting: consecutive interpreting with note-taking, simultaneous interpreting for international conferences, and dialogue interpreting in community settings. Contributions to this didactic literature often consist of reports by educators sharing their specific approaches, ranging from descriptive accounts to prescriptive methods (Eser et al., 2020; Pöchhacker, 2022). In classroom interpreting practice, fieldwork within the classroom setting is strongly recommended, typically using qualitative case studies. Due to the significant time and effort involved in such studies, (Setton & Dawrant, 2016) outlined three key steps in the interpreting practice process: preparation, in-class performance, and critique, followed by a wrap-up phase: Preparation: The instructor develops a lesson plan, selects materials, schedules activities, and informs students of objectives and materials a week in advance. In class, the instructor explains objectives, presents materials, and discusses exercises, including relevant background and terminology. Performance, Critique, and Teaching: Students complete exercises, receive feedback, participate in discussions, and have opportunities to improve their performances, with additional exercises or instructor demonstrations as needed. Wrap-up: The class concludes with a 5-10 minutes summary of the session's practices and discussions, along with takeaways, homework, and recommendations for further study.

METHODS

In conducting the research, the researchers used the R&D, especially using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Aswirna & Ritonga, 2020; Rayanto & Rusmawan, 2020; Sahrir et al., 2017). Research and Development (R&D) is the strongest choice for developing materials including Interpreter book. ADDIE model R&D is

widely used by educators in instructional design worldwide (Nadiyah & Faaizah, 2015). It provides a structured, systematic, and iterative approach to instructional design. It ensures a logical flow in developing learning materials. Each phase builds upon the previous one, reducing errors and improving quality. The Analysis phase helps identify the learners' needs, challenges, and learning objectives, ensuring that the book is relevant and effective. The Design phase allows for the creation of a well-structured book, including clear learning objectives, chapters, exercises, and assessments, making the content easy to follow. The Development and Implementation phases involve prototyping, piloting, and revising the book based on feedback from educators and learners, improving content quality. The Evaluation phase ensures that the book is assessed for effectiveness and updated as needed, making it adaptable to changing educational needs.

This research was conducted in the English Education Department at State Islamic University Sultan Maulana Hasanuddin Banten, where the researchers taught interpreting practice to sixth-semester students in classes A, B, C, D, and E. Each class consisted of 29 to 30 students, with a total of 148 students enrolled in the even semester of the 2023/2024 academic year.

The researchers take the source of data from the following lesson parts: wiretapping and tape transcription, videoconference interpreting, television interpreting, sign language interpreting, telephone interpreting, sight translation, bilateral or liaison interpreting, whispered interpreting, conference interpreting, conference consecutive interpreting, simultaneous interpreting, professionalism, and ethics in interpreting. The sources of primary data are taken from some interpreting reference books and YouTube videos. The reference books are The Interpreter's Resource (Pöchhacker, 2022), and Conference Interpreting: A Complete Course (Setton & Dawrant, 2016). Other sources of primary data are also taken from Youtube videos, especially speeches and talks that are discussed in English, Bahasa Indonesian, Javanese, and Sundanese. The other data are taken from likert 1-4 questionnaires (Admojo et al., 2023; Astutik et al., 2022; Marta et al., 2020). The questionnaires were used as the need analysis as presented in Table 1.

The Need Analysis Form (Table 1) was designed to assess individuals' academic, personal, and career-related needs, particularly in interpreting and language development. It uses a rating scale from 1 to 4, where 1 represents a poor need, 2–3 indicate an average need, and 4 signifies an excellent need. The form was divided into three main sections: academic, personal, and career needs.

In the academic section, the focus was on learning and skill development in interpreting and English proficiency. It assessed the necessity of learning both the theory and practice of interpreting, along with improving the four fundamental language skills—listening, speaking, reading, and writing. There is also an open-ended option for respondents to specify other skills they need to improve. The personal needs section evaluates the importance of fostering one's native languages, including Bahasa Indonesia, Javanese, and Sundanese,

while also enhancing multilingual listening and speaking skills. Respondents could also indicate other languages they wish to develop. The career section helped individuals explore career opportunities in interpreting, language teaching, and other related professions. It included options such as becoming a Bahasa Indonesia-English interpreter, a Javanese-English interpreter teacher, a Sundanese-English interpreter teacher, or a general English teacher. There is also space for respondents to specify other career paths they may wish to pursue. The evaluation is presented in Table 2.

Table 1. Need analysis form

Rate each: 1 – 4 (1 = poor; 2-3 = average; 4 = excellent; N/A = not applicable).

Need Analysis	1	2	3	4
Academic Needs				
to learn more about the theory of interpreting				
to learn more about the practice of interpreting				
to improve my English listening ability				
to improve my English speaking ability				
to improve my English reading ability				
to improve my English writing ability				
other skill you need to improve	write your opinion			
Personal Need				
to foster my native language (Bahasa Indonesia)				
to foster my native language (Javanese)				
to foster my native language (Sundanese)				
to be able to listen better from various languages (English, Bahasa Indonesia, and other local languages)				
to be able to speak better in various languages (English, Bahasa Indonesia, and other local languages)				
other language you need to foster	write your opinion			
Career				
to explore a variety of career opportunities in interpreting				
to learn more about my career interests				
to become a Bahasa Indonesia - English interpreter				
to become a Javanese – English interpreter teacher				
to become a Sundanese – English interpreter teacher				
to become a good English teacher				
other career option you need to explore	write your opinion			

The Evaluation Form (Table 2) was designed to assess instructional materials in terms of format, content, supplemental materials, and assessment methods. Like the Need Analysis Form, it employed a four-point rating scale. The format section examined whether the material is engaging, makes appropriate use of illustrations and graphics, and is well-organized for ease of

understanding. The content section evaluated whether the material is interesting, readable, inclusive of multicultural examples, and integrates various thematic and interdisciplinary approaches. It also considered the accuracy, relevance, and alignment with grade-level expectations, as well as the development of critical thinking skills.

Table 2. Evaluation form

Rate each: 1 – 4 (1 = poor; 2-3 = average; 4 = excellent; N/A = not applicable).

Evaluation Form	1	2	3	4
Appealing to the student				
Appropriate use of illustration and other graphic aids				
Organization easy to understand and logical				
Content				
Interesting to students				
Readability is appropriate				
Contains multicultural examples				
Thematic approach				
Integrated approach (other disciplines)				
Incorporates writing skills				
Content is current, accurate and inclusive.				
The degree to which the instructional material is able to communicate the essential elements of the standards to students.				
Content is grade-level appropriate.				
Readability is on grade level.				
Critical thinking skills are developed.				
Supplemental Materials				
Workbooks				
Manipulative				
Software/CD-ROM				
Online components				
Other (please specify):				
Assessment				
Variety (formative, summative, performance, objective, writing assignments, research projects)				
Grading guides (rubrics, model answers)				

In addition to content and format, the form assesses the availability of supplemental materials such as workbooks, digital tools (software/CD-ROMs), online components, and other supplementary resources that support learning. Finally, the assessment section evaluated the variety of assessment tools used, such as formative and summative assessments, performance tasks, objective tests, writing assignments, and research projects. It also checked for the inclusion of grading guides like rubrics and model answers. Together,

these tables help institutions or educators tailor learning experiences and materials to meet students' specific needs while ensuring instructional quality Students from all classes A,B,C,D, and E were to fill the forms of the above need analysis of the Table 1 at the beginning of the semester and evaluation form of the Table 2 at the end of the semester. Both of the forms (the need analysis of the Table 1 and the evaluation form of the Table 2) were in the Google Form.

There are 29 to 30 each class to obtain the data from. The data are used to support the evaluation process and need analysis to redesign the lesson plan. Here is a flowchart illustrating the steps of the ADDIE model, along with descriptions of each step focusing on product development in the context of research. The ADDIE model is presented in Figure 1 below.

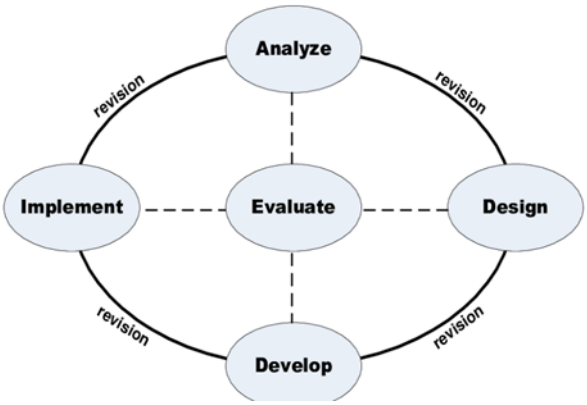

Figure 1. ADDIE cycle

ADDIE Model Steps (Branch & Varank, 2009):

1. Analysis: Identify the project's needs, goals, and challenges, including the target audience and gaps in existing resources.
2. Design: Create a blueprint for the product, including lesson plans and material selection, based on the analysis.
3. Development: Develop the actual product, such as instructional materials or guides, according to the design plan.
4. Implementation: Test the product with the target audience to ensure it meets their needs and functions properly.
5. Evaluation: Assess the product's effectiveness through user feedback and outcome measurement to make any necessary revisions.

RESULT

Need Analysis

The first stage in determining the particular difficulties and goals associated with classroom interpreting is the analysis phase. This involves assessing the current needs of the students, including any gaps in their ability to process information and any shortcomings in the resources that are already available. A comprehensive analysis of pertinent literature and comparison with

effective models facilitates the identification of best practices and promising innovations. Key stakeholders, including as lecturers, students, and interpreting specialists, were asked for input in order to gain understanding of their expectations and experiences. Success criteria, which center on enhancements in interpreting abilities and user happiness, were devised to gauge the efficacy of the interpreter book. To understand student needs, the researcher conducted a survey with younger students (fourth semester) who rated their needs on a scale of 1 to 4 (1 = Strongly Needed, 4 = No Need). The feedback gathered focused on various areas: academic needs included a desire to understand interpreting theory and practice, as well as improving their English skills in listening, speaking, reading, and writing. Personal needs highlighted the importance of speaking better in multiple languages, including English, Bahasa Indonesia, and local dialects. Career needs revealed an interest in exploring various career opportunities in interpreting and aspirations to become interpreters or English teachers.

Based on the need analysis 85% of the student agree that the book must meet the students' needs including academic needs, personal need, and carrier need. In their academic needs, they need to learn more about the theory of interpreting, to learn more about the practice of interpreting, to improve my English listening ability, to improve my English speaking ability, to improve my English reading ability, and to improve my English writing ability.

In their personal needs, they need to foster their native language (Bahasa Indonesia 60%, Javanese 20%, and Sundanese 20%), they need to be able to communicate better in various languages (English, Bahasa Indonesia, and other local languages).

To guarantee the project's viability, various obstacles including financial restrictions and technological requirements are also evaluated. This thorough examination guarantees that the interpreter book's development is based on legitimate requirements and pragmatic factors. Based on this analysis, we redesigned the book titled Interpreter Book: A Classroom Interpreting Practice. Key changes include an updated course description that introduces proper interpreting (English to Indonesian) and inverse interpreting (Indonesian to English). The book emphasizes the development of skills necessary for various interpreting practices, such as sign language interpreting, conference interpreting, and adherence to ethical standards in the field.

Design

The course offers students the study and practice of interpreting. Students learned terminology, concepts, skills, approaches, and techniques of interpreting in different ways. They developed the skills necessary for interpreting. The skills to be developed and improved are as follows: listening skills, note-taking, use of cognitive complements, clear expression of ideas, transcoding where applicable, etc. The modes of interpreting were sequential to ensure students' progress, i.e., wiretapping and tape transcription,

videoconference interpreting, television interpreting, sign language interpreting, telephone interpreting, sight translation, bilateral or liaison interpreting, whispered interpreting, conference interpreting, consecutive interpreting, simultaneous interpreting, professionalism and ethics in interpreting, testing, and certification in interpreting. The meeting distributions is presented in Table 3 below.

Table 3. Meeting distributions

Meeting	Topics	Methods
1	Introduction: Learning Contract and Syllabus Discussion	Lecturing and Discussion
2	Wiretapping and Tape Transcription	Theory and Practice
3	Video conference Interpreting	Theory and Practice
4	Television Interpreting	Theory and Practice
5	Sign Language Interpreting	Theory and Practice
6	Telephone Interpreting	Theory and Practice
7	Sight Translation	Theory and Practice
9	Bilateral or Liaison Interpreting	Theory and Practice
10	Whispered Interpreting	Theory and Practice
11	Conference Interpreting	Theory and Practice
12	Consecutive Interpreting	Theory and Practice
13	Simultaneous Interpreting	Theory and Practice
14	Professionalism and Ethics in Interpreting	Theory and Practice
15	Testing and Certification in Interpreting	Theory and Practice

This course provides students with both theoretical foundations and hands-on practice in various interpreting modes and settings. Emphasis is placed on skill development, ethical considerations, and real-world applications of interpreting techniques in professional contexts. By the end of the course, students will be able to understand and apply different interpreting techniques across various settings, develop practical skills in listening, note-taking, and rapid language processing, demonstrate ethical and professional conduct in interpreting scenarios, and prepare for certification and professional testing in interpreting.

The course begins with an Introduction session, where students will discuss the learning contract, syllabus, and course expectations. This session will provide an overview of the different types of interpreting covered in the course and set the foundation for upcoming lessons. The second session focuses on Wiretapping and Tape Transcription, exploring the challenges of transcribing and interpreting recorded conversations while maintaining accuracy, confidentiality, and legal compliance. As the course progresses, students will engage in Video Conference Interpreting, learning to adapt interpreting techniques to virtual environments while handling technical issues and screen fatigue. The following session on Television Interpreting will introduce the demands of live broadcasts, requiring synchronization with visual content and fast-paced speech. A session on Sign Language Interpreting will highlight the unique challenges of interpreting for the deaf community,

emphasizing the differences between spoken and sign languages, as well as the ethical considerations involved. Midway through the course, students will explore Telephone Interpreting, which requires strong listening skills and effective turn-taking in audio-only settings. They will then practice Sight Translation, learning to convert written texts into spoken translation instantly. Before moving on to more complex interpreting modes, a Mid-Semester Review and Assessment will help consolidate learning, address challenges, and provide formative feedback. The second half of the course will delve into Bilateral or Liaison Interpreting, a technique commonly used in business meetings and diplomatic settings, where interpreters must navigate two-way communication effectively. Students will then learn Whispered Interpreting (*Chuchotage*), a specialized technique used in small groups, focusing on maintaining clarity while whispering. The next session on Conference Interpreting will introduce students to large-scale, multilingual settings, requiring teamwork and relay interpreting strategies.

Students will then move on to the essential interpreting modes: Consecutive Interpreting, which involves note-taking and memory retention, and Simultaneous Interpreting, which demands real-time translation while managing cognitive load and multitasking. These sessions will include intensive practice and simulation exercises to develop fluency and accuracy.

As the course nears its conclusion, students will explore Professionalism and Ethics in Interpreting, addressing confidentiality, neutrality, and cultural sensitivity. The final session on Testing and Certification in Interpreting will prepare students for professional exams, offering insights into industry standards, test-taking strategies, and career pathways.

Development

This book is developed as an accompaniment and follow-up to the students' interpreter/interpreting practice course in the English Studies Department, Faculty of Education and Teacher Training, UIN Sultan Maulana Hasanuddin Banten. They learned terminology, concepts, skills, approaches, and techniques of interpreting in different ways. They developed the skills necessary for interpreting. The skills to be developed and improved are as follows: listening skills, note-taking, use of cognitive complements, clear expression of ideas, transcoding where applicable, etc.

Every chapter consists of modes of interpreting as follows: the first chapter discusses introduction, the second chapter discusses about wiretapping and tape transcription, the third chapter discusses about videoconference Interpreting, the fourth chapter discusses about television interpreting, the fifth chapter discusses about sign language interpreting, the sixth chapter discusses about telephone interpreting, the seventh chapter discusses about sight translation, the eighth chapter discusses about bilateral or liaison interpreting, the ninth chapter discusses about whispered interpreting, the tenth chapter discusses about conference interpreting, the eleventh chapter discusses about consecutive interpreting, the twelfth chapter discusses about

simultaneous interpreting, and the thirteenth chapter discusses about professionalism and ethics in interpreting. The last part of this book is the appendix (Suaidi & Ilzamudin, 2022). This book is developed from three different resource books, i.e., Introducing Interpreting Studies (Pöchhacker, 2022), and Conference Interpreting: A Complete Course (Setton & Dawrant, 2016)

At the development stage the Interpreter Book: A Classroom Interpreting Practice undergoes the process of material production and refinement based on the previously designed framework. This stage transforms the structured blueprint from the design phase into actual instructional materials, integrating multimedia components, exercises, and practical applications to enhance learning outcomes. During the development stage, the book's content is written, structured, and formatted based on the predefined learning objectives. The cover and table of contents are presented in Figure 2 and Figure 3.

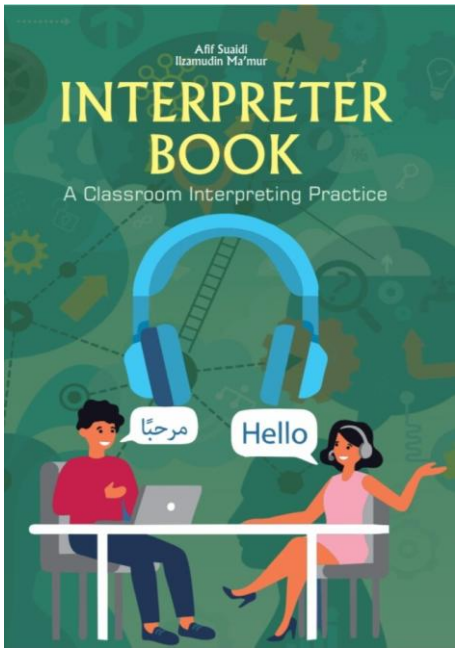

Figure 2. Cover

Figure 3 indicated that the chapters are systematically developed to ensure a logical flow, covering both theoretical foundations and practical exercises in interpreting. Each chapter includes structured components such as exercises, note-taking activities, and interpreting simulations to provide a hands-on experience for students. Additionally, the book incorporates audio and video materials, enhancing the practical applicability of interpreting skills. Feedback from instructors is gathered to refine the instructional design. Adjustments are made based on expert suggestions, ensuring that the material meets academic and industry expectations.

The development stage also involves pilot testing, where a group of students engages with the book in a classroom setting. This phase allows developers to

assess the effectiveness of exercises, the usability of note-taking sections, and the clarity of theoretical explanations. Based on student feedback, revisions are made to improve readability, engagement, and practical applicability. The development stage of this book under the ADDIE model focuses on content creation and pilot testing. It ensures that the instructional materials are accurate, practical, and effective for students learning interpreting. Through continuous refinement the book is optimized before its final implementation in classroom settings.

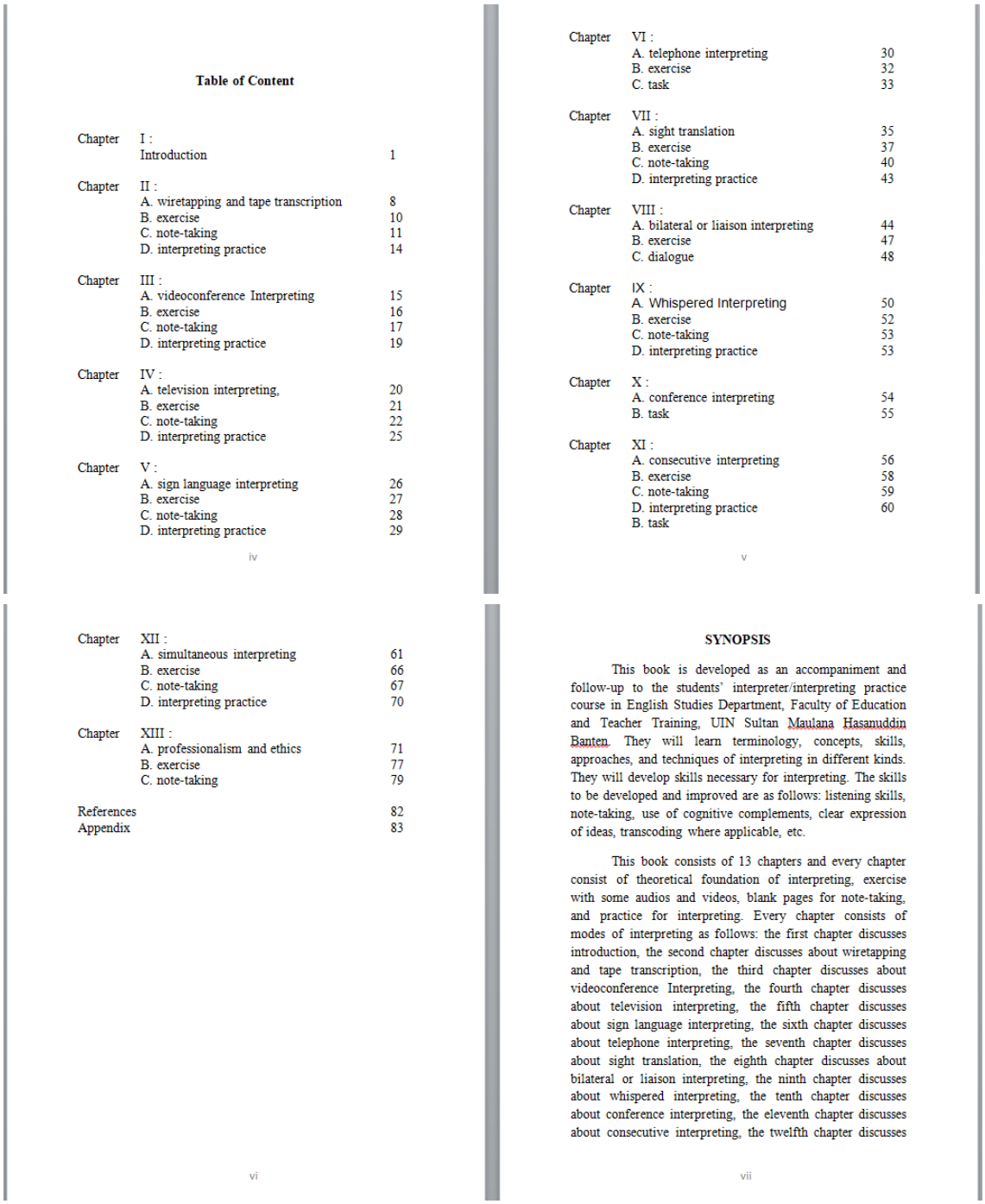

Table of Content

SYNOPSIS

This book is developed as an accompaniment and follow-up to the students' interpreter/interpreting practice course in English Studies Department, Faculty of Education and Teacher Training, UIN Sultan Maulana Hasanuddin Banten. They will learn terminology, concepts, skills, approaches, and techniques of interpreting in different kinds. They will develop skills necessary for interpreting. The skills to be developed and improved are as follows: listening skills, note-taking, use of cognitive complements, clear expression of ideas, transcoding where applicable, etc.

This book consists of 13 chapters and every chapter consist of theoretical foundation of interpreting, exercise with some audios and videos, blank pages for note-taking, and practice for interpreting. Every chapter consists of modes of interpreting as follows: the first chapter discusses introduction, the second chapter discusses about wiretapping and tape transcription, the third chapter discusses about videoconference Interpreting, the fourth chapter discusses about television interpreting, the fifth chapter discusses about sign language interpreting, the sixth chapter discusses about telephone interpreting, the seventh chapter discusses about sight translation, the eighth chapter discusses about bilateral or liaison interpreting, the ninth chapter discusses about whispered interpreting, the tenth chapter discusses about conference interpreting, the eleventh chapter discusses about consecutive interpreting, the twelfth chapter discusses

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Figure 3. Table of contents

Implementation

This book was implemented once for the sixth-semester students of the English Education Department at UIN Sultan Maulana Hasanuddin Banten in the academic year 2022. There are five classes, i.e., classes A, B, C, D, and E, and all of those classes utilized the book for classroom teaching and learning during the term. Class A was held every Monday from 7:30 a.m. to 10 a.m. Just after class A, class B was held at the following hours: 10 a.m.–12:30 p.m. Class C was held every Friday from 7:30 a.m. to 10 a.m. Class D and class E were on the same day. Class D was held every Thursday from 7:30 a.m. to 10 a.m., and class E was held at the following hours from 10 a.m. to 12:30 p.m.

Each lecturer explained the theory of interpreting practice. Students were involved in the discussion of the theory. After the discussion of the theory was done, the lecturer gave assignments to the students to do until the rest of the class hours. At the end of the semester the lecturer accumulated the scores in to the campus scoring system named as siakad.uinbanten. The final students' score is presented in Figure 4 below.

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DAFTAR NILAI KUMULATIF AKHIR SEMESTER GENAP
TAHUN AKADEMIK 2023/2024

KODE/NAMA MK : A03211457 – INTERPRETER
SEMESTER : IV (Empat)
FAK. TARBIYAH DAN KEGURUAN
JUR./PRODI : TBI - A

No	NIM	NAMA MAHASISWA	SMT	NILAI	KET.
1	221230133	VIDIA AZMI FATHIANNISA	4	A-	
2	221230134	PUJAEMAH	4	A-	
3	221230135	INDANA ZULFIA FAHLEFI	4	A-	
4	221230137	ZAHRA AULIA SALSABILA	4	A-	
5	221230138	AWALIA ANGGREANI	4	A-	
6	221230140	RAODATUL WASIAH	4	A	
7	221230141	SALSABILA	4	A-	
8	221230142	KHOIROTUNNISA	4	A-	
9	221230143	VALENTINA NURLAXMI	4	A	
10	221230144	NURUL AINI SALSABILA	4	A-	
11	221230145	DEVIA AGUSTIN	4	A	
12	221230146	GINA ALFI FAIZA	4	A-	
13	221230148	NURAINI	4	A-	
14	221230149	GAYU HENING DWI NASTITI	4	B+	
15	221230150	ALYA ROSA	4	A	
16	221230151	KHOIRYATUNNISA	4	A-	
17	221230152	CHOLIS CHORYANTI	4	A	
18	221230153	DEBY FERISZ CAMELIA	4	A	
19	221230154	MUHAMMAD WILDANUSSYIVA	4	A-	
20	221230155	IIS RAHMAWATI	4	A-	
21	221230157	VALENTINA PRIYANZA	4	B+	
22	221230158	LENI MARYANI	4	A	
23	221230159	AURORA OKTAVIA C	4	A-	
24	221230160	DESTY HERNAWATI	4	A-	
25	221230161	NOVA NURAZIZAH	4	A	
26	221230162	SHAFA GHINA NABILAH	4	A-	
27	221230163	CAESAR DWI KURNIAWAN	4	A	
28	221230164	NURHASANAH	4	A-	
29	221230165	TIARA NAZWA AYU	4	A	
30					

Serang, 26 Oktober 2024
Dosen,

Atif Suaidi
NIP/NIDN. 198712282019031003

Figure 4. Final students' score

The score of the above table was taken from class IV /A. It describes the final results of students' achievements that among the 29 students 9 of them were scored A, 17 of them were scored A-, and the rest of them were scored B+.

The assignments were in the form of video or audio clips, especially in the topics of wiretapping and tape transcription, videoconference interpreting, television interpreting, sign language interpreting, telephone interpreting, whispered interpreting, and consecutive interpreting. Students practiced their interpreting skills during the semester. Assignments in the meeting of sight translation were given in the form of texts, pictures, graphs, and diagrams. Assignments in the meeting of bilateral or liaison interpreting were given in the form of dialogues. Assignments in the meeting on professionalism and ethics in interpreting were given in the form of case studies.

Each lecturer explained the theory of interpreting practice. Students were involved in the discussion of the theory. After the discussion of the theory was done, the lecturer gave assignments to the students to do until the rest of the class hours. The assignments were in the form of video or audio clips, especially in the topics of wiretapping and tape transcription, videoconference interpreting, television interpreting, sign language interpreting, telephone interpreting, whispered interpreting, and consecutive.

The final assessment of the course, i.e., the final examination, was done by practicing their skills by creating a video of their interpreting practice that was uploaded to the YouTube channel so that the lecturer could access their work to measure their ability. The result of the assessment was combined with other scores like mid-examination, formative, and summative assessments so that it resulted in the final score.

Evaluation

We also undertook an evaluation process based on previous feedback, which led to the addition of new features, including illustrations and YouTube video links for all chapters. The book is structured into thirteen chapters, most of which contain four parts: Part A covers the theoretical foundation, Part B features exercises with audio and video, Part C includes blank pages for note-taking, and Part D provides practical interpreting exercises. The exercises in Part B are sourced from various platforms to ensure a diverse range of materials for student practice. This book is designed for sixth-semester students in classes A, B, and C. Students are required to complete prerequisite courses before enrolling in this subject, ensuring they have the foundational knowledge necessary for success. At the end of the semester, all students were required to evaluate the the book they had used. They give inveluable feedback about the book thay have used. Students found the concept interpreter book helpful for developing skills like speaking, writing. The students' responds in the evaluation form is presented in Table 4.

The table shows students' evaluations of instructional materials, divided into four categories: Format, Content, Supplemental Materials, and Assessment. In the Format category, students found the materials unappealing (90.91% poor),

poorly organized (63.64% poor), and lacking effective visuals (81.82% poor). The Content category revealed similar issues, with students rating the materials as uninteresting (45.45% poor), difficult to read (72.73% poor), and outdated (90.91% poor). Additionally, the content was seen as not grade-level appropriate (72.73% poor) and lacking in multicultural examples (63.64% poor). Critical thinking skills were also not well-developed (72.73% poor). Overall, the format and content of the materials failed to engage students or meet their learning needs.

Table 4. The students' responds in the evaluation form

Students' Responds	Students' Evaluation Response
Appealing to the student	90.91% poor and 9.09% average
Appropriate use of illustration and other graphic aids	81.82% poor and 18.18% average
Organization easy to understand and logical	63.64% poor and 36.36% average
Content	
Interesting to students	45.45% poor and 54.54% average
Readability is appropriate	72.73% poor and 27.27% average
Contains multicultural examples	63.64% poor and 36.36% average
Thematic approach	54.55% poor and 45.45% average
Integrated approach (other disciplines)	63.64% poor and 36.36% average
Incorporates writing skills	63.64% poor and 36.36% average
Content is current, accurate and inclusive.	90.91% poor and 9.09% average
The degree to which the instructional material is able to communicate the essential elements of the standards to students.	72.73% poor and 27.27% average
Content is grade-level appropriate.	72.73% poor and 27.27% average
Readability is on grade level.	90.91% poor and 9.09% average
Critical thinking skills are developed.	72.73% poor and 27.27% average
Supplemental Materials	
Workbooks	63.64% poor and 36.36% average
Manipulative	81.82% poor and 18.18% average
Software/CD-ROM	9.09% poor, 63.64% average, and 27.27% excellent
Online components	63.64% poor, 45.45% average, and 9.09% excellent
Assessment	
Variety (formative, summative, performance, objective, writing assignments, research projects)	72.73% poor and 27.27% average
Grading guides (rubrics, model answers)	45.45% poor and 54.55% average

In the Supplemental Materials category, workbooks (63.64% poor) and manipulatives (81.82% poor) were rated poorly, though software/CD-ROMs received more positive feedback (27.27% excellent). Online components were inconsistent, with 63.64% rating them as poor. For Assessment, students found the variety lacking (72.73% poor) and grading guides only somewhat useful (54.55% average). To improve, the materials need a more appealing and organized format, updated and inclusive content, better supplemental tools, and more diverse assessments with clearer grading guidance. Addressing these issues will help create a more engaging and effective learning experience for students.

They suggested adding more complete content and interesting examples to enhance learning. İn tems of the content clarity, the explanations have been given, especially in the introduction and throughout various chapters to ensure better understanding. İn terms of additional examples: illustrations and examples, particularly in Chapters 2, 5, and 7, to enhance learning has been added more clearly. Expanded Sections: Included more comprehensive information in Chapters 1, 10, and 11 to ensure a fuller understanding of the material. İn terms of practice enhancements: practice sections in multiple chapters to offer clearer guidance and relevant tasks has been revised. And interm sof references and resources, the reference list to include additional relevant sources, ensuring a more robust foundation for students has been updated.

This process results some new features i.e., pictures for illustration for every all chapters, YouTube links for videos attached, and texts. The following image is an example of development process that includes pictures in the display of the videos attached. The evaluation result is presented in Figure 5.

The final result of the book evaluation is the added the conference title, provided a direct video link, included alternative sources for practice, and enhanced illustrations and materials. This book was developed from the previous book entitled 'Interpreter Book: A Classroom Interpreting Practice. As explained in the first development it was derived from three different resource books i.e., Introducing interpreting studies written by Pöchhacker, published by Routledge in 2016, The Interpreter's Resource written by Phelan published by Multilingual Matters in 2001, and Conference Interpreting–A Complete Course written by Setton & Dawrant published by John Benjamins Publishing Company in 2016. In terms of the arrangement of the chapters' order, there is no change at all.

This book consists of thirteen chapters and most of the chapters consist of four parts i.e., part A (theoretical foundation of interpreting), part B (exercise with some audios and videos), part C (blank pages for note-taking), and part C (practice for interpreting). Eight chapters of the book consist of the four parts (A, B, C, and D) i.e., chapter two, chapter three, chapter four, chapter five, chapter seven, chapter nine, chapter eleven, and chapter twelve.

Exercise with some audios and videos in part B, are taken from some different sources i.e., YouTube links, videos and audios clips bought by the researcher. Blank pages for note-taking in part C are given to make it possible for the lecturer to measure students' note taking ability. Practice for interpreting in part D is also given to sign that students must be ready for doing the interpreting practice.

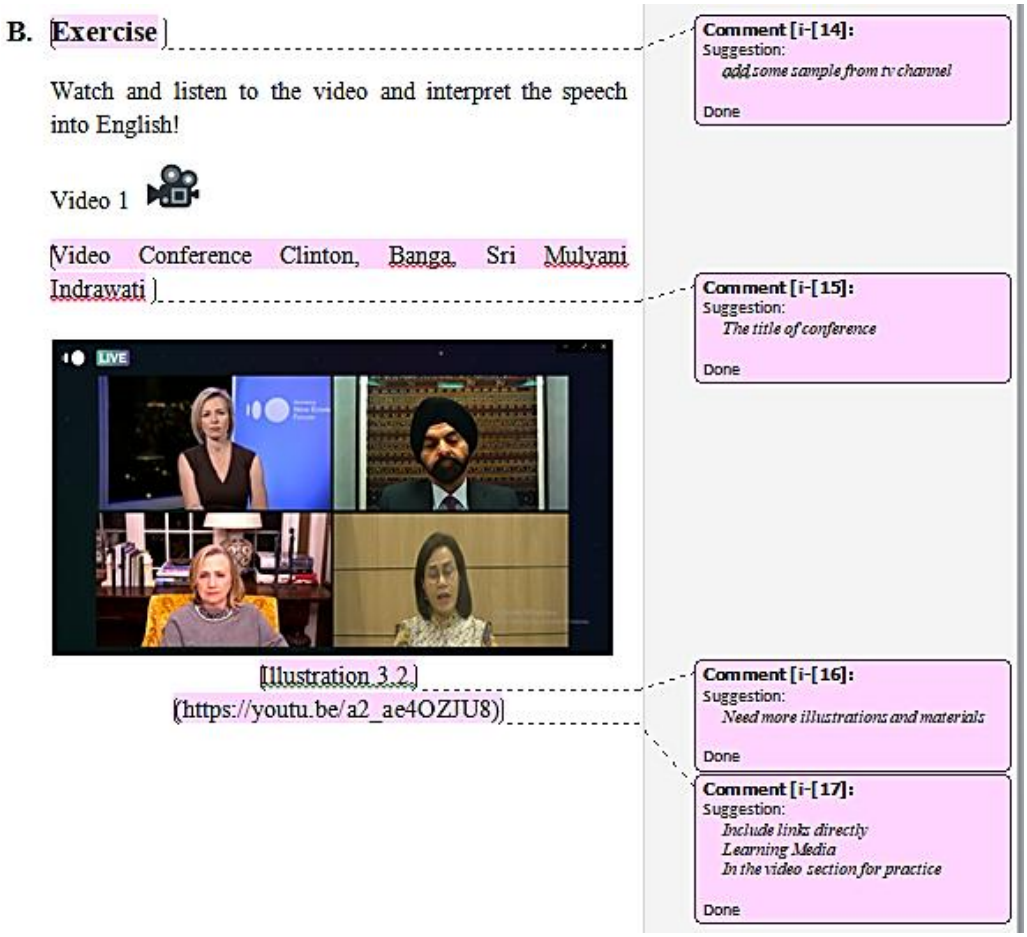

Figure 5. Evaluation result

DISCUSSION

The findings from the need analysis, design, development, implementation, and evaluation of the interpreter book, Interpreter Book: A Classroom Interpreting Practice, highlight significant insights into the challenges and advancements in classroom interpreting education. This section discusses the implications of these findings, identifying strengths, areas for improvement, and their relevance to interpreting studies and professional practice.

Addressing Student Needs through Course Design

This research found that students required academic, personal, and career-oriented support in developing their interpreting skills. The findings are relevant to the theory proposed by (Gile, 2009) and (Pöchhacker, 2016), which

states that interpreter training should incorporate both theoretical knowledge and practical experience to enhance professional competence. Furthermore, (Mikkelson & Jourdenais, 2015) emphasize that career preparation is a critical component of interpreter education, aligning with the needs identified in this study.

Compared to previous research, these findings are consistent with (Aswirna & Ritonga, 2020; Yuan et al., 2023), who highlighted the importance of multilingual competence in interpreter training. However, unlike studies that focus exclusively on English as the primary medium (Mertayasa et al., 2022), this research considers the linguistic diversity of students, incorporating Bahasa Indonesia, Javanese, and Sundanese as essential components of interpreting practice. This suggests that a culturally responsive approach to interpreter training is necessary to meet the needs of students in diverse linguistic settings.

Effectiveness of the Development and Implementation Process

This research found that the structured development of the interpreter book enhanced students' engagement and learning outcomes. The findings align with (Sawyer, 2004) and (Pérez-González & Susam-Saraeva, 2012), who argue that well-structured interpreting materials improve comprehension and practical skills. The inclusion of note-taking strategies, multimedia elements, and case studies contributed to a more interactive and effective learning process.

Compared to previous research, this study expands on the work of (Ngui et al., 2020) and (Chan, 2021), who examined the role of digital resources in interpreter education. While their studies focused primarily on digital learning, this research integrates both digital and print-based materials, providing a hybrid learning experience. This suggests that incorporating multiple instructional modalities can better support students' diverse learning preferences.

Evaluation Insights and Future Refinements

The evaluation phase revealed that students positively received the book's multimedia features but identified areas for improvement in engagement and supplementary resources. This supports the theory of active learning proposed by (Brown & Green, 2019), which suggests that interactive materials foster deeper learning. Additionally, the findings align with (Luo & Ma, 2019), who stress the need for comprehensive note-taking materials in interpreter training.

However, in contrast to (Li, 2019), who found that existing interpreter textbooks are generally well-structured but lack adaptability, this study highlights the need for continuous refinement based on student feedback. Future revisions of the interpreter book should incorporate more case studies, real-world interpreting simulations, and peer-reviewed assessments to address these gaps.

Challenges and Recommendations

The research found that while the book provided a strong foundation for interpreting education, challenges such as financial constraints and technological accessibility need to be addressed. These findings align with (Katan & Taibi, 2021) and (Munday et al., 2022), who argue that interpreters must navigate practical and logistical barriers in their training. Additionally, (Robinson, 2019) and (Pöchhacker, 2022) emphasize that interpreters function as mediators across cultures, requiring exposure to diverse communication scenarios.

Compared to previous research, this study provides new insights by integrating region-specific linguistic needs into interpreter education. Unlike (Erisafitri, 2017) and (Safriyanti, 2021), who focused on material development without extensive field testing, this research includes pilot testing and iterative revisions, ensuring the book's effectiveness in real classroom settings. To further enhance the effectiveness of the book and course, the following recommendations are proposed: the first is to enhance Engagement i.e., to incorporate more real-world interpreting case studies, role-playing scenarios, and AI-driven assessment tools. The second is to expand Digital Resources i.e., is to develop a companion website with additional videos, interactive exercises, and live interpreting practice opportunities. The third is to strengthen Assessment Methods i.e., to provide clearer grading rubrics, peer evaluation mechanisms, and industry-based certification preparation. The fourth is to address Technological Barriers i.e., to ensure that materials are accessible in various formats to accommodate students with limited digital access (Pérez-González & Susam-Saraeva, 2012).

This research found that the Interpreter Book: A Classroom Interpreting Practice successfully meets students' academic, personal, and career needs. These findings are relevant to (Pöchhacker, 2016), who emphasizes the importance of structured interpreting curricula. While the book has been effective in its current form, ongoing refinements based on student feedback and technological advancements will ensure its continued relevance in interpreter education.

Compared to previous research, this study contributes a unique perspective by integrating multilingual and culturally responsive elements into interpreter training. These findings emphasize the importance of a dynamic and adaptable approach to interpreter education, ensuring that students are well-prepared for the evolving demands of the interpreting profession (Mikkelson & Jourdenais, 2015).

CONCLUSION

Overall, the Interpreter Book: A Classroom Interpreting Practice has successfully met the identified academic, personal, and career needs of students, equipping them with fundamental and advanced interpreting skills.

While the book has been effective in its current form, ongoing refinements based on student feedback and technological advancements will ensure its continued relevance in interpreter education. By addressing engagement, resource accessibility, and practical assessment methods, future iterations of the book can further enhance interpreting training and professional readiness. These findings emphasize the importance of a dynamic and adaptable approach to interpreter education, ensuring that students are well-prepared for the evolving demands of the interpreting profession.

This study has several limitations that should be acknowledged. First, the research was conducted in a single institution, which may limit the generalizability of the findings to other educational settings with different linguistic and cultural backgrounds. Future research could explore the effectiveness of similar interpreter books in a wider range of institutions and regions. Second, while the book integrates multimedia elements and real-world case studies, its long-term impact on students' professional interpreting careers remains unexamined. Further studies should track students' progress beyond the classroom to assess their ability to apply these skills in professional contexts. Lastly, technological accessibility remains a challenge, as not all students have equal access to digital resources. Future research could investigate alternative methods to ensure equal learning opportunities for all students.

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SCAR: Scrap Book based on Culturally Responsive Teaching Enriched with Augmented Reality

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Abstract
Cultural diversity in the material of practicing the 3rd principle of Pancasila can introduce cultural diversity, foster an attitude of tolerance, and respect from an early age. However, the lack of variations in learning media makes it difficult for students to understand the diversity of Indonesian culture, and they tend to be passive in learning. Based on the results of observations and interviews that have been conducted, it shows that there are obstacles experienced by teachers in developing media and using learning methods. Limited time, energy, and resources make it difficult for teachers to create varied learning media. This study aims to develop valid and engaging learning media by integrating the Culturally Responsive Teaching approach and Augmented Reality technology to improve students' understanding of cultural diversity. The research and development (R&D) method is applied in this research, which applies the ASSURE model. The validation results from media experts obtained 90%, material experts 85%, and teachers 94%. If interpreted, all three are included in the category of very valid. While the results of the attractiveness test on a small scale obtained a percentage of 93.75% and a large scale of 98%, both are included in the very attractive category if interpreted. So it can be concluded that SCAR: Scrap Book based on Culturally Responsive Teaching Enriched with Augmented Reality is worth using.
Keywords: Augmented Reality; Scrap Book; Culturally Responsive Teaching.

INTRODUCTION

Pancasila education is essential in elementary schools. The diversity of ethnicity, religion, race, and culture in Indonesia makes Pancasila a reference in behaving as a good citizen (Pertiwi & Dewi, 2021). In line with the motto located on the Indonesian state's symbol, the garuda bird reads “Bhinneka Tunggal Ika,” which means “Different but still one”. According to Wika Alzana et al (2021) his motto perfectly represents Indonesia's diversity. It is a real implementation of the 3rd principle of Pancasila, which emphasizes the importance of unity in diversity. One of the subjects in elementary school, namely, Pancasila Education, aims to develop the spirit of Pancasila students to appreciate cultural diversity and strengthen national unity.

Cultural diversity is one of the materials in the practice of the third precept of Pancasila in class V in elementary school. Cultural diversity material can introduce cultural diversity, foster tolerance, and respect from an early age (Wahidah et al., 2023). However, the lack of variations in learning media makes it an obstacle for students to understand the diversity of Indonesian culture and tends to be passive in learning (Almira et al., 2023). As researched Sevtieny et al (2023), media limitations on cultural diversity material make it difficult for students to remember the material.

The results of observations and interviews conducted during PPL (Praktik Pekerjaan Lapangan) show that there are obstacles experienced by teachers in developing media and using learning methods. Limited time, energy and resources make it difficult for teachers to develop learning media and use varied learning methods. Teachers' learning media are limited to conventional tools such as blackboards and books. Technology integration in learning is minimal, limited to video playback or image display. In addition, the learning methods applied tend to use lectures, questions and answers, and assignments, so learning methods tend to be less varied. As a result, students are less motivated and have difficulty understanding the material, especially related to practicing the 3rd Pancasila precept in cultural diversity.

One effective way to increase student motivation and understanding is to develop innovative learning media integrated with learning approaches and technology. As a learning media considered innovative to motivate and provide knowledge of cultural diversity learning, selecting scrapbook media is a solution (Rahayu, 2019). A scrapbook is a creative album containing images accompanied by captions, illustrations, colors, and writings arranged attractively according to students' preferences (Hijjah & Bahri, 2022). Additionally, integrating approaches to learning used by teachers can stimulate interest, activate, and guide students in achieving learning goals (Wulandari et al., 2023). One of them is through the CRT (Culturally Responsive Teaching) approach, which is an approach related to cultural elements. By linking cultural elements in learning, of course, the Culturally Responsive Teaching approach can help students recognize and explore their cultural background (Hijjah & Bahri, 2022).

This media is also equipped with technology that can support learning. Augmented Reality becomes very relevant in the context of technology-dependent learning media because it can present a more meaningful learning experience (Ong & Kutty, 2022). Augmented Reality in learning media can create a more dynamic, interactive, easy-to-use learning atmosphere, replacing the use of virtual learning modules (Hijjah & Bahri, 2022). With Augmented Reality technology, virtual objects in 2D and 3D can be projected in real-time into a 3D real environment by integrating virtual elements into the physical environment (Rinaldi et al., 2024).

Development and relevant research have been carried out in many learning activities, such as research conducted by Pramesti (2024) in developing scrap book learning media on cultural diversity to improve students' creative thinking skills in Natural and Social Sciences subjects in grade 4 elementary schools. However, this research only focuses on developing scrap book media without being integrated

with technology. However, this research only focuses on developing scrap book media without being integrated with technology. Meanwhile Zuhra (2022) Developing Scrap Book Media Based on Local Wisdom for SD / MI. However, this research and development do not explain the subject material used. As well as research conducted by (Prabowo, 2020) regarding the development of augmented reality-assisted picture story scrap book media to increase interest and reading activities. This study uses augmented reality assistance in increasing interest and reading activity, but without being linked to related materials and subjects in the curriculum.

Based on the problems that occur and previous relevant research, to meet these needs, researchers decided to develop SCAR learning media: Scrap Book, based on culturally responsive teaching enriched augmented reality (AR) with the novelty of combining scrap book media with an integrated culturally responsive teaching approach and augmented reality on cultural diversity material. Strengthening the foundation of Culturally Responsive Teaching (CRT) in SCAR media is a significant theoretical urgency. Hammond (2014) emphasizes the importance of culturally responsive learning to increase learning engagement and achievement. SCAR media facilitates CRT by enabling the representation of local culture through physical and digital elements, creating stronger cultural relevance for students from diverse backgrounds. The development of SCAR media that integrates Culturally Responsive Teaching (CRT) and Augmented Reality (AR) has great practical urgency in improving inclusive and contextualized learning, in line with research by Nugroho & Wijayati (2025) showing that the use of AR in learning can improve students' understanding of material, such as civic values, in a more interactive and relevant way, thus supporting more inclusive and contextualized learning for learners with diverse cultural backgrounds. This research aims to produce valid and interesting products in scrap book learning media based on a culturally responsive teaching approach with the help of augmented reality.

METHODS

The data were collected through interviews, observations, and questionnaires. The questionnaire aims to determine the results of the validity test of the media and the results of the material test on the product by validators consisting of media experts, material experts, and teachers, as well as the test of attractiveness by students. The attractiveness test was carried out through small-scale and large-scale tests. The small-scale test was conducted at SDN Pandanwangi 3 Malang, a public elementary school in Malang, involving four students from class VB with different thinking abilities (high-medium-low). In comparison, the large-scale test was conducted at SDN Pandanwangi 3 Malang, involving 25 students from class VA who were divided into five groups so that group learning could run well with active involvement of students and effective management of resources. Students are divided into five groups because each group consists of a maximum of 5 people.

Because this number is more effective when learners conduct discussions and equalize perceptions of understanding (Susanto, 2020).
The research and development (R&D) method is applied in this research. This research applies the ASSURE model. The ASSURE model is considered by the research and development of SCAR: Scrap Book based on Culturally Responsive Teaching Enriched with Augmented Reality in Class V Elementary School because this model combines learning media, learning approaches, and technology (Smaldino, 2015) with steps consisting of (1) Analyze Learner, (2) State Standards and Objective, (3) Select Strategies, Technology, Media, and Materials, (4) Utilize Technology, Media, and Materials, (5) Require Learner Participation, (6) Evaluate and Revise. Each stage of the activities in this model is organized systematically. In particular, one of this model's stages is related to integrating technology with the developed media. This is why researchers use the ASSURE model in the development of a media scrap book based on a Culturally Responsive Teaching Enriched Augmented Reality. This study uses quantitative and qualitative data. Qualitative data were obtained through comments, criticisms, and suggestions from the validity test questionnaire and the students' interest questionnaire. Qualitative data is presented in narrative form. Quantitative data is obtained from the validity test questionnaire assessment results and the students' interest questionnaire. The data is processed using the formula for analyzing data on the level of validity and attractiveness (Akbar, 2013). After the percentage results are obtained, the data results are converted into validity and attractiveness criteria.

RESULT AND DISCUSSION

This research results in SCAR: scrap book based on culturally responsive teaching enriched with augmented reality. SCAR media is unique from previous scrapbook media. It is equipped with a culturally responsive teaching approach that can complement the understanding of concepts related to cultural diversity by involving cultures that exist in the environment. In addition, SCAR media utilizes AR technology, which can provide 3D visualization related to cultural forms in Indonesia. In accordance with the demands of the Merdeka Curriculum, teachers are required to apply technology to learning activities. Technology can make it easier for teachers to convey information to students effectively and provide more accurate data (Emarawati, 2020). This media was developed for use by fifth-grade students. This research uses the ASSURE development model, which has several stages. This stage consists of analyze learners, state standards and objectives, select strategies, technology, media, and materials, utilize technology, media, and materials, require learner participation, evaluate and revise. The ASSURE model is considered appropriate for SCAR media research and development because this model combines learning media and technology (Iskandar & F, 2020).

Analyze learners

This stage analyzes the learning process. The analysis aims to find out the needs of the school. At the learning analysis stage, it is carried out in class VA. Learning analysis includes observations, interviews, and questionnaires, analyzing the needs

of students. Based on the results of observations during the Pancasila Education learning process in class VA, students tend to be passive. The involvement of students in learning is still lacking, and some students look sleepy due to the lack of utilization of media or learning resources that can encourage students' activity in the learning process. In addition, technology is still not well utilized, even though the facilities at school are adequate. Learning that does not integrate with technology will make students feel bored and become monotonous. Therefore, teachers should be able to develop a learning medium integrated with technology that can encourage students to be actively involved in the learning process (Nurissamawati et al., 2024).

The results of interviews with VA class teachers are that in learning Pancasila Education, students often have difficulty with the material on cultural diversity in Indonesia and the material on the principles of Pancasila. The reason is that the potential utilization of learning media is still not optimal. The learning methods and media used are still not varied, so students' learning motivation decreases. In addition, the delivery of material is still ambiguous, so students' understanding of the material is still relatively lacking. After conducting interviews with class teachers, a questionnaire containing several questions was also distributed to students to find out the learning needs of students. The needs analysis questionnaire consists of 1) students' difficulties in learning Pancasila Education, 2) students' difficulties in the material of the experience of the Pancasila principles, 3) students' difficulties in understanding cultural diversity in Indonesia, 4) students' opinions on the learning media used, 5) students' characteristics, 6) students' interest in technology-based learning media so that based on these questions more accurate information can be obtained related to the problems experienced by students. The results of the needs analysis questionnaire obtained an average percentage of 84%, which is categorized as very much needed (Muslimah et al., 2021).

State standards and objectives

After knowing the needs analysis results, it is necessary to determine the standards or learning objectives. Learning standards or objectives need to be determined so learning activities can be directed and the learning outcomes can be identified. Learning objectives should be formulated well to be a reference for choosing appropriate strategies, technology, media, materials, and evaluation techniques.

In determining learning objectives, it is necessary to determine the Learning outcomes and learning objectives. Learning outcomes and learning objectives can be seen in Table 1.

Select strategies, technology, media, and materials

This stage determines strategies, technology, media, and materials. This media uses a culturally responsive teaching approach. This approach uses the culture around the learners in the learning process. The culturally responsive teaching approach will create an active learning process due to learners' collaboration, participation, and communication (Nasution et al., 2023). The technology used is augmented reality, which is a technology that can provide 3D visual information about abstract

concepts. Learning media that apply augmented reality will make learning activities more effective and efficient (Aditama et al., 2021). The media chosen is SCAR media, a scrap book media that uses paper-based materials.

Table 1. Learning Outcomes and Learning Objectives

Learning Outcomes	Learning Objectives
Learners describe the meaning of the values of Pancasila as the foundation of the state, outlook on life, and ideology of the nation and state	1. Learners are able to identify forms of cultural diversity in Indonesia as a form of application of the 3rd Pancasila principle correctly. 2. Learners are able to use AR on forms of cultural diversity in Indonesia as forms of application of the 3rd Pancasila principle correctly.

Utilize technology, media, and materials

At this stage, we start developing the learning media. For example, activities can start from designing media in the form of storyboards that contain learning materials, images, colors, activities, and others. After the design is finished, the next step is to print the book and create interactions in the book such as pulling, folding, and opening, as in Figure 1 below.

Figure 1. Interaction in the Book

Require learner participation

At this stage, the learning media have been developed. The next step is to test the product with students. This stage needs the involvement of students. Before testing students, the media must be validated regarding the material and media. This aims to determine the feasibility of learning media regarding the material and media. Validation was carried out by three validators: media experts, material experts, and teachers as users. The results of the media expert validation are presented in Table 2.

Based on the table, it is known that the percentage of validation results from experts obtained an average of 89.6%, which if interpreted in the validity criteria, is included in the value criteria of 85.1% - 100% with a validity level that is very valid. The validation results were obtained after revisions were made based on suggestions from media experts and material experts. Based on suggestions from media experts, SCAR media needs to use thicker paper to make the media more durable. This is in line with the opinion of Chusna & Hifdiyah (2022) that paper that is thick enough if

used in a learning media will be more durable and not easily torn. In addition, the suggestion from the material expert is to improve the writing of the lyrics in the song "From Sabang to Merauke" to be adjusted to the verse to make it easier to read. This is in line with the opinion of Retnomurti & Hendrawaty (2022) hat writing song lyrics is a means for the songwriter to convey the meaning of the song.

Table 2. Expert Validation Percentage Results

No.	Validator	Percentage	Criteria
1.	Media expert	90%	Very Valid
2.	Material expert	85%	Very Valid
3.	Teacher	94%	Very Valid
	Average	89,6%	Very Valid

Then the traditional game material should use the appropriate name because if there is a mismatch in the learning process it will cause students' misconceptions (Setiawan & Rusmana, 2020). In addition, in one of the materials in the SCAR media, namely in role-playing activities, a command should be given after presenting a story so that students can understand the purpose of the story. So the use of language skills in giving commands must be clear so that students understand the flow of activities in the media (Rosalinda, 2021). The additional suggestion from the teacher as a user is that SCAR media uses an attractive design. According to Nadia & Desyandri (2022) interesting learning media will encourage and increase student activity.

After validating the media, the next step is to test or implement the learning media to students. The trial was conducted through small-scale and large-scale trials. Small-scale trials were conducted in class VB involving four students which aimed to find out things that needed to be improved and the attractiveness of the media before the media was ready for large-scale trials. At the large-scale trial stage, it was carried out in class VA involving 25 students. The implementation of the small-scale trial is presented in Figure 2 and the large-scale test is presented in Figure 3.

Figure 2. Small-scale trial

Figure 3. Large-scale trial

Large-scale trials were conducted to determine the level of attractiveness of the learning media developed. The results of the percentage level of attractiveness of the developed SCAR learning media are presented in Table 3.

Table 3. Percentage Result of SCAR Media Attractiveness Test

No.	User (Students)	Percentage	Criteria
1.	Small-scale trial	93,75%	Very attractive
2.	Large-scale trial	98%	Very attractive
	Average	95,87%	Very attractive

Based on the table of attractiveness test of SCAR learning media, the average percentage of 95.87% is obtained, which if interpreted in the criteria for attractiveness, is included in the value criteria of 85.1% - 100% with the level of attractiveness, namely very interesting. Based on the results of the trial use of the media, students gave a positive response to the learning media developed, it is known that SCAR media can increase knowledge. This is in line with the opinion of Moto (2019) that the benefits of learning media are that students understand learning material more easily and can develop potential. One of the potentials in question is knowledge. Learners show interest in the media and look enthusiastic. In addition, based on comments obtained through questionnaires, students feel that learning becomes fun because they can play and learn at the same time. Learners find it easier to recognize and understand the cultures that exist in Indonesia. This is in line with the role of learning media, which is to help convey information to students so that students more easily understand the information received (Tafonao, 2018). In addition, students' responses to the presentation of the material can be said to be clear and well conveyed. In line with the opinion of Ardhani, et al., (2021) ho argue that learning media is something that is used to convey information and is able to attract the attention, learning interests, and thoughts of students. This is also in accordance with the opinion of Rohani (2019) regarding the benefits of learning media, namely (1) learning media helps students to more easily

accept and understand the material being studied; (2) learning activities become less boring; (3) abstract learning can be expressed in concrete form.

The results of the SCAR media trial also show that students agree that SCAR media can improve understanding of the concept of cultural diversity because in SCAR media there are various interactions such as pulling, folding, sliding, and others. In addition, there are also activities to scan QR codes using android phones to access 3D forms of traditional clothing and traditional houses. This is in line with the opinion of Muslichatun, et al (2021) that the implementation of android-based interactive media significantly contributes to the improvement of conceptual understanding and academic achievement of students.

SCAR media has advantages consisting of (1) attractive, this media has an attractive design and has bright colors, (2) there is a direct learning experience. Because students must directly scan the QR code in the book so that through this activity students are directed to learn independently, (3) make it easier for teachers to convey information to students and encourage student-centered learning activities. In this media there are also shortcomings, namely (1) SCAR media only contains Pancasila education subject matter about cultural diversity in Indonesia so that it cannot be used on all learning materials in the content of Pancasila Education, (2) if there is a change in data regarding culture in Indonesia, then the content of the material explanation in the QR code cannot be updated automatically or needs to be changed manually.

Based on the results of validity test data from material expert validators, media experts, and teachers, as well as the attractiveness test by students, it is known that SCAR media: Scrap book based on culturally responsive teaching approach enriched with augmented reality on the material of cultural diversity in Indonesia is worthy of being classified as learning media and can be applied during learning activities. This is because SCAR has met the requirements or criteria for selecting ideal learning media according to Arsyad (2017) namely (1) linear with objectives; (2) durable, practical, and flexible; (3) teachers are able and capable of using.

Evaluate and revise

At this stage contains the results of evaluating the product developed and revising the product if needed. Based on the evaluation results from the material expert validator, there needs to be revisions to the material on the SCAR media, namely improving the writing of the lyrics in the song "From Sabang to Merauke" so that it is adjusted to the verse to make it easier to read. Then, the media expert suggests that SCAR media needs thicker paper to make the media more durable. Meanwhile, there were no revisions from the teacher.

Based on the results of the review of relevant previous researchers, there are comparisons and differences in research, so there is novelty in this study. SCAR media not only uses scrap books as learning media but also integrates technology in the form of augmented reality and is accompanied by a culturally responsive teaching approach so that this media can convey information to students about the description of forms of cultural diversity in Indonesia in 3D. Previous research conducted by Indahsari & Sumirat (2023) showed the results of using AR technology

in learning, namely the involvement of students, increased motivation to learn, and increased understanding of students. In addition, research by Najib et al (2023) obtained an effectiveness of 56.17%, which indicates that learning media using AR is quite effective in improving students' understanding. Another study conducted by Handayani (2024) obtained a feasibility percentage of 93% from media experts and 90% from material experts. The results also show that AR media can improve student learning outcomes.

CONCLUSION

The result of this research is a learning media, SCAR media: Scrap Book based on Culturally Responsive Teaching Enriched with Augmented Reality. Based on the media validation test, the average percentage of validation by material experts, media experts, and teachers is 89.6%, categorized as very valid media. The developed media have been tested for attractiveness. The media attractiveness test on a small scale was conducted in class VB SDN Pandanwangi 3 Malang involving four participants and on a large scale involving 25 students of class VA SDN Pandanwangi 3 Malang who obtained the results of the percentage of media attractiveness trials with an average of 95.87% with an attractiveness level that is very interesting. Therefore, it is known that SCAR media: scrap book based on a culturally responsive teaching enriched with augmented reality is very valid and very interesting. Hence, SCAR media: scrap book based on a culturally responsive teaching enriched with augmented reality is suitable for use in learning activities.

Suggestions in this study are SCAR: Scrap book based on culturally responsive teaching enriched with augmented reality should be used in groups, the ideal number is 2-5 people. If the application is carried out in one group with a large number, then the utilization of learning media is not optimal. Then the suggestion for further development is that the media should contain more varied content or material content about cultural diversity in Indonesia such as songs, photos, or videos so that the presentation of the material becomes more interesting and varied.

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Development of digital comics to improve reading comprehension and self-efficacy of grade V students

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Abstract
This study investigates the development of digital comics as an innovative instructional medium aimed at improving both reading comprehension and self-efficacy among fifth-grade elementary school students. The research is grounded in the context of declining student interest and performance in reading, particularly in understanding explanatory texts as mandated in the Indonesian language curriculum. The objective is to provide an engaging, accessible, and pedagogically sound media format that aligns with student learning characteristics and enhances their academic engagement. The research adopts a Research and Development (R&D) approach using the ADDIE model, which includes five stages: Analysis, Design, Development, Implementation, and Evaluation. Data were obtained through qualitative and quantitative methods including interviews, classroom observations, student questionnaires, and pretest-posttest instruments. The developed media was validated by material experts, media experts, and classroom practitioners. The digital comics were designed using Canva and distributed interactively through Heyzine, incorporating structured narrative elements and visual appeal to support literacy development. The validation results revealed a high feasibility score of 91.59%, and the effectiveness test yielded an average n-gain score of 0.6793, signifying a moderate yet meaningful improvement in students' reading comprehension. Furthermore, students' self-efficacy scores reached 75.82%, placing them in the "good" category. These findings suggest that digital comics are not only effective in enhancing cognitive literacy but also in supporting students' confidence and motivation in the learning process. This research implies that digital comics can serve as a valuable pedagogical tool in elementary education. Future implementations should explore broader accessibility, including offline versions, and their integration into other subject
Keywords: Digital Comics; Reading Comprehension; Self-Efficacy; Instructional Media; ADDIE Model; Elementary Education.

INTRODUCTION

Indonesian is one of the important subjects for elementary school students. Abidin (2019) explained that Indonesian is a language used to communicate with humans.

One of the Indonesian materials in elementary school is an explanatory text taught in class V. Priyatni in Suprianto (2020) explained that an explanatory text is a text that contains a series of processes for the occurrence of diverse phenomena such as natural, social, cultural, and other phenomena. Harianto (2020) stated that the ability to read is a process of obtaining information involving the limbs. In this study, the researcher took the ability to read comprehension according to the problems contained in the research site. Alpian & Yatri (2022). Therefore, reading comprehension is one of the abilities that must be developed in order to increase students' knowledge related to science that is always developing with the aim of knowing the meaning contained in the text.This is supported by the opinion of Putri, et al. (2022) who revealed that students have the ability to read, but are not fully able to know the information in reading. Therefore, the role of teachers is as a facilitator who provides facilities and motivation to students to be interested in reading.

Problems with reading comprehension were also found in SD Negeri 04 Randublatung Blora grade V. Based on the results of observations and interviews with grade V teachers, it is known that students' reading comprehension ability is still relatively low. Of the 19 students, only 6 children were able to follow the learning well because of their ability to understand reading well. The rest, namely 13 children, have not been able to understand the content of the reading well. This is evidenced by the learning outcomes and student scores on the explanatory text material as follows.

The results showed that 72% of students were not able to understand the content of the reading well, while 28% were able to understand the content of the reading. Low reading ability in students affects their confidence in completing the assigned tasks. This is called *self-efficacy*. Zagoto (2019). Wulaningtyas, et al. (2020) explained that self-efficacy can affect the situation experienced by a person. When a person is unable to control himself, he will experience a lack of confidence, anxiety, and full of pressure. Therefore, it is necessary to develop learning media that suit the needs of students. The application of media that suits the needs of students can attract their attention and interest in reading.

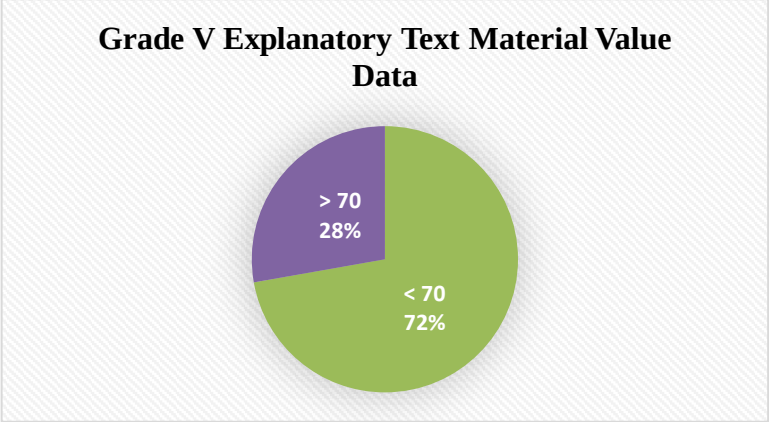

Figure 1. Reading comprehension diagram

The problem of self-efficacy was found in grade V students of SD Negeri 04 Randublatung. Based on the results of observations, students tend to be less confident in themselves in completing the tasks given by the teacher (Figure 1). The results of the class teacher interview stated that one of the subjects that made students less confident was Indonesian with explanatory text material. This is supported by research on student self-efficacy conducted by Anitasari, et al. (2021) that self-efficacy affects student behavior. Therefore, there is a need for media innovation in learning with the aim of improving students' reading comprehension and self-efficacy in carrying out their duties. The right learning medium to increase students' self-efficacy is the use of digital comics. Comics are one of the learning media that contains information. Willya, et al. (2023) stated that digital comics can attract students' attention in their interest in reading. Digital comics can be enjoyed by anyone from various walks of life. The use of digital comics is efficient to increase students' self-efficacy because it can be accessed at any time through the internet network.

Some of the previous studies supporting this research include the PGSD journal with the title "The Effectiveness of the Use of Digital Comic Media in the Reading Comprehension Ability of Elementary School Students" by Leni Marliana and Heru Subrata Volume 11 Number 06 of 2023, the results of which the effective use of comic media is given to students in achieving reading comprehension skills. This is evidenced by data that shows that the score of students before using comic media in the experimental class was 80.76 and the control class was 57.69. Meanwhile, after using comic media, there was an increase with the average result of students in the experimental class was 82.3 and the control class was 73.84. So that it can be known if teachers carry out learning activities well and pay attention to the use of comic media. From the journal, it was concluded that there was an influence of comic media in learning. This influence shows a good influence after the use of comic media. In addition, the journal "Improving Reading Comprehension and Self-Efficacy Skills Through Educational Comic Media in Class V Students" by Barokah (2019). The result of the study is that the use of educational comic media to overcome the problem of reading comprehension has been effective. This can be seen from the data on the results obtained by students before the application of the media is 47.82%, while after going through the experiment, it increases to 78%. Through educational comic media, students are more interested in reading and can understand the content of the readings presented. Therefore, it can be concluded that the use of educational comic media can overcome problems in reading comprehension. In addition, in research conducted by Muhaimin, et al. (2023) stated that the use of comics in learning can improve students' reading skills. Siskawati, et al. (2022) revealed in their research that comics can increase students' interest in reading because of their attractive appearance.

This part is immensely crucial for the objectives of this research, particularly in identifying the research gaps and highlighting the novelty of the study.

Based on the review of previous research, it is evident that digital comics have been successfully utilized to enhance students' reading comprehension abilities. These studies generally employed digital comic media as a learning tool and reported positive outcomes in students' understanding of texts.
However, a closer comparison reveals several distinctions between previous studies and the current research. First, the previous research primarily focused on different grade levels and educational contexts, whereas this study specifically targets grade V students at SD Negeri 04 Randublatung. Second, the subject matter and curriculum content used in earlier studies differ from the learning materials applied in this research, indicating a gap in contextual and content-based application.
Furthermore, while previous studies may have focused predominantly on reading comprehension alone, this research adds a new dimension by integrating the concept of self-efficacy. The dual focus on both reading comprehension and students' self-efficacy represents a significant novelty in this study. Addressing self-efficacy is crucial, as it relates to students' confidence in their own learning abilities, which can significantly influence academic performance.
Therefore, the novelty of this research lies in its contextual focus—namely, grade V students at SD Negeri 04 Randublatung—and its integrated approach that simultaneously seeks to improve reading comprehension and self-efficacy through the use of digital comics. By addressing these two key areas, the study aims to contribute more comprehensively to the body of knowledge on the effectiveness of digital comics in primary education

METHOD

The research method used in this study is research and development (R&D). Wuruwu (2024) revealed that R&D is a type of research that has procedures to answer life problems. This opinion is supported by Sugiyono in Okpatrioka (2023) explaining that the *Research and Development* (RnD) method is a research method used to produce certain products and test the effectiveness of those products. The development model used in this study is the ADDIE development model. Kurnia et al. (2019) explained that the ADDIE model is a development model that has structured stages. The ADDIE model consists of five stages, namely ***analyze***, ***design***, ***development***, ***implementation***, and ***evaluation*** Cahyani, et al. (2021). The ADDIE development model is appropriate to use in the development of digital comics because it has simple stages. The stages of the ADDIE model are described in the following Figure 2.

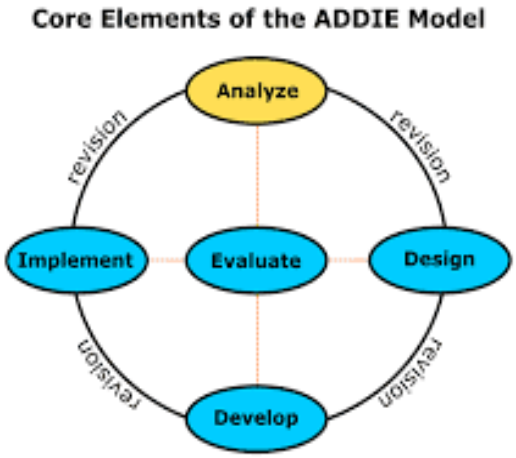

Figure 2. Stages of the ADDIE model

The first stage in the ADDIE development model is analysis. At this stage, the research is carried out with field studies. The first step taken is to conduct literature research on the digital comic products to be developed. After that, it is continued by analyzing the feasibility and conditions of product development.

The second stage is design. In the design stage, the researcher designed related to digital comic media that will be developed through the Canva application. Meilani (2023) revealed that Canva is one of the applications used to design learning media designs to improve the quality of learning. This stage starts from designing the concept and content of the product. The instructions for the application of comic products are also explained in detail and clearly in the comics.

The third stage is *development*. At this stage, it contains activities for the realization of the comic design that has been previously designed. The framework that had previously been designed, then realized into a product that is ready to be implemented. At this stage, instruments are also made to measure product performance.

The fourth stage is *implementation*. At this stage, the product developed is aimed at getting feedback on the media being developed. Initial feedback is obtained by asking things related to the purpose of product development.

The fifth stage is evaluation. At this stage, it is done to give feedback to product users, so that revisions can be made according to the results of the evaluation or unmet needs of the product.

The data sources used in this study came from grade V students, grade V teachers, and media experts. The data collection techniques of this research are test and non-test techniques. Test techniques through *pretest* and *posttest*. As for non-test techniques through observation, interviews, questionnaires, and documentation. The types of data used in this study are qualitative and quantitative data analysis. Qualitative data analysis was obtained from interviews with grade V teachers of SD Negeri 04 Randublatung and input from expert validators related to the product. The analysis obtained from

teachers and the input of expert validators is used as material to make improvements to the developed digital comic media. Quantitative data analysis is from the results *of pretest* and *posttest*, student needs questionnaire, and validation questionnaire for material and media experts. Data from reading comprehension ability were obtained from *pretest* and *posttest* calculated using normality test, homogeneity test, and t-test, and n-gain test. Then the data from self-efficacy, validation of media experts, and material experts were calculated using the Likert scale. The results of the data that have been collected from the validation questionnaire of material experts and media experts are presented in the following table.

Table 1. Eligibility categorization criteria

Achievement rate (%)	Criterion
76% - 100%	Very worthy
51% - 75%	Proper
26% - 50%	Quite decent
0% - 25%	Less feasible

Table 2. Effective categorization criteria

Score level	Criterion
$g > 0.7$	Tall
$0.3 \leq g \leq 0.7$	Keep
$g < 0.3$	Low

Based on the categories in Table 1, digital comic media to improve students' reading comprehension and self-efficacy skills is declared feasible if the percentage of the feasibility test results > 50%. If the results of the feasibility test ≤ 50%, then improvements will be made based on suggestions and input from expert validators to achieve product feasibility. Furthermore, in the effective categorization in Table 2, digital comics are declared effective if > 0.3 in the medium category. If ≤ 0.3, improvements will be made to meet the effectiveness of the product.

RESULTS AND DISCUSSION

This research produces digital comic-based learning media designed to improve the reading ability of elementary school grade V students. This media was developed through the ADDIE model and validated by subject matter experts, media experts, and classroom teachers.

These findings show that digital comic media is able to answer students' problems in understanding explanatory texts. Increased reading comprehension scores indicate that visual and narrative features in comics help students in understanding, processing, and remembering information more effectively. The increase in self-efficacy scores also shows that students become more confident and motivated in the learning process, especially

when using interactive media that is in accordance with the characteristics of the digital generation.

The results of this study are in line with the research of Marliana & Subrata (2023) and Barokah (2019) which showed that the use of comic media significantly improves students' reading skills. Similarly, research by Muhaimin et al. (2023) and Siskawati et al. (2022) emphasizes the positive impact of comics on students' reading interest. However, this study makes a new contribution by integrating cognitive (reading comprehension) and affective (self-efficacy) aspects simultaneously, thus providing dual benefits in learning.

This research contributes to the development of technology-based learning media, especially in the context of basic education. Digital comics have been proven to not only help improve understanding of the material, but also support the strengthening of students' confidence in learning. These results can serve as a basis for teachers and learning developers to consider visual-narrative media as part of a fun, meaningful, and impactful teaching strategy.

This study has some limitations. The implementation was only carried out in one school with a limited number of samples, so the results could not be generalized widely. In addition, the media developed still relies on internet access, which may be an obstacle in areas with limited infrastructure. Therefore, further research is recommended to test these media in a broader context and develop offline versions to make them more inclusive and accessible to more students.

At the analysis stage, interviews were carried out with class V teachers, then students filled out a needs analysis questionnaire to ascertain student needs and problems in learning. The results of the interview with the teacher include (1) students' difficulties in Indonesian subjects, especially reading comprehension, (2) low interest in reading, (3) learning media that are not yet available. This is supported by data on students' reading comprehension skills, which is 72% of students who are not able to understand the content of the reading well. Thus, it can be concluded that grade V students of SD Negeri 04 Randublatung Blora need learning media to support reading comprehension skills, especially in explanatory text material.

Figure 3. Digital comic cover and cover design

The second stage is product design. Digital comic learning media is created through the Canva application and then realized into a product by utilizing Heyzine.com site. Comics are created by combining text, images, and colors from elements within the Canva app. In the content of the comic, various topics are presented, explanatory text material with a clear structure and attractive images. The results of the development of digital comic products are presented in the following Figure 3.

The next stage is the development stage. The development of digital comics for explanatory text materials was developed to improve the reading comprehension and self-efficacy of grade V elementary school students. Digital comics are developed according to the characteristics and needs of students. Digital comics are made in line with the Merdeka curriculum by utilizing projectors, internet networks. Digital comics are equipped with interesting text, illustrations, and images that make the appearance of comics more attractive.

The digital comics that have been designed are then realized into ready-to-use products. To find out the performance of the product, a digital comic instrument is made. The product performance instruments are presented in the following Figure 4.

Table 3. Digital comic product instruments

Aspects	Number
Media in accordance with the learning objectives to be achieved	1,2,3
	4,5,6,7
Corresponding to the student's level of development	8,9,10
The media is easy for students to use	11,12,13,14
Attractive media design	

The finished digital comic product is then validated by three validators, namely media experts, material experts, and teachers. The validation results of the validators are presented in the following table 3.

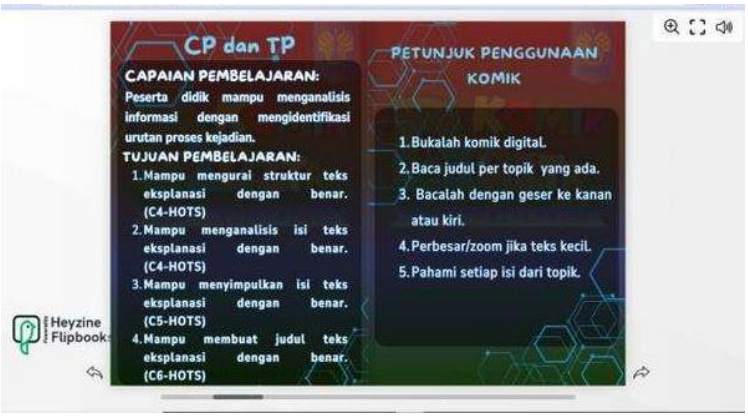

Figure 4. CP, TP, and instructions for using digital comics

Figure 5. Display of comic material content

Table 4. Product validation results by validators

It	Validators	Validation Value (%)	Group
1.	Material Expert	96,42%	Very worthy
2.	Media Members	90%	Very worthy
3.	Teacher	98,68%	Very worthy
	Middle	95, 03%	**Very worthy**

Based on the Table 4, results of the comic validation by the three validators above, it can be seen that the average percentage is 95.93%. It can be concluded that digital comics in the category are very feasible after revisions based on expert validators. There is input from material expert validators, namely that the presentation of explanatory text in comics must be accompanied by the correct text structure. This is because digital comics focus on improving reading comprehension, so it is hoped that students can understand the material with the correct and sequential explanatory text structure.

The next stage is the digital comic implementation stage. At this stage, comics are applied to grade V students to improve their reading comprehension and self-efficacy. The application of digital comics is divided into large groups and small groups. For small groups of 6 students with low student ability, medium student ability, and high student ability. Then for a large group of 13 people. In learning using digital comics, both small and large groups are given *pretest* and *posttest* questions to measure students' reading comprehension. Large groups and small groups obtained normal results. For *small group pretest* and *posttest*, it can be seen in Table 5, while *large group pretest posttest* can be seen in Table 6 as follows.

Table 5. Small group pretest and posttest

Factor	Statistics	Df	Sig.
Pretest	.775	6	.035
Postest	.933	6	.607

Table 6. Large group pretest and posttest

Factor	Statistics	Df	Sig.
Pretest	.976	19	.881
Postest	.921	19	.116

In the small group, based on the results of the SPSS output, the results of the pretest and *postest* normality tests with *the Shapiro Wilk formula* assisted by SPSS version 25 obtained a Sig value of > 0.035 for the pretest and a score for the postest > 0.607. The data is said to be normally distributed or receive H0 if the value $sig > 0{,}05$, and not normally distributed if the value $sig < 0{,}05$. Based on the output, the *pretest* and *posttest values* were normally distributed**.** Based on the calculation of these data, it can be concluded that the pretest and posttest values are normally distributed.

In the large group, based on the results of the SPSS output above, the results of the *pretest* and *postest* normality test with *the Shapiro Wilk formula* assisted by SPSS version 25 were obtained with a Sig value of > 0.881 for the pretest and a score for the posttest > 0.116. The data is said to be normally distributed or accept H_0 if the sig value > 0.05, and not normally distributed if the sig value < 0.05.

Students' self-efficacy was measured using a Likert scale. This is reinforced by Bandura in Zagoto (2019) measuring students' self-efficacy consisting of three dimensions, namely level, strength, and generalization. The results of the students' self-efficacy are presented in the following Table 7.

Table 7. Student self-efficacy

Score (%)	Category	Code
75,82%	Good	3

The result of student self-efficacy of 75.82% was included in the good category. The results were obtained from a questionnaire that had been distributed to students, then they filled it out by choosing one of the four options, namely SB (Very Good), B (Good), TB (Not Good), and STB (Very Bad). After the results are obtained, the next thing is to calculate by tabulating the data to get the average percentage of students' self-efficacy.

The last stage is the evaluation stage which is carried out at the end of the research. At the analysis stage, the evaluation is carried out to improve the digital comics developed according to the needs and characteristics of students. At the design stage, the evaluation is carried out on digital comics after being given input and suggestions from supervisors. At the development stage, the evaluation is carried out on digital comic instruments. At the implementation stage, the evaluation of digital comics is carried out after receiving input from media experts and material experts. The last stage is the evaluation stage, comics are developed to the next stage

in research. The final result obtained from this development is a digital comic to improve the reading comprehension and self-efficacy of grade V students of SD Negeri 04 Randublatung Blora.

CONCLUSION

This research produced a learning media in the form of digital comics designed to improve the reading comprehension and self-efficacy of grade V students. The effectiveness test showed an average n-gain value of 0.6793 (medium category), which proved that digital comics were effectively used in explanatory text learning. Thus, digital comics can be an innovative solution to increase students' interest in reading, reading comprehension, and confidence in the learning process. The limitation of this study is the media's dependence on suboptimal internet access. Further research is recommended to develop digital comics that can be accessed offline and test these media on a larger student population to reinforce the generalization of research results.

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Development of the eduka gantari website to improve literacy and numeracy in realizing the Profil Pelajar Pancasila

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Abstract
Literacy and numeracy as a manifestation of critical reasoning in the Profil Pelajar Pancasila an important role in life, including in elementary school students. However, the achievement of literacy and numeracy skills of students is still relatively low. The aim of this research is to develop digital learning media with the "Eduka Gantari" website. This type of research is development research using the Plomp model which consists of three stages, namely the preliminary stage, the prototyping stage, and assessment phase. The results obtained from this research are in the form of digital learning media in the form of the "Eduka Gantari" website on the topic of Literacy and Numeracy which is valid, practical and effective. Data from the results of the research carried out showed that the average validation result was 4.21 on a scale of 5, the practicality of the media was up to 100% and the effectiveness in terms of the completeness aspect of learning outcomes from the pretest percentage was 48% and the posttest was 100%. Furthermore, the effectiveness of this media is from the average N-gain test for each ability, which is 0.72 for literacy skills and 0.74 for numeracy skills so that the product is in the high effective category. Thus, the media developed can provide opportunity for elementary school students to learn about Literacy and Numeracy because its valid, practical and effective in realizing the Profil Pelajar Pancasila.
Keywords: Digital Learning Media; Literacy; Numeracy; Profil Pelajar Pancasila.

INTRODUCTION

The Profil Pelajar Pancasila is being promoted to Indonesian students as one of the learning implementation structures through the Strengthening the Profil Pelajar Pancasila by the Ministry of Education, Culture, Research and Technology in 2022 in the Kurikulum Merdeka. The Profil Pelajar Pancasila is a character that is not only framed in the ethics of an Indonesian student, but also in good competence as in the cultivation of noble values in Pancasila (Diputera et al., 2022). For this reason,

the Profil Pelajar Pancasila which outlines the character and competencies need to be built by every student in Indonesia through the direction of education policies that are oriented towards students as good Indonesian learners. The policy direction creates six dimensions in the Profil Pelajar Pancasila in Permendikbudsitek Number 20 of 2020 which are then used as indicators of the Profil Pelajar Pancasila, namely faith, devotion to the almighty and noble character, world diversity, independence in mutual cooperation, critical reasoning and creativity. The Profil Pelajar Pancasila students shows the character of students who are lifelong learners with a global outlook with Pancasila values. Thus, in the learning process, learning that occurs must be carried out in accordance with changing times including the demands of society. As a result, the learning materials taught can be used as a media in internalizing the characters of the Profil Pelajar Pancasila. Through the material taught, students must be directed to the character of the Profil Pelajar Pancasila, so that learning objectives do not only focus on cognitive goals, but also the character or values of the Profil Pelajar Pancasila dimension.

To implement this policy, the government stipulates a policy is Permendikbudristek Number 5 of 2020 in providing a competency focus for basic education students through Literacy and numeracy skills so that students can follow further education. Based on the six dimensions of the Profil Pelajar Pancasila, the critical and creative reasoning dimension can be implemented by providing stimulation from learning outcomes about the basics of Literacy and Numeracy to students (Diputera et al., 2022). Thus, literacy and numeracy can be said to be the main component in shaping students into Pelajar Pancasila.

UNESCO states that literacy is a manifestation of real skills that specifically lead to cognitive skills in reading and writing, regardless of the context in which these skills are obtained from whom, where, and how they are obtained (Purwati, 2017). Similar to UNESCO, Ati and Widiyarto (2020) state that literacy is the ability of individuals to be able to read and write, while Lestari et al. (2021) state that literacy refers to the comprehensive ability to identify, understand information, communicate, and calculate using printed materials in various contexts. Thus, it is concluded that literacy is an individual's cognitive ability to search, process, and analyze information and re-present information comprehensively.

Numeracy is one of the branches of mathematical literacy (Andriatna et al., 2024), where numeracy is different from mathematical literacy (Rakhmawati & Mustadi, 2022). The difference between the two refers to the knowledge and skills (Kemendikbud, 2017). World Economic Forum (2015) states that numeracy is the ability to use numbers and other symbols to understand and express a quantitative relationship. Another opinion states that numeracy is the ability of individual thinking in using mathematical concepts, procedures, facts, and tools to solve daily life problems (Kus, 2018; Kusaeri, 2020; OECD, 2012; Yore et al., 2007). Prihapsari et al. (2023) stated that numeracy is an individual ability that aims to solve a problem by understanding numbers, data, and/or assessing a condition to find solutions to problems that arise. Thus, numeracy emphasizes the individual's ability to use mathematical skills to solve the daily problems they face.

Literacy and numeracy have indicators that become benchmarks to determine the extent of an individual's ability to understand and process information including using mathematics to solve life problems. In literacy, the indicator of emphasis is on how individuals (students) have the ability to read and write individuals to process and analyze information, while numeracy has indicators in the form of the ability to understand numbers and data including concepts / facts / procedures in mathematics. Both literacy and numeracy lead to how these skills are used to help solve problems in life.

In Indonesia, literacy and numeracy began to be echoed along with the policy on the Kurikulum Merdeka through the Profil Pelajar Pancasila. However, the Profil Pelajar Pancasila, which is a strategic plan packaged into a project on the Merdeka Curriculum, has experienced a serious obstacle in its realization. This obstacle is shown by a number of national and international institutions through the index results of the two main components of the Profil Pelajar Pancasila, namely literacy and numeracy, which are still in the low-ranking category in the world. The most worrying thing about the ranking results is at the Elementary School level.

According to the Progress in International Reading Literacy Study (PIRLS) survey in 2011 related to the study of the average reading score of fourth grade elementary school students around the world, Indonesia occupied the 45th position out of 48 participating countries (Nugrahanto & Zuchdi, 2019; Ratri, 2015). In line with that, students' numeracy skills in Indonesia are still low. This is based on several research results related to numeracy skills (Andriatna et al., 2024; Nur'aini et al., 2021; Sujadi et al., 2022). The results of the PISA survey in 2018 show that in the numeracy category Indonesia ranks in the bottom 10 out of 79 countries in the survey with an average math ability, which is 52 points below the average ASEAN student (Nur'aini et al., 2021). In line with the above results, Anisa et al. stated that Indonesian students are only able to solve problems at the C-1 level (Remembering aspect) (Novitasari et al., 2022). This problem creates a gap in the plan to achieve the Pancasila Student Profile with global competence caused by the low level of literacy and numeracy of students in Indonesia. Literacy and numeracy ratings that are still very low can have an impact on the Human Development Index (HDI) which is a measure of the potential quality of human resources in a country.

Through this case, the elementary school level is of particular concern because in addition to being caused by a major upheaval in literacy and numeracy rankings, this level is also a very important time in human life to mobilize all the potential of children through encouragement to develop optimally (Adinda et al., 2022). Primary school students become the foundation generation in creating the spirit of Pancasila students who are devoted to God, have noble character, global diversity, mutual cooperation, independence, critical reasoning, and creativity. For this reason, the elementary level is an important level to effectively promote learning based on literacy and numeracy skills in order to create the Profil Pelajar Pancasila. However, realizing the limited ability to realize equitable learning facilities in Indonesia results in teachers who must have creative and innovative abilities in creating a fun learning process.

In addition, the current digitalization era is one of the benchmarks for the existence of the Kurikulum Merdeka. The Kurikulum Merdeka also aims to answer the challenges being faced in the field of education in the era of revolution 4.0, which in its implementation must be able to support critical, creative and innovative thinking skills, as well as communication and collaboration skills of students which are realized in the Profil Pelajar Pancasila project.

Departing from the realization of the Profil Pelajar Pancasila which is identical to global competencies that utilize technological advances, it has implications for educational equity in creating the Profil Pelajar Pancasila based on literacy and numeracy components which are realized in the use of technology through innovative learning strategies and accepted by students, namely digital learning media that are adaptive to the times. Digital learning media can be introduced, either through the form of applications or websites. The most widely used digital media is the website (Soejono et al., 2018).

Websites are a digital medium that can be an effective medium for learning in a fun way, more environmentally friendly, more durable, innovative, and practical to use (Verananda, 2021). In general, websites have a variety of digital tools that are flexible to use. This is as stated by Paul et al. (2021) that the website can be an educational media with the nickname "one-stop shop" because it can allow learners to enjoy various sensory objects such as images, videos, and efficiently created literature.

Falaq (2020) stated that in Curriculum 2013 in particular, most teachers are still in the category that has never utilized digital media, especially website-based media. It cannot be denied that there will be equal opportunities for teachers who have implemented the Profil Pelajar Pancasila Project in the Kurikulum Merdeka. Moreover, the implementation of the curriculum still needs to be reviewed and will only be ready for comprehensive implementation at all levels of education in 2024 (Ngurah et al., 2022). Therefore, implementatively, a complete, practical, collaborative, and complete website that is oriented towards realizing the Pancasila Student Profile has not yet been found due to the lack of website-based learning media that optimally provides this basic convenience. Thus, this digital service can be an innovative and creative solution to become a fun and suitable learning media for elementary school students to provide a broader understanding of literacy and numeracy competencies to achieve the Profil Pelajar Pancasila with global competence. Therefore, efforts are needed to develop learning media that focus on improving literacy and numeracy of elementary school students that contain a lot of education. So, the development of website learning media “Eduka Gantari” as an increase in literacy and numeracy to form the Pancasila Student Profile needs to be implemented.

METHODS

Research Design

This research is a Research and Development with Plomp model which consists of three stages, namely preliminary research stage, prototyping stage, and assessment phase (Plomp, 2010).

The Preliminary Research Stage

The preliminary research stage includes analyzing the curriculum, students, teachers, and learning materials. The results of the analysis of curriculum, students, teachers, and learning materials served as the basis for prototyping.

The Prototyping Stage

The prototyping stage includes activities to design digital learning media websites on Literacy and Numeracy materials at the elementary level. At the prototyping stage, the media that has been prepared is then validated by experts (experts review) and then the results are used as a reference for improvement before conducting a one-to-one test on three students. The results of the individual test are then used as a reference for making improvements to the learning media based on the students' point of view. Furthermore, the revised learning media based on the individual test was carried out small group testing on students to obtain practicality data through a questionnaire.

Assessment Phase

The assessment stage is a limited trial stage for students. At this stage, the learning media tested at the prototype stage is applied to a limited number of 23 students to obtain data on effectiveness. The effectiveness data is obtained based on the Gain index score for literacy and numeracy skills after being given learning using learning media.

Participants

The participants in this research consisted of participants for preliminary studies consisting of teachers and students of SDN 01 Gerdu Karanganyar. In addition, this study also used validation subjects consisting of material and learning media experts, namely teachers and lecturers, while the test participants for practicality and effectiveness were students of SDN 01 Gerdu Karanganyar.

Data Collection Technique

The data collection techniques used in this study used test, questinare, and interview. The test technique using test instruments was used to obtain data on the effectiveness of the Eduka Gantari website media on students' literacy and numeracy skills. While the questinare technique is used to obtain data on the practicality and validity aspects of the Eduka Gantari website media. The instruments used through a practicality questionnaire for students and media and

material expert validation sheets. The interviews were conducted with teachers to obtain data regarding the needs of the Eduka Gantari website media development.

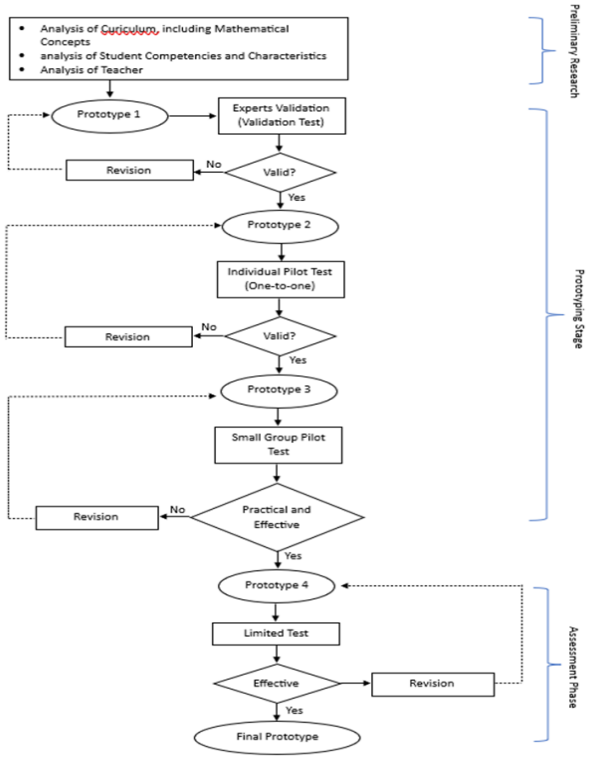

Figure 1. Flowchart of Plomp Model Development Research

Data Analysis

Data analysis of the results of validation of learning media products by validators, namely one learning media expert and one as a material expert, both media experts and material experts play a role in reviewing the language aspects of the product. This test uses data analysis techniques from the product validity test results in the form of descriptive analysis so that conclusions can be obtained from the assessment criteria modified from Hobri (Amalia & Lestyanto, 2021) which are described as in Table 1.

Table 1. Interpretation of product validity test results

Interval	Interpretation
$1 \leq X < 2.33$	The developed learning media is unvalid
$2.33 \leq X < 3.67$	The learning media developed is less valid so there needs to be major improvements
$3.67 \leq X < 5$	The developed learning media is valid, but there are minor improvements
$X = 5$	The developed learning media is very valid and no improvement

Data analysis of the practicality of the Eduka Gantari website learning media was obtained from the results of the student response questionnaire while using the Eduka Gantari website learning media with Likert scale calculations. The results of the analysis were obtained from a percentage based on the modified results of the Likert scale interpretation according to Widoyoko et al. (2020). Learning media is categorized as feasible if the results of interviews and student questionnaires are in good or very good criteria with a percentage of more than 60%.

Table 2. Likert scale category

Percentage	Category
$X \leq 20$	Very Less
$20 < X \leq 40$	Less
$40 < X \leq 60$	Fair
$60 < X \leq 80$	Good
$80 < X \leq 100$	Very Good

Data analysis of the effectiveness of digital learning media on the Eduka Gantari website is also based on the average score of the Gain Index ($\boldsymbol{N-Gain}$). The gain index formula used is based on Hake (2002) as follows.

$$\boldsymbol{N-Gain} = \frac{\boldsymbol{Posttest\ Score - Pretest\ Score}}{\boldsymbol{Maximum\ Ideal\ Score - Pretest\ Score}}$$

Based on what was stated by Hake (2002), the results of the $\boldsymbol{N-Gain}$ test analysis can be interpreted into three categories The categories of the $\boldsymbol{N-Gain}$ score interpretation are outlined in Table 3.

Table 3. Interpretation of $\boldsymbol{N-Gain}$ score

Interval	Interpretation
$N - Gain \leq 0.3$	Low
$0.3 < N - Gain \leq 0.7$	Medium
$N - Gain > 0.7$	High

RESULT AND DISCUSSION

The research on the development of Eduka Gantari digital webstite learning media on literacy and numeracy materials for elementary students uses the Plomp research and development model. This model was developed to design learning systems in the field of education. In the model compiled through this research, it is carried out through several stages which can be described as follows.

Preliminary Research

The preliminary research stage was conducted to identify the basic problems needed in developing the learning media. This stage requires researchers to analyze the curriculum, students, materials, and teachers as well as reviewing literature to obtain a needs and context analysis so that they can plan further activities. Based on

an interview with an elementary school teacher at SDN 01 Gerdu, Karanganyar, it was found that in general, students at the elementary school still have difficulty in understanding the topics of literacy and numeracy with the standard of mastery (KKM) set at the school, especially at the level of grades 1 to 3 Elementary School due to a lack of motivation to learn to read and think critically. In addition, this is also supported by the results of a student needs questionnaire that was distributed to 24 grade 5 students at SDN 01 Gerdu. Based on the results of the questionnaire in Table 4, 100% of students stated that literacy and numeracy materials were difficult to understand dynamically. In addition, 91.7% of students answered that teachers more often give literacy and numeracy problems from books or by writing on the blackboard. This raises the issue of student motivation in learning literacy and numeracy for elementary school. In general, students will be more interested in something if it is not done too often and monotonously and presented in a more interactive and advanced learning media.

Table 4. Student response in preliminary research

Student Initials	Student Response	
	Are literacy and numeracy materials difficult to learn?	Does your teacher more often give problems about math literacy and numeracy through books or the blackboard?
R	Yes	Yes
S	Yes	Yes
A	Yes	Yes
N	Yes	Yes
D	Yes	Yes
AD	Yes	Yes
RN	Yes	Yes
NN	Yes	Yes
G	Yes	Yes
ND	Yes	Yes
NI	Yes	Yes
RS	Yes	Yes
NA	Yes	Yes
F	Yes	Yes
FA	Yes	Yes
RA	Yes	Yes
RL	Yes	Yes
Y	Yes	No
YU	Yes	Yes
I	Yes	Yes
SR	Yes	Yes
FI	Yes	Yes
KA	Yes	Yes
SA	Yes	Yes

Prototyping Stage

The prototyping stage is carried out in this research by designing the digital learning media developed so that it becomes an educational and attractive website. Even so, the essence of literacy and numeracy learning that is learned with a website is still accepted by students. In this case, it is necessary to start by conducting a needs analysis (need assessment) and then enter to prepare the development of a website-based digital learning media prototype. Additional elements also need to be prepared in an effort to support and increase student interest and the completeness of the menu on the developed media. The materials developed in Eduka Gantari include materials for the development of literacy and numeracy skills as follows in Table 5.

Table 5. Literacy and numeracy development materials in Eduka Gantari

Literacy Materials	Numeracy Materials
Reading and Viewing Descriptive Texts Learning Objectives: 1. Students can understand the information conveyed from the description reading text well. 2. Students can identify the main idea and understand the message in the description text correctly.	Integer Numbers Learning Objectives 1. Students can sort integer numbers. 2. Students are able to calculate addition, subtraction, multiplication, and division of integers.
Writing a Description Text Learning Objectives: 1. Students can write description text based on accurate and relevant information. 2. Students can write descriptive texts using linguistic rules correctly	Data Presentation Learning Objectives: 1. Students can present data results using bar charts. 2. Students can read and analyze data from bar charts.

After completing the preparation of the prototype, then the researcher needs to validate the learning media product to the validators. The validators consist of learning media experts and material experts. The validators include a Universitas Sebelas Maret (UNS) Mathematics Education Lecturer as a media expert and a teacher at SDN 01 Gerdu as a material expert to obtain assessments and suggestions regarding the media developed. Based on the validation test results obtained from the validators' questionnaires, a recapitulation of the validation score calculation is presented as in Table 6.

Table 6. Recapitulation of validation test

Validator	Aspect	Mean Validation Score
V1	Materials	4.20
V2	Media and Learning	3.75
V2	Graphics and Typography	4.40
V1 and V2	Language	4.50
Grand Mean		4.21

V1 Elementary Education Teacher
V2 Innovative Learning Media Expert

Based on Table 6, the aspects reviewed by the expert are in the form of material, media and learning aspects, product graphics and typography, and language. The final score or value obtained from the product validation test results is 4.21 on a scale of 5. Thus, the digital learning media product developed is on a valid criterion, but still needs to be revised on a relatively small scale. As for other things, namely related to the notes of suggestions from the validators which are used as another reference in improving the prototype. Some improvements of the developed media can be observed in Table 7.

Table 7. Suggestions and improvements for digital learning media products developed

Suggestions	Revision
Detailing the learning objectives with the Basic Competencies (*Kompetensi Dasar*, KD) presented in the media so that the two things are more compatible and can be understood properly	Detailing learning objectives with Basic Competencies (*Kompetensi Dasar*, KD) on the website more fully and in accordance with each other
Need to improve the appearance of the title screen to be more clear, neat, and in accordance with the typography of the theme displayed on the website	Redesigning the title screen that is clearer, neater, and in accordance with the typography on the website display theme
There are typos in some words in the question section presented in the developed website learning media	Correcting words with typos

Based on the results of the review and improvement based on the suggestions from the validators, the researchers made small-scale revisions by remaking the developed media so as to create the first prototype of a better product with a clearer and more attractive appearance. The developed digital learning media is shown in Figure 2.

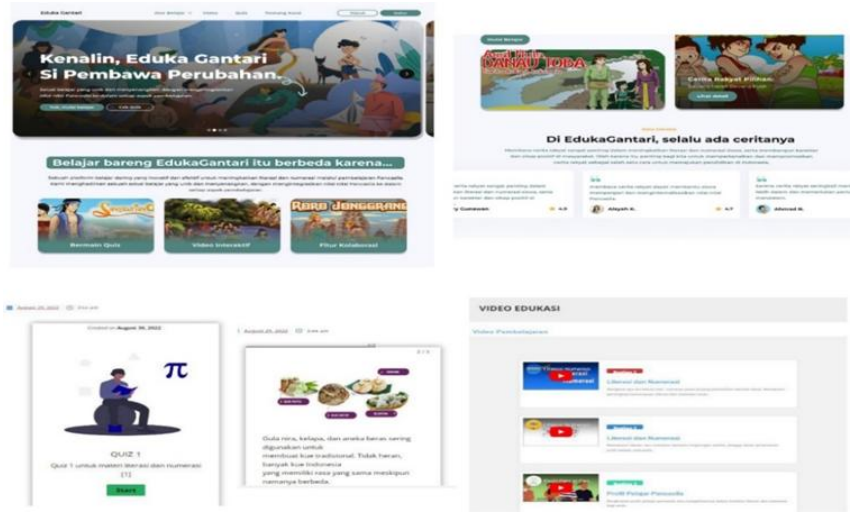

Figure 2. Digital Learning Media Developed "Eduka Gantari"

Figure 2 shows the appearance of the Eduka Gantari learning media developed based on the preliminary study. In the media, several sections are presented that are used to develop literacy and numeracy skills. The development of literacy and numeracy skills is done through the presentation of stories or contextual problems as in Figure 2 above.

Products that have been revised based on the results of expert validation consisting of media experts and material experts, can then be carried out one-to-one evaluation tests obtained from data collection in the form of interview sheets. This trial was conducted on students who represented students with low, medium, and high abilities in the literacy and numeracy ability categories. This interview activity was carried out to grade 5 elementary school students with the aim of getting responses from student representatives to the products developed in the form of digital learning media on the Eduka Gantari website with the main material, namely literacy and numeracy so that they could pocket student input and comments on the Eduka Gantari website prototype from the revised results from the validator. The following are comments on the results of interviews with these students which are attached in Table 8.

Table 8. Students' comments and suggestions on individual evaluation

Subject	Class	Comments and/or Suggestions	Researcher's Response
L- Students representing groups with low literacy and numeracy ability	5th Grade	Digital learning media that is fun and easy to understand because learning videos are provided so that it is motivated to learn literacy and numeracy. The questions presented are varied.	Accepted

Subject	Class	Comments and/or Suggestions	Researcher's Response
M- Students representing groups with medium literacy and numeracy ability	5th Grade	The material presented is complete, easy to understand, attractive website display. The questions on the learning media are complete.	Accepted
H- Students representing groups with high literacy and numeracy ability	5th Grade	Need to add more questions	Accepted to be used as improvement material

In the results of the interview sheet in the individual evaluation and direct observation, it can be shown that students L, M, and H experienced ease in understanding the subject matter related to literacy and numeracy, especially the material presented in the learning video feature on the website. This is also supported by the illustration element presented in the presentation of materials and questions on the Eduka Gantari website because this element creates interest so that they understand more easily and are motivated to learn literacy and numeracy. Then, on direct observation, it was found that the students found it easy and quick to understand how to operate this digital learning media. Suggestions regarding questions that are too long and the addition of the number of items are recommendations that researchers receive for further revision. The suggestions from the three students became the supporting basis for revising the product again so as to obtain the third protoype.

Based on the results of product revisions in the individual evaluation, the second prototype was obtained which was then tested on a small group of nine students who did not participate in the one-to-one test. In this trial, students were given a student response questionnaire while using the second prototype of the learning media. The results of the student response questionnaire were interpreted through the Likert scale interpretation percentage distribution in Table 9.

Table 9. Practicality test results based on small group pilot test

Percentage	Category	Small Group Pilot Test	
		Frequency	Percentage
$X \leq 20$	Very Less	0	0
$20 < X \leq 40$	Less	0	0
$40 < X \leq 60$	Fair	0	0
$60 < X \leq 80$	Good	1	11
$80 < X \leq 100$	Very Less	8	89

Based on Table 9, it can be obtained that the results of the assessment of the nine students response questionnaire have a good category of 11% and a very good category of 89%. This shows that the assessment is at a percentage of more than 60%. Therefore, it can be concluded that the digital learning media developed is suitable

for use because it has been said to be of practical value. This is supported by research conducted from Priyani (2022) and Rizkyani (2023) that digital technology is feasible to use so as to provide practical value in its use to improve student literacy and numeracy, especially in creating digital interactions for elementary school students.

Assessment Phase

After being tested in a small group, the learning media prototype was then tested again through a limited trial with a larger number of students than the small group trial. The limited trial was conducted on 23 students by giving a student response questionnaire in the form of a Likert scale. The results of the student response questionnaire increased the number of percentages in the excellent category, which amounted to 100% in the test. This means that the learning media developed is suitable for use in learning activities for students on the topic of literacy and numeracy because it has met the standard value of the practicality of learning media.

Practical digital learning media allows students to have an easy and enjoyable learning experience. This is because utilizing digital technology in the form of a website can provide students with a learning and practice experience that is more efficient, practical, independent, active, and its use is not limited by time. This is reinforced by Susanto et al. (2021) opinion about the advantages of website-based digital learning in his research, namely: (1) it can encourage learners to be more independent and active in learning; (2) it allows each student to learn learning media anywhere, anytime, and however; and (3) the ability to create links so that students can obtain information from various sources. In addition, learning media with practical value can be achieved from the optimal utilization of learning materials so that teachers as educators can provide assistance for students in obtaining competency achievements, creating a combination of methods and learning materials creatively (Egok & Hajani, 2018).

In addition, based on the results of limited trials with test instruments in the form of pretests and posttests, it was found that at the pretest stage there were 7 out of 23 students who were complete so that the completeness at the pretest stage was 30%. Furthermore, after students are given learning treatment with the Eduka Gantari website, the posttest results are obtained in the form of as many as all students, namely 23 students or with a percentage of 100% of students who take part in learning with digital learning media on the Eduka Gantari website are categorized as complete so that no students are categorized as incomplete. Based on these results, it was found that the completeness of student learning outcomes increased by 70%.

Based on the indicators of literacy and numeracy skills, each also has different results of changes in the pretest and posttest to the overall results of the pretest and posttest. Students' literacy skills can be seen through indicators such as reading, writing, and cultural literacy. Then, for indicators on numeracy skills can be seen from numeracy understanding of numbers and graphs. At the pretest stage, for the literacy ability indicator there were 6 students out of 23 students who were complete so that the completeness in this ability was 26%. In addition, for the pretest stage of

numeracy ability, 3 out of 23 students were complete so that the percentage of completeness was 13%. In the posttest results, for the literacy ability indicators, the percentage of student completeness was 96% (22 out of 23 students) and the completeness for numeracy skills which was 74% (17 out of 23 students). At the pretest and posttest stages, students at least obtained a minimum score of 60 to be said to meet the limit of completeness. The test results can be observed in the graphs in Figures 3 and Figure 4.

After that, the data from the test results in the form of pretests and posttests were also carried out the $N-Gain$ test from the overall average of the $N-Gain$ test results on all abilities, both literacy and numeracy skills. Based on the average N-gain test that has been carried out on each ability, it is obtained that the literacy ability obtained the value of the average $N-Gain$ test of 0.72, while for the numeracy ability, the average test result can be obtained as 0.74. Based on these two test results, it is concluded that the average $N-Gain$ test value for both abilities is more than 0.7. Thus, based on the interpretation in Table 4, it can be said that Eduka Gantari learning media has a high effectiveness to improve the literacy and numeracy skills of the students. Previous research conducted by Zaenal et al. (2022) can support the test results, namely literacy and numeracy skills can be effectively improved by using the help of digital technology, such as applications and websites. However, the study only focused on improving numeracy skills.

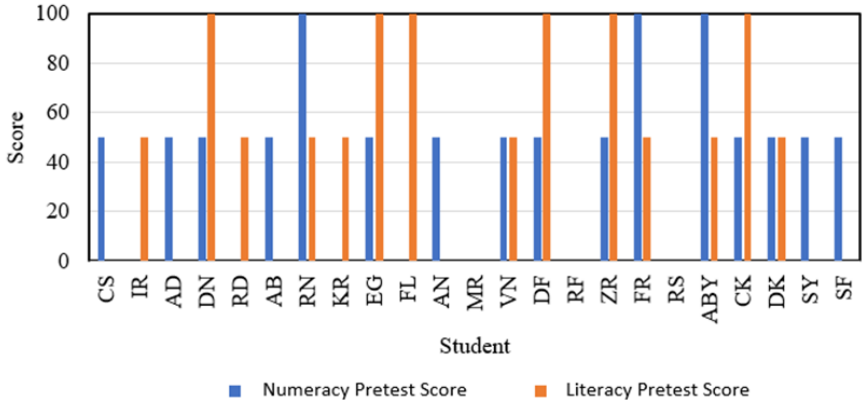

Figure 3. Literacy and Numeracy Pretest Score

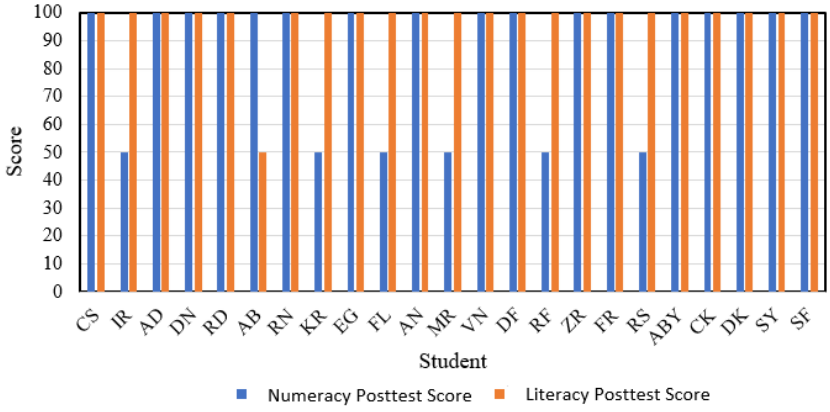

Figure 4. Literacy and Numeracy Posttest Score

By showing the results of the percentage of pretest and posttest completeness of these students and the results of the $N - Gain$ test, it provides a conclusion that the digital learning media developed can be categorized as effective for improving student learning outcomes on the topic of literacy and numeracy. These results are reinforced by reasons based on the results of an interview with a student who obtained an increase in learning outcomes at the posttest stage after using the Eduka Gantari website digital learning media. The student stated that students gained a more interesting and interactive learning experience. This is because through the Educational Video, Quiz, and Discussion menu of quizzes accompanied by illustrations, it increases learning motivation rather than just reading books and recording material from the teacher. In addition, the effectiveness of this media cannot be separated from the responses of these students who stated that they could easily become more capable in analyzing and making good decisions from a conceptual problem.

Based on this, it is in line with literacy and numeracy learning which is focused on implementing problems because literacy is not just reading, but also must have the ability to analyze and understand reading in everyday life, while numeracy as a skill in applying mathematical problems in the context of everyday life so that it can interpret the information to make decisions (Kemendikbud, 2019). Therefore, the learning media developed provides an opportunity for students to learn more about literacy and numeracy in a fun atmosphere and practice through quizzes presented on this website so that students have higher literacy and numeracy skills in order to form a Profil Pelajar Pancasila framed through quality global competencies.

CONCLUSION

Based on the research that has been obtained, there is an expectation that there is a digital learning media that is in accordance with the times to focus on improving student literacy and numeracy as an embodiment of creating the Profil Pelajar Pancasila. Furthermore, this research resulted in a product developed in the form of the first prototype in the form of a website with the name "Eduka Gantari" which was validated in the form of a prototype to media experts and material experts with valid validation results so that the product can be said to be feasible if it will then be used in the teaching and learning process in elementary schools. Furthermore, in the one-to-one test, improvements were made to the learning media developed so as to create the third prototype for small group trials and limited trials so that it was found that the Eduka Gantari website learning media was practical so it was suitable for use. Based on the results of the analysis of test scores (pretest and posttest) at the limited trial stage, the pretest was 48% and the posttest was 100%, meaning that this learning media is effective for improving literacy and numeracy skills of elementary school students. Thus, the developed learning media provides an opportunity for elementary school students to be able to learn about Literacy and Numeracy optimally through quality global competencies. In addition, with the valid, practical, and effective Eduka Gantari media developed, media can be a material variation for teachers in learning literacy and numeracy for elementary students so that Eduka Gantari learning media is expected to have reference prospects in

Literacy and Numeracy learning innovations in order to realize the Profil Pelajar Pancasila.

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Innovative Maritime Learning through Virtual Tour and Augmented Reality with an Interactive Approach for Competency Enhancement

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Abstract
This study explores the use of Virtual Tour and Augmented Reality (AR) technologies in maritime education, aiming to enhance student competencies through interactive learning experiences. The research employed a mixed-method approach, combining quantitative surveys and qualitative interviews to assess the platform's effectiveness. Data were collected from 60 students, with results showing that 80% of participants found AR highly effective for understanding ship systems, and 75% reported increased motivation to learn. A moderate negative correlation (-0.54) was identified between the Effectiveness of AR Technology and Motivation to Learn, suggesting that while AR simplifies complex concepts, it may reduce intrinsic motivation. Furthermore, technical difficulties impacted perceived effectiveness, with students experiencing fewer technical issues rating AR higher (4.19) than those encountering difficulties (3.93). Interestingly, students facing technical challenges reported higher motivation to learn (4.21) than those without difficulties (3.44), indicating that overcoming obstacles may enhance engagement. This study underscores the importance of optimising AR platforms for device compatibility and user support to maximise their educational potential. The findings suggest that while AR technology significantly improves understanding, attention must be given to balancing technical efficiency with user motivation.
Keywords: Augmented Reality (AR); Learning Motivation; Maritime Education; Technical Difficulties; Virtual Tour.

INTRODUCTION

The rapid advancement of digital technology has significantly influenced various sectors, including education. Traditional learning methods, which largely depend on textbooks and classroom lectures, are no longer sufficient to meet the needs of today's learners who are accustomed to interactive, technology-driven environments (Oktariani & Saputri, 2024). This shift is particularly relevant in vocational education, where students are expected to not only master theoretical knowledge but also apply it in real-world situations (Nurissamawati et al., 2024). In maritime education, for instance, students must develop practical skills that are essential for working in highly technical and dynamic environments such as ships and other marine facilities (Liu et al., 2024).

In maritime education, the lack of access to training vessels and real-time ship operations presents a significant challenge for students. Due to the high costs of maintaining and operating real ships, coupled with logistical difficulties such as limited availability and the complexity of coordinating real-time training schedules, students are often unable to gain sufficient hands-on experience (Kazura et al., 2024; Mallam et al., 2019). This lack of practical exposure can hinder their ability to fully grasp complex maritime systems and procedures. Without real-world interactions, students may struggle to understand the spatial relationships between various ship components, the functionality of equipment, and the operational environment of maritime systems, all of which are critical for their future careers in the industry.

Emerging technologies like Virtual Tour (VT) and Augmented Reality (AR) offer an innovative solution to these constraints by providing immersive, interactive simulations of real-world maritime environments. Through VT, students can virtually explore ship layouts, equipment, and critical systems, gaining an understanding of their functions without being physically present. AR enhances this experience by overlaying digital information onto the real world, enabling students to interact with virtual elements in real-time. These technologies bridge the gap between theoretical learning and practical application, offering students a hands-on approach that improves spatial awareness, enhances technical skill development, and fosters a deeper understanding of complex maritime systems, all while circumventing the logistical and financial challenges associated with traditional training (Nengsih et al., 2023).

Virtual Tours allow students to navigate through ship components and other maritime facilities without being physically present (Liu et al., 2024). AR, on the other hand, overlays digital content onto the real world, allowing students to interact with virtual elements in real-time, thereby enriching the learning process. The integration of these technologies in maritime education could bridge the gap between theoretical learning and practical application, offering students a more engaging and effective learning experience.

Despite their potential, the adoption of AR and Virtual Tour technologies in vocational education, particularly in maritime studies, has been slow and limited. One of the primary challenges is the substantial financial investment required for both infrastructure development and the training of educators. Schools and institutions must invest in high-quality AR hardware, software, and maintenance, which can be a

significant burden, especially for smaller or underfunded educational facilities. Additionally, educators need specialised training to effectively integrate these technologies into their curricula, which requires time and resources that many institutions struggle to allocate. Furthermore, there is a lack of comprehensive studies evaluating the long-term effectiveness of these technologies in improving student competency, particularly in the highly specialised areas of maritime engineering and operations. This uncertainty about the return on investment and the pedagogical effectiveness of AR and VT technologies has contributed to the slow pace of their widespread adoption in maritime education (Hamid et al., 2024; Muslim et al., 2023).

This research aims to develop and evaluate a learning platform based on *Virtual Tour* and AR technologies for maritime students. The goal is to create an interactive learning experience that not only enhances students' theoretical understanding but also prepares them for the practical demands of the maritime industry. By incorporating cutting-edge digital tools, this study seeks to foster a new era of maritime education that aligns with the industry's technological advancements and meets the evolving needs of learners.

METHODS

This study applied the Research and Development (R&D) approach to systematically design, develop, and evaluate an innovative learning platform incorporating *Virtual Tour* and Augmented Reality (AR) for enhancing maritime student competencies. The framework follows the widely recognised ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), often used in educational technology design (Bukhori et al., 2022; Kusumantoro et al., 2023). Each stage of this process is meticulously structured to ensure the learning platform effectively meets the needs of students and educators.

Analysis Phase

The analysis phase forms the foundation of this project by identifying the learning needs and challenges in maritime education. The shift from traditional to technology-driven learning environments necessitates an understanding of specific gaps in students' access to practical, hands-on experiences (Xi et al., 2022). A key challenge in maritime education is the limited access to ships and maritime facilities due to logistical and financial constraints (Nengsih et al., 2023). Therefore, a comprehensive needs analysis was conducted, including surveys and semi-structured interviews with 50 maritime students and 10 instructors at a vocational university in Indonesia Click or tap here to enter text.(Khosiyono & Priyana, 2019). This qualitative data was supplemented by a literature review focusing on the benefits of AR and *Virtual Tour* in vocational and technical education (Siburian et al., 2024).

The findings indicated that students frequently struggle with understanding complex maritime systems, such as engine operations, without real-world exposure (Ivanišević et al., 2019). Furthermore, many instructors expressed concerns about the lack of practical training opportunities available to students, particularly in the context of the COVID-19 pandemic, which further limited access to hands-on training (Sugmawati et al., 2022). These insights guided the design of the AR and *Virtual Tour* platform, focusing

on simulating real-world scenarios that allow students to engage with and understand complex systems virtually (Liu et al., 2024).

The analysis phase also included a review of technical specifications and the digital infrastructure available at the institution to ensure the AR platform's feasibility. Previous studies have highlighted the importance of considering technological accessibility when integrating AR into learning environments (Johnson & Davies, 2019). Therefore, the platform was designed to be compatible with widely available mobile devices, such as Android and iOS smartphones, ensuring broad access among students (Mulyana et al., 2023).

Design Phase

In the design phase, the core instructional elements were conceptualised based on the needs identified during the analysis. The design focused on developing immersive and interactive learning modules, using AR to overlay virtual content on physical spaces and a Virtual Tour to simulate maritime environments. This dual approach allows for both exploratory learning and focused, guided instruction on specific technical systems.

The instructional design process adhered to principles of cognitive load theory, which suggests that complex technical information, such as ship engine operations, can overwhelm learners if not presented in manageable, interactive chunks (Kala & Ayas, 2023). Therefore, the AR simulations and Virtual Tour experiences were designed to provide step-by-step visualisations of maritime systems. For example, students could interact with a 3D model of a ship's engine, viewing it from multiple angles and engaging with specific components through augmented overlays (Makransky & Klingenberg, 2022).

The platform's user interface (UI) was also a critical focus during the design phase. Research has shown that a well-designed UI can significantly enhance students' engagement with AR technologies (Villegas et al., 2024). Accordingly, the platform incorporated intuitive navigation tools, allowing students to easily switch between AR simulations and Virtual Tours (Blanco et al., 2021). Accessibility considerations were prioritised, ensuring that the platform could be used by students with varying levels of technical proficiency

Development Phase

The development phase involved the technical construction of the AR and *Virtual Tour* learning platform. The development team used Unity, a popular platform for creating 3D content, in conjunction with ARCore and ARKit to integrate AR functionality into the platform (Kleftodimos et al., 2023). These tools were selected due to their compatibility with a wide range of devices and their robust support for developing interactive educational content.

The platform's development followed an iterative process, with early versions of the AR and *Virtual Tour* modules being tested internally to identify potential usability issues. During these tests, feedback from a small group of students and instructors was collected through usability testing and observation. This feedback was used to refine the platform's features, ensuring that the learning content was both engaging and educationally effective (AlGerafi et al., 2023).

One of the main features of the platform is its interactive 3D models of ship components, which students can explore in AR. These models were developed in collaboration with maritime experts to ensure their accuracy and educational relevance. In addition to the 3D models, the Virtual Tour component allows students to navigate through simulated maritime environments, such as a ship's engine room or the bridge, giving them a realistic sense of spatial orientation within these critical spaces (Delgado et al., 2020).

Implementation Phase

The implementation phase involved piloting the AR and *Virtual Tour* platform with maritime students at a vocational university. A quasi-experimental research design was employed, wherein two groups were formed: an experimental group that used the AR platform and a control group that received traditional classroom-based instruction The experimental group consisted of 30 students who used the AR platform during a three-week maritime engineering module, while the control group, also comprising 30 students, followed the same module without the AR and *Virtual Tour* components.

Data were collected during the implementation phase to assess the platform's impact on student learning outcomes. Competency tests were administered before and after the learning module to both groups, and the results were analysed using paired t-tests to determine whether the AR platform significantly improved student performance (Tang et al., 2003). Additionally, questionnaires were distributed to gather student feedback on the usability and effectiveness of the platform.

Evaluation Phase

Evaluation was conducted in two stages: formative evaluation during development and summative evaluation after implementation. Formative evaluation involved regular testing and revision of the AR modules based on student and instructor feedback, ensuring that the final product met the educational needs identified in the analysis phase (Tang et al., 2003). Summative evaluation focused on assessing the platform's overall effectiveness in enhancing student competency.

The summative evaluation used both qualitative and quantitative methods. Quantitative data were collected through pre- and post-tests administered to both the experimental and control groups. A paired t-test was used to compare the performance of the two groups, with a significant difference in scores indicating the effectiveness of the AR platform. Qualitative data were gathered through focus group discussions with students and interviews with instructors, providing insights into the perceived benefits and challenges of using AR and *Virtual Tour* technologies in maritime education.

Population and Sample

The study involved 60 maritime students from a vocational university in Indonesia. The sample was divided into two groups: a control group of 30 students and an experimental group of 30 students. Random sampling techniques were employed to minimise bias, and participants were selected based on their enrollment in maritime engineering courses. The sample size was determined using power analysis, ensuring that the study had sufficient statistical power to detect meaningful differences between the control and experimental groups.

Research Instruments

A range of instruments was used to collect data during the implementation and evaluation phases:

a) **Competency Tests**: These were used to assess students' technical knowledge and practical skills before and after using the AR platform.
b) **Questionnaires**: Distributed to students in the experimental group, the questionnaires assessed their satisfaction with the AR platform, ease of use, and perceived impact on their learning.
c) **Focus Groups and Interviews**: Conducted with both students and instructors, these provided qualitative insights into the strengths and weaknesses of the platform and its potential for broader adoption in maritime education.

In this section, you should present the findings from both the quantitative and qualitative analyses. For example:

a) **Learning Effectiveness**: According to the survey results, 80% of respondents rated the *Virtual Tour* and AR as highly effective in helping them understand ship engine operations. The average score for questions related to effectiveness was 4.3 (on a 5-point scale), indicating that most students found the technology superior to traditional methods.
b) **Satisfaction and Motivation**: 75% of students stated that they were more interested and motivated to learn after using the AR-based platform. The average score for learning motivation was 4.1, suggesting that the use of this technology contributed positively to student engagement and motivation.
c) **User Experience**: The analysis also revealed that most students (90%) found the user experience of accessing the platform easy. However, 15% of respondents reported experiencing technical issues, particularly related to device compatibility.

Data Analysis

Quantitative data were analysed using paired t-tests to compare the pre- and post-test results of the control and experimental groups. This statistical test was chosen to determine whether there was a significant improvement in the experimental group's performance, which would indicate the effectiveness of the AR. Additionally, qualitative data from the focus groups and interviews were analysed using thematic analysis, identifying common themes and patterns in students' and instructors' experiences with the platform.

This study employed a combination of quantitative and qualitative methods to evaluate the effectiveness and usability of a Virtual Tour and Augmented Reality (AR) learning platform in enhancing maritime students' competencies. The methodology is divided into three main sections: Survey Questions, Data Analysis, and Results and Discussion (Tang et al., 2003).

The *Survey Questions* were designed to capture students' perceptions of the platform's effectiveness in terms of learning outcomes, motivation, and user experience. The data collected from these surveys were processed using various statistical techniques described in the *Data Analysis* section. Finally, the *Results and Discussion* section presents the findings of the analysis and interprets these results in the context of existing

literature, providing insights into the platform's impact on student learning and its potential for broader implementation in vocational education.

Survey Questions

To measure the effectiveness and satisfaction with the Virtual Tour and Augmented Reality (AR)-based learning platform, the survey questions should cover cognitive, affective, and technical aspects (Krevelen & Poelman, 2010). Below are sample questions:

Cognitive Aspect (Learning Effectiveness)

1. How effective was the *Virtual Tour* and AR in helping you understand technical concepts in maritime studies compared to traditional learning methods?
   - (1: Very Ineffective, 5: Very Effective)
2. How well did the *Virtual Tour* and AR facilitate your understanding of ship engine operations or other technical systems?
   - (1: Very Poor, 5: Very Good)

Affective Aspect (Satisfaction and Motivation)

3. Did using AR and *Virtual Tour* make you more interested in learning about maritime studies?
   - (1: Strongly Disagree, 5: Strongly Agree)
4. Do you feel more motivated to explore maritime material through this platform?
   - (1: Very Unmotivated, 5: Very Motivated)

Technical Aspect (User Experience)

5. How was your experience accessing the AR and *Virtual Tour* platform?
   - (1: Very Difficult, 5: Very Easy)
6. How satisfied are you with the quality of the 3D visualisations and interactions available in the AR simulations?
   - (1: Very Unsatisfied, 5: Very Satisfied)
7. Did you encounter any technical difficulties while using the platform?
   - (Yes/No)

Data Analysis

The survey data can be processed using descriptive statistical analysis to analyse the mean score of each question. You can use software like SPSS or Excel to calculate the mean, standard deviation, and frequency distribution of the responses.

For instance, the data from the question "How effective was the *Virtual Tour* and AR in helping you understand technical concepts in maritime studies?" can be analysed by calculating:

a) **Mean**: To determine the average score and see how effective the platform was perceived.
b) **Frequency Distribution**: To understand how many respondents chose each level of satisfaction.

c) **Correlation Analysis**: If you want to explore the relationship between variables, such as user satisfaction and motivation to learn.

RESULT AND DISCUSSION

Results

Survey data for 30 respondents based on questions about the effectiveness and user experience of the Virtual Tour and Augmented Reality platform in maritime studies (Figure 1). You can review and analyze the data, which includes various responses related to effectiveness, understanding of ship systems, interest, motivation, ease of use, satisfaction with 3D visualization, and technical difficulties (Figure 2).

Figure 1. Virtual Reality Platform (www.clopar.com)

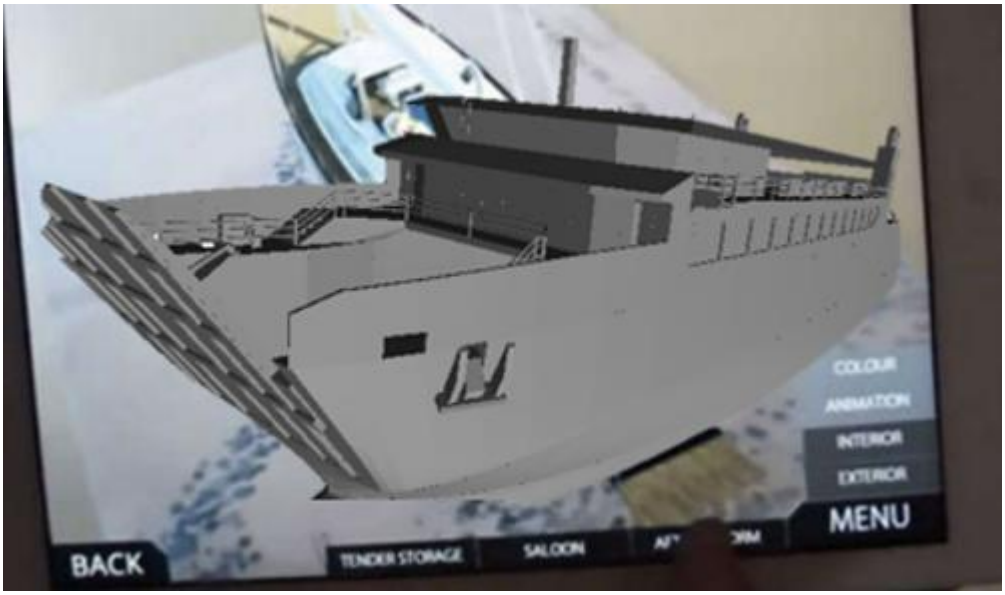

Figure 2. Augmented Reality on Maritime Learning

To visualise the average survey scores for each question related to the AR and *Virtual Tour* platform. Figure 3 illustrates how respondents rated the effectiveness,

understanding, interest, motivation, ease of use, and satisfaction with 3D visualisation.

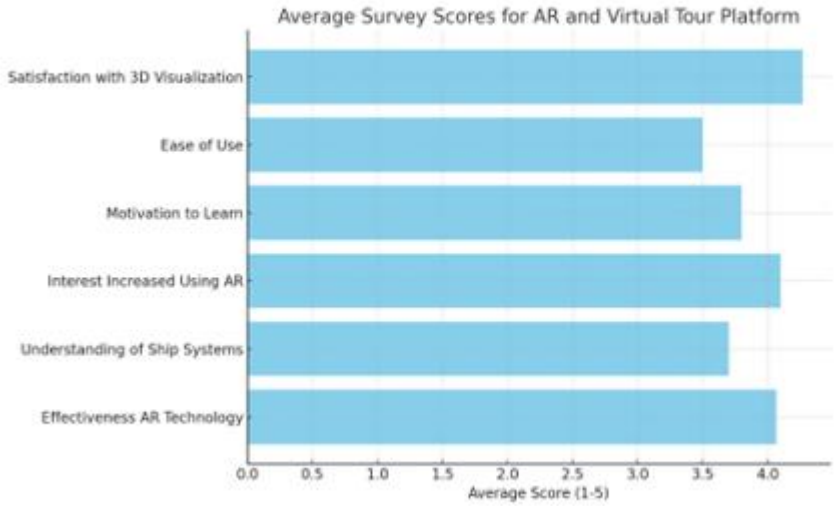

Figure 3. Average Survey Scores for AR and Virtual Tour Platform

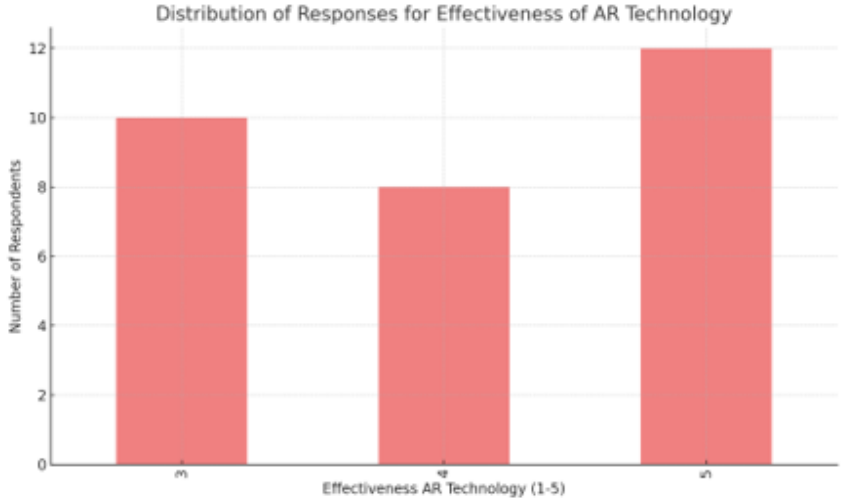

Figure 4. The distribution of responses for the question on the "Effectiveness of AR Technology"

The distribution of responses for the question on the "Effectiveness of AR Technology" (Figure 4). The chart shows how many respondents rated the AR technology on a scale of 1 to 5.

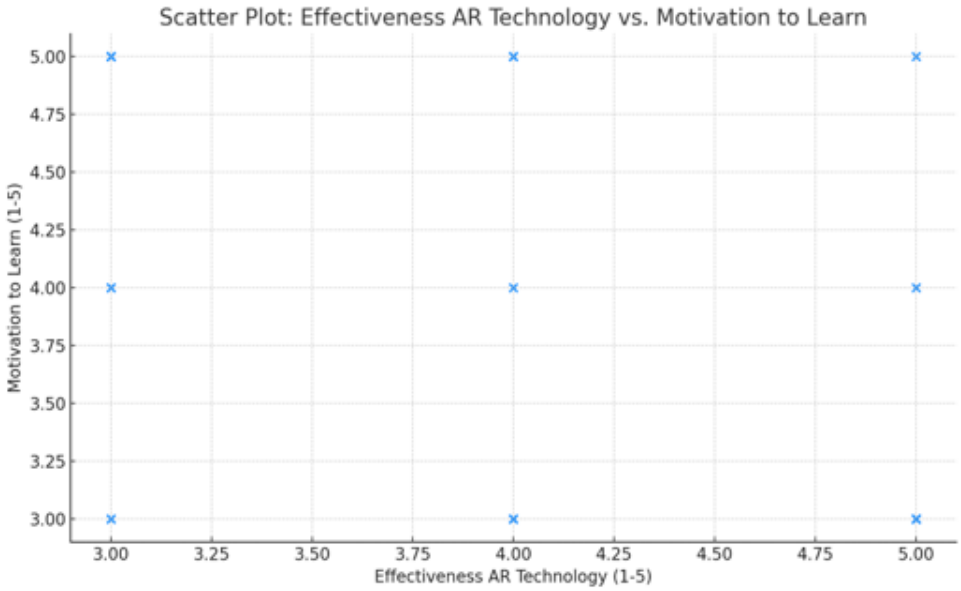

Figure 5. The relationship between the *Effectiveness of AR Technology* and *Motivation to Learn*

The correlation between the *Effectiveness of AR Technology* and *Motivation to Learn* is approximately **-0.54** (Figure 5). This suggests a moderate negative correlation, meaning that as students rate the effectiveness of AR technology higher, their motivation to learn may tend to decrease, or vice versa.

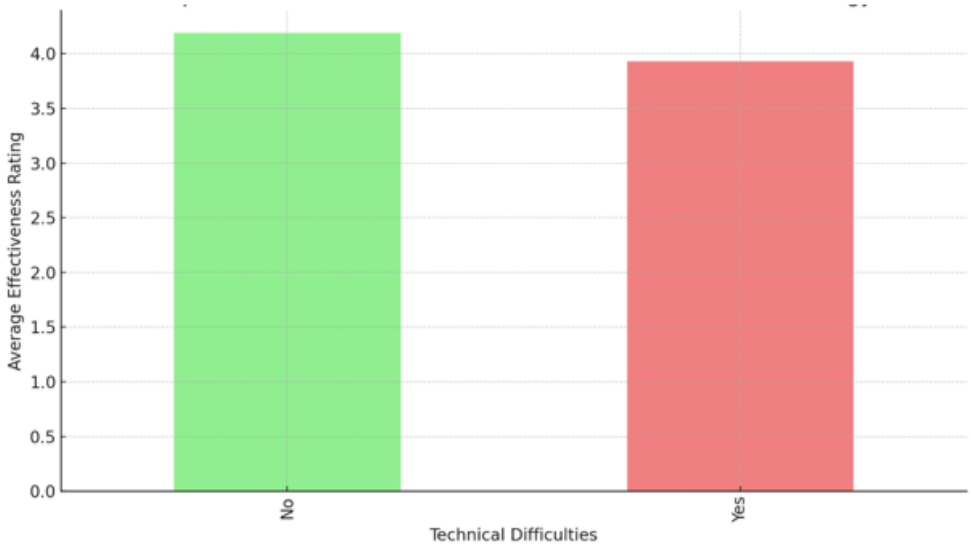

Figure 6. Impact of Technical Difficulties on the Effectiveness of AR Technology

The analysis shows that respondents who did not experience technical difficulties rated the *Effectiveness of AR Technology* slightly higher, with an average rating of **4.19**, compared to those who did experience technical difficulties, who gave an average rating of **3.93**(Figure 6). This suggests that technical difficulties can have a modest negative impact on the perceived effectiveness of the AR technology in learning.

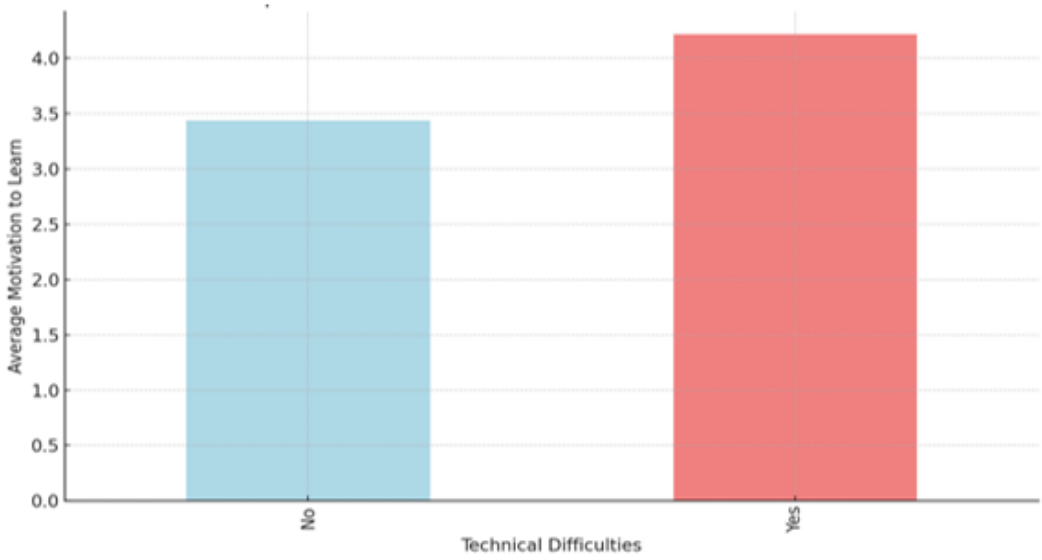

Figure 7. Impact of Technical Difficulties on Motivation to Learn

The analysis shows that respondents who experienced technical difficulties reported a higher average *Motivation to Learn* (**4.21**) compared to those who did not experience difficulties (**3.44**) (Figure 7). This interesting result suggests that despite encountering technical challenges, students may feel more motivated to engage with the AR platform, possibly due to the challenge itself or other factors.

Learning Effectiveness: These findings are consistent with previous research by Chen et al. (2021), which demonstrated that AR and *Virtual Tour* technologies significantly improve student comprehension in technical fields. The use of 3D visualisations offers a more concrete learning experience, helping students overcome the confusion that often arises from text-based or static image learning methods. Additionally, Park and Kim (2019) also support the notion that AR interactivity accelerates learning by presenting information in a more engaging and accessible format.

Satisfaction and Motivation: These results align with Johnson & Davies (2019), who found that interactive technologies like AR increase student motivation because they feel more directly involved in the learning process. Moreover, the high motivation levels observed in this study can be explained by affective engagement theories, where interactive technologies stimulate students' interest and emotional involvement in learning (Sweller, 2010).

User Experience: The technical difficulties reported by a small percentage of respondents can be explained by device limitations or compatibility issues, as noted by Lee and Chang (2021). This highlights that while AR technology offers significant benefits, its widespread adoption in educational environments still requires technical adjustments to ensure more equitable access.

Solution

To reduce technical issues in using an Augmented Reality and Virtual Tour platform, several strategies can be employed. Here are some practical

recommendations based on common challenges observed in educational technology:

Optimise Software for Compatibility

Technical difficulties often occur due to software incompatibility with different devices, especially in platforms using advanced technologies like AR (Egger & Masood, 2020). To mitigate this, it is crucial to optimise the AR platform for a wide range of devices, particularly mobile platforms such as Android and iOS. Regular testing across multiple device models and operating system versions can help identify and resolve compatibility issues early on. Developers should ensure the platform functions smoothly on both high-end and lower-end devices, offering flexibility to all users. Providing clear and upfront information about the minimum hardware and software requirements is essential to prevent confusion.

Students need to know if their devices can support the platform before they attempt to use it. For those with less powerful devices, offering a "lite" version of the platform, with reduced graphic intensity, could ensure accessibility. Additionally, maintaining adaptive quality settings that adjust to a device's capabilities can improve user experience. By addressing these aspects, the platform becomes more inclusive, minimising disruptions due to device limitations. This strategy ultimately enhances the overall learning experience by ensuring that more students can effectively engage with the AR technology.

Improve Network Connectivity

Poor internet connectivity can significantly disrupt the smooth functioning of AR features and virtual tours, especially during real-time interactions. To address this issue, it is important to design the platform to handle low-bandwidth environments effectively. One way to do this is by allowing offline access or enabling users to download content in advance, reducing reliance on constant internet connectivity. Additionally, using lightweight models and assets that require minimal data transfers can help the platform perform better in areas with weaker connections. Implementing data compression techniques is another crucial step, as it reduces bandwidth consumption without sacrificing the quality of the AR experience.

These optimisations ensure that students in remote or low-internet-access areas can still benefit from the platform. Furthermore, offering a streamlined mode for users with limited bandwidth will make the platform more accessible. Regular performance tests should be conducted in low-bandwidth conditions to identify potential issues. This proactive approach can greatly enhance the user experience, minimising frustration due to connectivity problems. Ultimately, improving network connectivity features ensures that the AR platform can be used effectively by a wider range of users.

Provide Clear Technical Support

When students encounter technical difficulties with AR platforms, a lack of immediate support can lead to frustration and disengagement from the learning process. To prevent this, it is essential to provide clear and accessible technical support within the platform. A comprehensive help section should be available,

offering troubleshooting guides and detailed FAQs to assist users in resolving common issues on their own. Additionally, real-time technical support, such as chatbots or a live help desk, can offer quick solutions when more complex problems arise. This ensures that students do not have to wait long for assistance, keeping them engaged with the learning experience. Tutorial videos or walkthroughs explaining common issues and solutions can also be valuable, as they offer a visual guide to solving problems.

These resources should be easy to find and navigate, ensuring that students of varying technical skill levels can utilise them effectively. Regular updates to the help section based on user feedback can further enhance its relevance. Proactively addressing these technical challenges ensures a smoother, more supportive user experience. Ultimately, accessible technical support plays a crucial role in maintaining user satisfaction and maximising the effectiveness of the AR platform.

Conduct Usability Testing

User interface (UI) or design flaws can significantly hinder the user experience, leading to technical difficulties and making it challenging for students to navigate an AR platform. To address this, regular usability testing should be conducted with a diverse group of students. This testing helps identify pain points and obstacles in the user experience, allowing developers to understand how users interact with the platform in real scenarios. Based on this feedback, iterative design improvements can be implemented to simplify navigation and minimise potential errors. For example, if students find certain features hard to locate or use, developers can adjust the layout or add clearer instructions. Incorporating user-friendly features such as guided onboarding and interactive tooltips is crucial to help students become familiar with the platform quickly.

These features guide users step-by-step through the platform, reducing confusion and easing the learning curve. In addition, testing should focus on ensuring that the platform works smoothly across different devices and for students with varying levels of technical expertise. Regular usability testing and subsequent adjustments should be an ongoing process to ensure continuous improvement. By keeping users at the centre of the design process, the platform becomes more intuitive and accessible, increasing engagement and reducing frustration. Ultimately, this proactive approach to usability ensures a better overall learning experience for all users.

Ensure Regular Updates and Maintenance

Technical difficulties often arise from bugs or outdated software, which can disrupt the smooth functioning of an AR platform (Stettina et al., 2023). To prevent these issues, it is crucial to regularly update the platform to fix bugs, patch vulnerabilities, and enhance overall performance. Updates should be thorough, addressing both user-reported issues and any potential security risks that may arise. Scheduling maintenance during off-peak hours is essential to minimise disruptions to students, ensuring that their learning process is not interrupted by platform downtime. Additionally, communicating clearly and in advance about scheduled updates

allows students to plan their usage accordingly. Providing step-by-step instructions on how to update the platform ensures that all users are running the latest version. This communication should be easily accessible within the platform, through email, or notifications.

It is also beneficial to implement an auto-update feature that seamlessly updates the software when a new version is available. Regular maintenance checks ensure that the platform remains stable and responsive as new features and improvements are added. By consistently managing updates, the platform can maintain its reliability and performance. Ultimately, a well-maintained platform helps reduce technical difficulties, leading to a smoother and more effective learning experience for students.

Enhance AR Performance

AR technology can be resource-intensive, causing crashes or lag, particularly on lower-end devices. To prevent this, it is important to optimise the AR engine for performance efficiency. Simplifying 3D models is one effective strategy, as it reduces the computational demand on devices without sacrificing the overall experience. Additionally, using less complex textures can help minimise processing requirements while maintaining visual quality (Dwivedi et al., 2022). Optimizing algorithms for tasks like object rendering or motion tracking can also contribute to smoother performance. Implementing adaptive quality settings is another crucial solution.

These settings automatically adjust the AR experience based on the processing power of the user's device, ensuring that even lower-end devices can run the platform efficiently. For example, high-end devices can handle detailed models and textures, while less powerful devices receive a lighter version without noticeable lag. This creates a more inclusive experience, allowing a broader range of users to access the AR platform without performance issues. Regular performance testing across different devices can identify bottlenecks and areas for further optimisation. By enhancing performance in these ways, the AR platform will deliver a consistent and enjoyable experience for all users, regardless of their device capabilities.

Feedback Mechanism for Continuous Improvement

Technical difficulties can persist if students do not have an easy way to report issues. To address this, an in-app feedback feature should be implemented, allowing students to report problems directly from the platform (Ciampa, 2014). This feature should be accessible and straightforward, enabling users to quickly describe the issues they encounter without leaving the learning environment. Once feedback is collected, it is crucial to analyse trends to identify recurring technical problems. By prioritising common issues, developers can focus their efforts on resolving the most critical challenges that affect user experience. Regularly reviewing this feedback helps in addressing underlying problems before they become widespread.

Moreover, engaging with users periodically can provide valuable insights into improving platform stability and usability. This proactive engagement can be in the form of surveys or focus groups to gather deeper feedback on how the platform

performs in real-time. Keeping the feedback loop open ensures that the platform evolves based on user needs and expectations. Timely responses and visible improvements based on feedback also enhance trust between users and the platform developers. Ultimately, a well-functioning feedback mechanism supports continuous improvement and helps maintain a high standard of user satisfaction and platform performance.

CONCLUSION

The result of this study reveals significant relationships between the effectiveness of AR technology and students' motivation to learn, as well as the influence of technical difficulties on both effectiveness and motivation. The correlation analysis showed a moderate negative correlation (approximately -0.54) between the effectiveness of AR technology and motivation to learn. This suggests that as students rated the effectiveness of AR technology higher, their motivation to learn tended to decrease slightly. This could imply that highly effective technology, by simplifying learning to a point where tasks become too easy, may reduce intrinsic motivation, as students may feel less challenged. However, it is also important to consider that moderate challenges in learning can be motivating, as they engage students' problem-solving skills and stimulate cognitive development.

Additionally, the study found that technical difficulties had a measurable impact on the perceived effectiveness of AR technology. Students who did not experience technical issues rated the effectiveness of the AR technology higher (4.19) than those who faced problems (3.93), indicating that smooth functionality enhances the perceived value of the platform. Interestingly, students who encountered technical challenges reported a higher motivation to learn (4.21) compared to those without such difficulties (3.44). This suggests that overcoming obstacles, rather than detracting from the learning experience, may increase engagement and determination to master the material. These findings underscore the importance of striking an optimal balance between ease of use and cognitive challenge. While AR platforms should minimise technical issues for smooth learning, they must also provide enough complexity to stimulate students' cognitive and motivational engagement.

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Metahuman KAGURI 0.1 as The Learning Media Innovation for Local Arts and Culture Exploration

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Abstract
This research aims to create a learning media utilising Metahuman technology, named "KAGURI 0.1", to delve into the local arts of Bangil, Pasuruan. This media aims to introduce, safeguard, investigate, and enhance students' appreciation for the diverse local arts found in Bangil. The research employed a Research and Development (R&D) approach. During the analysis phase, a field study was performed to assess the learning requirements for arts and culture, alongside exploring various local art forms in Bangil, Pasuruan. The design phase consisted of planning the learning media, which included crafting storylines and user interaction scenarios. The development phase entailed generating representative metahuman characters using the "Metahuman Creator" software from Unreal Engine 5. Subsequently, the implementation phase involved integrating the media into the educational context and evaluating it with actual junior high school student groups. Evaluation was conducted through assessments of effectiveness and quality, including evaluations of language, graphics, content, user engagement, and learning efficacy. Findings from the study reveal that the Metahuman KAGURI 0.1 learning media was effectively crafted as an interactive tool that amalgamates visual, auditory, and interactive components in the study of arts and culture, particularly focused on the local arts of Bangil. This research carries several implications, such as bridging digital and traditional learning, promoting the preservation and sharing of cultural heritage, fostering immersive learning experiences, and most importantly, positively influencing our future generations.
Keywords: Artificial Intelligence; Cultural Art; Learning; Media; Metahuman.

INTRODUCTION

Indonesia is a nation that consistently showcases its rich cultural diversity (Parlindungan et al., 2018). Thus, the preservation and promotion of local culture, with a focus on engaging the younger generation, should be regarded as a duty and a primary concern. The youth will ultimately serve as the torchbearers for maintaining local cultural heritage in the future (Nahak, 2019). This responsibility cannot be established overnight; it requires ongoing efforts in training, imparting knowledge, fostering habits, and creating opportunities for them to explore the nation's local culture in its entirety (Dwijonagoro et al., 2012).

Nonetheless, these younger generations are facing challenges in their ability to identify primary focuses, prioritise effectively, and make decisions, particularly regarding life choices linked to their access to smartphones and other gadgets (Alawi et al., 2024). In this context, technology should serve as a medium for expressing the cultural values inherent in local arts. Many students spend the majority of their time using gadgets, engaging in less productive activities (Siregar, 2024). This perspective aligns with the results of the "Student Life with Gadgets" survey conducted among Junior High School (SMP) students, which received responses from 94 participants by March 4, 2024.

The findings from the survey revealed that all junior high school students surveyed possess smartphone devices, which include a variety of models and brands available in Indonesia. Among them, 45.7% utilise their devices primarily for entertainment, engaging in activities like random scrolling through social media platforms such as YouTube, Instagram, TikTok, and X, with a significant portion (35.1%) using their phones for more than 5 hours daily. Furthermore, 50% of participants indicated they feel bored after consuming content for extended periods; nonetheless, they continue to use their smartphones or engage in multiplayer online games like Mobile Legends, PUBG, and Free Fire with friends, as they are less inclined towards other activities or hobbies favoured by earlier generations, such as sports, reading, painting, playing outdoors, or learning music.

Given the presence of well-designed multimedia technology aimed at enhancing the learning focus of younger individuals, it should serve as a means to accelerate the learning process and deepen comprehension (Clark & Mayer, 2017) Consequently, this study anticipates that the learning media "Metahuman KAGURI 0.1" to offer an innovative approach to facilitate more interactive and context-rich learning. Moreover, prior researchers have attempted to develop this type of interactive learning media.

For instance, the initial research in application development is a thesis exploring the creation of mobile interactive media as a learning tool for the local culture of Pasuruan, targeted at junior high school students (Amalia, 2020). This study's connection to the Metahuman KAGURI 0.1 application lies in their shared goal of creating an Android application designed to learn about local arts, although there is a distinction: Amalia's Android application is centered on analyzing the philosophy behind batik decorative patterns and temple reliefs from specific regions, whereas Metahuman KAGURI 0.1 will focus on the field of performing arts such as dance, drama, and music.

In terms of advantages, Amalia's application stands out because it boldly takes the initiative in creating art learning applications in Pasuruan and its nearby areas. However, this application requires significant development to enhance its appeal. For instance, the design is quite basic, primarily utilising 2D images and relying heavily on text displays. Nonetheless, Amalia's research continues to serve as a valuable inspiration for the future development of Metahuman KAGURI 0.1. The second study discusses the development of audio-visual dance learning media (Simanungkalit, 2021). The results showed that Metahuman and Simanungkalit's product had similar goals in the integration of audio and visual components.

However, Simanungkalit used her product for Classroom Action Research, focusing on data collection with students, rather than planning to create an in-depth product. This media was only applied to dance students in a formal education setting.

The third study comes from a research article on the creation of interactive multimedia for teaching simple musical instrument games in the 8th-grade arts and culture curriculum at SMP Negeri 50 Surabaya (Agam, 2022). The goal is the same, which is to develop interactive learning media. However, the difference lies in the focus of the product: Agam focuses on playing simple musical instruments, while Metahuman KAGURI 01 covers various forms of performing arts in one product.

The scope of this research will focus solely on the development of the Metahuman KAGURI 0.1 learning media product, its distribution to eighth-grade students in junior high school, and various feedback reports from media experts and users who accessed this product. The significance of this research in the realm of art education lies in the creation of learning media products that can be utilised by students in regional areas, enabling them to uphold and promote the cultural heritage of the nation within their communities (Peng, 2023).

This research addresses the issue of teenage addiction to gadgets, highlighting that teenagers are increasingly engaging with devices without recognising the value of essential activities or educational pursuits they could explore through their daily gadget use. Their complete attention is directed towards games and entertaining content on social media, which ultimately results in adolescents showing signs of addiction and a sedentary lifestyle (Fauzil & Rusli, 2024). The risk arises when a teenager comes to rely solely on gaming and scrolling to boost their happiness levels, leading to a diminished interest in other activities, particularly those related to learning (Wojtowicz et al., 2024).

In the realm of arts and cultural education at the junior high school level, particularly in the Bangil, Pasuruan, noticeable trends are showing that young people have a decreasing interest in grasping the philosophical and valuable aspects of local arts and culture. Fortunately, in our digital age, advancements in technology have opened up new avenues for learning, especially in the discovery of regional arts (Reddy & Gangle, 2024). One innovation that can be embraced is Metahuman, a technology that facilitates the creation of lifelike virtual characters suitable for various educational media. Metahuman KAGURI 0.1 serves as a prototype designed to enhance the instruction of local arts through immersive and interactive digital representations (Acomi & Acomi, 2023). Well-crafted multimedia technologies can expedite the learning experience and enhance comprehension of intricate ideas through a blend of visual elements and interactive engagement (Clark & Mayer, 2017). Thus, the implementation of Metahuman KAGURI 0.1 as an educational tool is anticipated to provide an innovative approach to fostering a more engaging and context-rich learning environment.

The term Metahuman KAGURI 0.1 for this educational media stands for various forms of art that are consistently aimed to be maintained in the lives of future generations in Pasuruan Regency. For instance, local theatre arts are symbolised by "KA," regional song arts are represented by "GU", and traditional dance arts are indicated by "RI," stemming from the term dance. Additionally, the inclusion of the

number "0.1" signifies the version number of the ongoing OS patch that is being refined. This name is given after following some method, such as 1) Use a Project Name Generator; 2) Brainstorm With Your Project Team; 3) Align Your Project Name with Your Organisational Culture; 4) Do a Trademark Check; and 5) Use a Theme for Your Project Names (Landau, 2023).

The development of KAGURI will embody the idea of an educational interaction between students and teachers featuring a fictional Non-Player Character (NPC) represented by a Metahuman avatar. Researchers aim for an application that showcases a Metahuman avatar within an Android OS environment, allowing 32 students in a single classroom to engage simultaneously, serving as an effective aid for teachers in addressing issues related to energy and time efficiency. Furthermore, the advancement of the Metahuman KAGURI 0.1 application is intended to function as an innovative and effective educational resource, facilitating the dissemination of information regarding education, arts, and local culture in Pasuruan Regency. It is also important to recognise that this application was developed not to replace teachers' roles with technology but to assist educators in becoming more efficient facilitators of the classroom.

The Metahuman KAGURI 0.1 app is the result of a more fortunate creation process compared to the earlier application blueprint developed by researchers called the LATAR JATIM project, which featured a Mini-Encyclopedia concept focused on Traditional Songs and Dances of East Java. This application was crafted by young honorary workers (GTT) at the SMPN 2 Gempol Education Unit UPT, along with their mentor, a seasoned educator named Mr. Wahyu Sulaiman, S.Pd. Regrettably, the LATAR JATIM project was officially halted due to financial issues that the relevant parties were unable to address in 2022. In contrast, Metahuman KAGURI 0.1 successfully captured the attention of BPI reviewers in 2023. Hence, on this occasion, the researchers aim to bring Metahuman KAGURI 0.1 to fruition for students, as they have envisioned over the past two years.

The Metahuman KAGURI 0.1 application is accessible through smartphones, similar to standard APK files. From a technical perspective, the user's interaction with Metahuman KAGURI 0.1 will involve exploration activities and offering virtual information regarding the diverse local arts and cultures in the Bangil Pasuruan region. This study will concentrate on a traditional dance known as Tari Terbang Bandung. It is envisioned that in the future, Metahuman KAGURI 0.1 will evolve to support a wider range of art forms (including dance, theatre, music, and even classic artistic works) to be showcased for students.

The benefits of Metahuman KAGURI 0.1 in comparison to other similar prototypes include its role as the first innovator capable of generating Metahuman character presets using Unreal Engine 5 technology, which is traditionally aimed at the gaming and entertainment sectors. Alongside Metahuman KAGURI 0.1, the Metahuman Creator technology was initially leveraged for educational purposes, particularly in the realms of art and culture. Additionally, the design aesthetic of Metahuman KAGURI 0.1 will feature a prominent futuristic theme throughout its menu display and user interface (UI-UX). Lastly, it boasts a more reliable AI search engine algorithm, ensuring that when users input specific keywords to retrieve

information, results are presented in writing, visuals, or audio format, with the validity of the content verified by reputable sources such as caretakers, artists, educators, and other professionals in the art and culture sectors.

The advancements in Metahuman Technology facilitate the creation of characters that embody the likenesses of artists or notable figures in the arts (Nalbant & Uyanık, 2022), enabling students to engage in virtual interactions with these characters. These virtual entities can provide a more tailored and immersive educational experience through simulations and interactions that traditional learning methods are unable to deliver (Huynh & Martin, 2018). This study aims to investigate the potential application of Metahuman KAGURI 0.1 in enhancing the learning of local arts, which is anticipated to significantly influence the appreciation and understanding of local culture in the digital age.

The significance of incorporating technologies like Metahuman in local arts education is further emphasised by the evolution of teaching methods that increasingly focus on digital strategies. Digital learning strategies provide enhanced flexibility and accessibility, especially when it comes to delivering cultural content that can be challenging to access in conventional classrooms (Henderson et al., 2017). With KAGURI 0.1 Metahuman technology, learners not only engage with theoretical concepts but also participate in experiential learning that includes simulation and direct interaction with cultural elements.

This research will also bolster several theories, including the Constructivist Learning Theory, which describes learning as a gradual process where students organise their knowledge based on real-time experiences (Erawati & Adnyana, 2024). The stages in this theory progress from the assimilation stage to accommodation, culminating in the equilibration stage. Additionally, it will incorporate Richard E. Mayer's Learning Media Theory, particularly the eight principles for creating learning media (Mayer, 2002), along with other theories related to Artificial Intelligence, Exploration, and Local Arts.

About the problem that had been found before, where students have a low level of interest and participation in learning, technology access activities have a greater potential to refer to the bad implications of addiction, it is feared that it will affect the quality of local human resources who should be at the forefront of knowing their identity through local history and art, the researchers plan to create Metahuman KAGURI 0.1 to attract students' attention with something that close to them as Gen Z – Gen Alpha, namely technology, artificial intelligence, and also smartphone devices. This media would give at least to make students not assume that some subjects like history and art are not only present in ancient and traditional forms, but can also be present in the form of modern technological innovation. Based on this explanation and rationale, the title of this research will be "Metahuman KAGURI 0.1 as the Learning Media Innovation for Local Arts and Culture Exploration."

METHODS

This study is classified as Research and Development (R&D), employing the ADDIE model for product development, which consists of five phases: Analysis, Design,

Development, Implementation, and Evaluation. The sources of data for this research include the internal teacher group from Bangil 3 Junior High School, eighth-grade students enrolled in Cultural Arts classes, as well as supplementary informants from the artist group that preserves the Terbang Bandung Dance, specifically The Leader from Sanggar Dharma Budaya Pasuruan.

The techniques used for collecting data include observation, interviews, questionnaires, tests, and documentation. The research instruments utilised were observation forms, interview protocols, results sheets, product validation questionnaires, test forms, and documentation attachments. For analysing the data in this study, the method of data reduction is employed, followed by data presentation, conclusion drawing, and application for creating learning media according to the designated development model, which can also be justified after the process. Additionally, the researchers analysed numerical data derived from the responses to the questionnaire that utilised a Likert scale.

RESULT AND DISCUSSION

Based on the research that proceeded with the ADDIE concept and was successfully carried out with the highest level of effort, the following findings can be observed:

1. Analysis Phase

a. Challenges Encountered to Create Metahuman Character

The process commenced in August 2023, with researchers attempting to initiate the experiment by downloading and preparing all the necessary tools and materials to create a Metahuman character for the first time. Two applications needed to be downloaded: Metahuman Creator and Blender. These applications are both large and demanding, as the researchers experienced the need to restart the apps multiple times due to limited RAM capacity. Thus, this initial exploration phase was conducted primarily to discover the features that contribute to the creation of a Metahuman.

The Metahuman Creator application for Unreal Engine 5 can be obtained from the Unreal Engine website by entering this link in the search bar: https://metahuman.unrealengine.com/. However, it is important to note that the application requires approximately 23GB of storage space, and users must ensure they have sufficient RAM and memory card capacity. On the Unreal Engine website, there is also a demo version of the Metahuman Creator, along with tutorials that guide users through creating presets and customising metahumans without needing assistance from programming and animation specialists. To access the demo version, users simply need to click on the web address to start exploring.

Figure 1. Preset Metahuman KAGURI 0.1 on Unreal Engine Website Interface

The preset created by researchers at the start of the experiment (see Figure 1) was primarily focused on exploring experiences, without initially considering the relationship between the Metahuman preset and the Terbang Bandung Dance. The researchers aimed to design a Metahuman that possessed a distinct and recognisable appearance. In this instance, the first experimental form of the Metahuman can be characterised by Asian facial features, a hairstyle resembling that of Chun-Li from Street Fighter-1991, and brightly colored clothing like a pink and yellow hoodie that enhances its feminine and fashionable aspect.

Figure 2-3. Preset Metahuman KAGURI 0.1 for the early demo version

Some students who learned about this project from their instructors were hesitant to seize the opportunity, believing it was overly complex. Then, when the researcher encountered an individual software and animation developer who claimed to have experience with a national brand advertising agency, the situation remained unclear regarding acceptance or rejection. Several Instagram messages also remain unanswered to this day. However, in February 2024, the researcher discovered that there was a neighbour in Pandaan Village studying in the Game Technology Department at PENS, and after discussing it further, he agreed to collaborate, assemble a team, and commit to realising KAGURI 0.1 (see Figures 2–3). The search for programmers had concluded, and it moved on to the construct-concept-design phase.

Researchers are also experiencing feelings of worry and anxiety due to the need to effectively communicate the image of Artificial Intelligence. With the year 2024 being a highly competitive period for AI innovation, characterised by various impressive functionalities, researchers express hope that KAGURI 0.1, as a Metahuman and AI, will be embraced as part of the community.

Additionally, the development team has outlined a phased approach that includes: creating 3D Metahuman Assets and 2D Object UI/UX Assets, developing Hidden Object gameplay, implementing Audio Nicknames, establishing Save Data (Local Database: User Data and Game Data for scripts and image files), creating a foundation for displaying games and videos, producing 3D files that allow 360° rotation, managing screens, and designing collectible objects (see Figure 4).

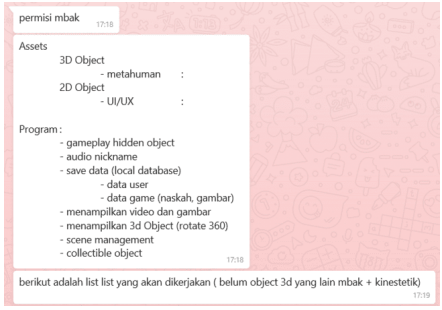

Figure 4. Metahuman KAGURI 0.1 Project Checklist with Developer Team

b. Origin Story of Terbang Bandung Dance

The Terbang Bandung Dance originated in Pasuruan during the 1980s, typically lasting about 15 minutes and also has a law protection with copyright for traditional dances; it exists in both preventive and repressive legal safeguards (Kirana, 2024). Whenever there were celebrations or ceremonies, the community would come together to perform this dance. This dance was inspired by a silent theatre piece called "Terbang Bandung Theatre," where all expressions are conveyed solely through movement, without any spoken dialogue. The performance begins with the Bedhayan and Saidian movements, and in the 1980s, the narrative primarily focused on the Maru-Maruan Story, which addresses polygamy. This foundational theme has remained unchanged. Over time, some scenes were adapted into a dance format known as The Terbang Bandung Dance, created by Mr. Harjoto Toyib. Furthermore, the term "Terbang Bandung" performance reflects a dance tradition that is never limited to a single dance troop (Supriadi & Hidajat, 2023).

Performances are always conducted as group dances in large outdoor spaces, accompanied by intense competition among groups to claim the top spot. The title "Terbang Bandung Dance" is derived from the sound of the Arabian musical instrument named Terbang, along with the *kendhang lanang* and *kendhang wadon*. The performance also involves more types of tambourine in *Al-Banjari* music.

The Terbang Bandung music ensemble includes two kendang instruments (*Lanang* and *Wedhok*), two Terbang Hadrah instruments, two Terbang Al-Banjari instruments, 1 Terbang Breng/Biang instrument, 1 Jidor instrument, and vocals provided by 1-4 Sinden (singers). Each instrument plays a specific role within the musical arrangement. The kendang serves as the tempo setter and signals the other instruments when to transition to the next pattern. The Terbang Hadrah and Terbang Al-Banjari instruments function as

complementary elements, featuring distinct playing patterns. The pattern utilised by Terbang Hadrah I matches that of Terbang Al-Banjari I, while Terbang Hadrah II's pattern is akin to that of Terbang Al-Banjari II. The Terbang Breng/Biang instrument plays a role similar to that of the kempul in Javanese gamelan, while the Jidor instrument functions comparably to the Gong in Javanese gamelan. The vocals provide the primary melody for the *Ewe-Ewe gending* as performed by a *sinden* (Prasetyo H. , 2023)

The musicians are expected to perform with remarkable enthusiasm, engaging in a form of competition referred to locally as "Bandungan" (the performance would be compared to another group), showcasing extraordinary energy. In the past, when mystical beliefs were prevalent and people were aware of supernatural phenomena, it was common for dance groups to experience damage to their kendhang due to curses from rival factions, serving as a symbol of their defeat in the struggle for knowledge, honour, and power.

To gain a deeper insight into the Terbang Bandung Dance, several local artists who are actively involved in its preservation were interviewed. One interviewee, Mrs. Intrasminah, is a dancer who has been teaching the Terbang Bandung Dance to children at Sanggar Dharma Budaya Pasuruan. She also mentioned that this dance has been handed down through generations in her family. She highlighted the significance of preserving the traditional aspects of the dance, particularly in the movements and the musical accompaniment utilised.

According to various sources, the movements in the Terbang Bandung Dance symbolise a balance between religious expression and traditional dance forms. Several key movements are derived from the positions and formations observed during *"Dhikr,"* or the act of remembering God in Islamic rituals by repeatedly mentioning His name. A significant point shared by the resource person was that the Terbang Bandung Dance encompasses not only the aesthetic quality of the movements but also a sense of *"spiritual connectedness."* Dancers are expected to perform with enthusiasm, supported by prayers and Dhikr that are reflected in the lyrics of the songs accompanying the dance.

A traditional musician skilled in playing the Terbang—an instrument resembling a tambourine made from cowhide—shared that the music accompanying the Terbang Bandung Dance greatly influences the dance's atmosphere. The rhythm and tempo of the performance convey the spiritual dynamics experienced by both the dancers and the audience. With the Terbang instruments being played in harmony, the musical backdrop energises the dance and inspires the dancers to synchronise their movements. These performers emphasised that while the dance has evolved, modern influences have not significantly altered its essence. They believe it is crucial to preserve the authenticity of this dance, although certain aspects like costumes and presentation methods are beginning to evolve with the times.

This significant historical event laid the foundation for the creation of the musical art known as "Terbang Bandung." This art form, which originally encompassed the theme of *maru-maruan* (polygamy), has since evolved to

convey a religious-spiritual moral narrative referred to as *"Ewe-Eweyang,"* emphasising that as Muslims, we must respect and honour one another. Whenever we encounter each other, whether passing by or meeting, we should greet one another, display courtesy, and maintain a friendly and polite demeanour (Suyatno, 2013).

c. People's Perspective on Terbang Bandung Dance as Regional Art

The youth in the Bangil area of Pasuruan have a very positive perception of the Terbang Bandung Dance. This dance is seen not only as a source of enjoyment but also as a way to preserve local religious and cultural customs (Prasetyo H. , 2023). For many, the Terbang Bandung Dance symbolises more than simple bodily movement; it is a vital part of their cultural heritage. In the Bangil community, the Terbang Bandung Dance is usually performed during religious and social events. The community views this dance as a way to express gratitude to God and as a symbol of solidarity. When the dance is performed, residents gather to watch, promoting a deep sense of togetherness. Moreover, this dance is often regarded as a form of Da'wah, strengthening religious feelings and spiritual connections within the community.

Many older residents in the community expressed their satisfaction in watching younger people continue the tradition of The Terbang Bandung Dance. They mentioned that this dance represents a deep philosophy of "simplicity, devotion, and respect for ancestors." Furthermore, the Terbang Bandung Dance is seen as delivering a moral lesson, highlighting the significance of maintaining a balance between spiritual and social aspects of life. Nonetheless, there is an opinion that this dance is rarely featured in the everyday lives of modern society, especially among the youth, who often lean towards popular culture. As a result, some community members are advocating for "greater efforts in preservation" through educational programs in schools and local cultural events to ensure that the Terbang Bandung Dance remains significant in the future.

The community values all initiatives aimed at revitalising the Terbang Bandung Dance, whether via digital platforms, educational programs, or cultural celebrations. They aspire for this dance to continue thriving and to be handed down to future generations, ensuring that its cultural significance and values are preserved amidst modernisation.

Currently, the Terbang Bandung art form in Pasuruan City is represented by a single art group known as "Karya Bakti." Additionally, there is only one original gending associated with Terbang Bandung, which is the Ewe-Ewe gending. To ensure the continuity of Terbang Bandung art, traditional artists in Pasuruan City have modified the original lyrics of the Ewe-Ewe gending and have incorporated it with the Terbang Bandung Dance art. This development has resulted in the original *Ewe-Ewe gending* being less recognised by the public (Prasetyo H. , 2023)

2. Design Phase

a. Main Idea of Metahuman KAGURI 0.1 and the Current Progress Report

The KAGURI 0.1 application starts with the following steps: 1) Students download the KAGURI 0.1 app, 2) They select either Sinau Mode for educational purposes or Dolen Mode for entertainment, 3) In Sinau Mode, students can choose to engage with content about Terbang Bandung dance through auditory (listening) or visual (viewing images or videos) learning styles; additionally, they can enter specific keywords in the writing section and press the "enter" button to quickly find relevant information 4. There is an interactive component where students engage with the learning media based on the command prompts they provide (see Figure 5).

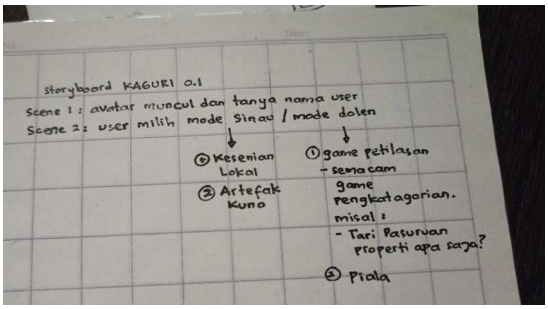

Figure 5. Metahuman KAGURI 0.1 Basic Concept

Throughout this journey, the KAGURI 0.1 project has progressed to the animation stage. Metahuman characters have been developed, mimicking interactions with placeholders (temporary substitute characters, which used to be called dummy dolls), while organising writing layouts, grammar, fonts, and graphic assets. The development team is currently still utilising the placeholder characters and has not established a physical connection between Metahuman and The Terbang Bandung Dance Art, as they are still working on revising the UI/UX section until October 2, 2024. Figure 6-7 are some of the documents provided to researchers as a report on work progress.

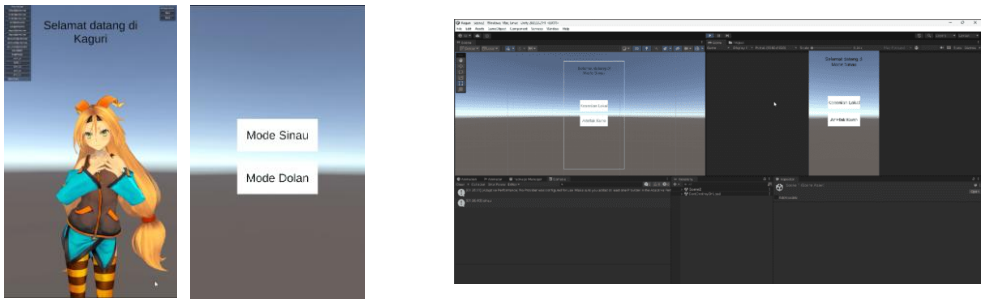

Figure 6-7. Preset Metahuman KAGURI 0.1 after Entering the Development Process

The creation and enhancement of groundbreaking products like Metahuman KAGURI 0.1 in the realm of art education cannot be accomplished quickly. This is due to the significant obstacles encountered in developing a novel technology that has yet to be realised, aimed at transforming or even revolutionising art

education methods. Innovations such as Metahuman KAGURI 0.1, which aim to blend artistic elements with cutting-edge metahuman technology, necessitate that developers engage in extensive research, experimentation, and interdisciplinary dialogue. All of this requires substantial time and resources.

Metahuman KAGURI 0.1 is a product that merges Metahuman technology—a high-realism digital character technology created by the Unreal Engine—with an art education curriculum. It was crucial to recognise that Metahuman goes beyond simply being a 3D character; it can realistically manipulate facial expressions, body movements, and engage with the digital environment. Incorporating this technology into art education requires careful consideration to develop how it can enhance the learning process, teaching methods, and overall art experience.

The design process must involve a thorough investigation into how Metahuman can be utilised to showcase art techniques, represent artworks in a virtual environment, or even act as an instructor or guide for art students. This necessitates research across various disciplines, including art theory, teaching methods, and expertise in 3D character development software, along with other visualisation technologies. Such complexity indeed demands significant time for designing and testing ideas.

Products like Metahuman KAGURI 0.1 represent a significant advancement in art education that integrates technology with visual arts in a tangible manner. Until now, no other product has successfully merged realistic digital characters for dynamic use in art instruction. Traditionally, art education has been primarily reliant on conventional methods such as in-person teaching, studio sessions, or traditional tools like books and projectors. The creation of innovative products that embrace cutting-edge technology in art education requires advancements that are not only technical but also pedagogical. Developers must research how this advanced technology can be used by art students and support more interactive teaching. The lack of direct references or similar products added to the challenge, as developers had to devise innovative strategies, methods, and applications that had never been used before in the context of art education.

The development process of Metahuman KAGURI 0.1 also involved collaboration between various disciplines, which slowed down the design process. The metahuman technology used in this product involved not only software developers, but also experts in art education who understand how the art learning process works well. The technology developers had to work closely with art education experts to ensure that the resulting product was not only visually appealing but could also improve the quality of learning and the development of art skills.

This partnership necessitated extensive communication among diverse teams with different expertise. Although this process was time-consuming, the outcome is anticipated to produce a product that effectively addresses the needs of the art education sector. Despite the lengthy development period of Metahuman KAGURI 0.1, the potential impact of this product could

significantly transform the future of art education. By utilising metahuman characters, art students will have the opportunity to engage with digital instructors who can showcase techniques, movements, or artistic expressions in real-time, enhancing their educational experience. This technology fosters more personalised and adaptive learning, resulting in a richer and more thorough educational journey.

b. Media Experts' Opinions and Criticise the Concept of Metahuman Learning Media KAGURI 0.1

The quality of this paper remains provisional, as the completion of KAGURI 0.1 is still in progress. Both the content and visual elements require refinement based on ongoing feedback from teachers and students who utilise it, experienced cultural arts instructors in relevant institutions, and guardians of The Terbang Bandung Dance, ensuring it is recognised as a reliable and high-quality educational resource.

Assessment of Language Aspects

The KAGURI 0.1 Metahuman learning media employs the Indonesian language, which is clear and easily comprehensible for middle school students. Cultural terms are simply explained without diminishing their traditional significance. The language utilised is tailored to the understanding level of the target audience, particularly high school students studying local culture. Typical cultural terms are also accompanied by brief and straightforward explanations. In narratives and instructions, the language has been modified to align with local customs and culture, highlighting politeness and respect for local traditions. Table 1 is an example of the Linguistic Expert Validator Rating Sheet.

Graphics Aspect Assessment

The digital avatars created with Metahuman Creator are regarded as remarkably lifelike, particularly in terms of skin quality, facial expressions, and movements that closely mimic reality. The dancers' visuals are tailored to reflect local cultural elements, showcasing traditional attire and accessories characteristic of the Flying Dance. The application features a straightforward yet efficient user interface. The presence of intuitive icons and straightforward navigation enhances usability for those who may not be well-versed in digital technology. The selected colours and layout in this medium promote a positive learning environment. The chosen colour palette is cohesive and does not disrupt focus, allowing users to concentrate on the content. Table 2 is an example of the Graphics Expert Validator Rating Sheet.

Table. 1: Outcome Result of Language Validator

Evaluation Aspects	Indicator	Question	Validate Score 1	2	3	4	5
Language	Diction	The instructional and narrative language used in the knowledge material on preserving local arts in Bangil, Pasuruan, is easy to understand, simple, and can be conveyed directly.				✓	
		The use of language in the learning media "Metahuman KAGURI 0.1" does not contain double or ambiguous meanings.			✓		
	Deliver	The narrative material used in "Metahuman KAGURI 0.1" for exploring local arts knowledge in Bangil Pasuruan has the potential to stimulate students' interest.				✓	
		The learning media "Metahuman KAGURI 0.1" developed is relevant to the use of the national language in students' daily lives.					✓
Score Total			16				
Average Score			4.00				

Table. 2: Outcome Result of Graphic Validator

Evaluation Aspects	Indicator	Question	Validate Score 1	2	3	4	5
Graphics	Visual of Avatar Metahuman KAGURI 0.1	Graphic illustrations used are appropriate to the material being discussed and its context.					✓
		Character Design					✓
		Animated Quality				✓	
		Font, Screen, Audio				✓	
		Display of the UI-UX					✓
		Display of Main Menu				✓	
	Audio of Avatar Metahuman KAGURI 0.1	Audio (Iluustration Music)					✓
		Audio (Voice Over)				✓	
		Audio (Sound Effect)				✓	
	Mini-Games	Hidden Game as an option to attract student attention			✓		
		Display of "Hall Of Fame" (achievement menu to show player progress)				✓	
Score Total			47				
Average Score			4.27				

Content Aspect Assessment

The provided content is highly pertinent to the learning objectives, which aim to introduce and delve into the culture of Terbang Bandung Dance. All aspects of the dance, including fundamental movements, its history, and the philosophical interpretations, are explored thoroughly. The cultural information shared, encompassing the history of the Terbang Bandung Dance and insights into associated cultural elements, has been deemed very accurate and confirmed by local cultural authorities. This media effectively motivates learners to gain a deeper understanding of local culture and cultivate appreciation for it. In addition to imparting knowledge, it also sparks learners' creativity and curiosity through interactive engagement with digital characters. Every significant aspect of the Terbang Bandung Dance, from its historical context to the practice of the dance itself, is presented comprehensively. It succeeds in delivering a detailed overview without omitting any crucial elements of the dance and its cultural significance. Table 3 is a sample of the Content Expert Validator Rating Sheet.

Table. 3 Outcome Result of Content Validator

Evaluation Aspects	Indicator	Question	Validate Score				
			1	2	3	4	5
Content	Whole Learning Content	Content suitability with the plan of learning progress				✓	
		Content suitability with the learning purpose					✓
	Assessment Indicator	Content suitability with the learning assessment					✓
	The Depth of content	The depth of content helps students feel related to another art discussion.				✓	
		Content related to the illustration (picture)					✓
		Content compatibility with the teenage student				✓	
	Content Accuracy	Easily understand					✓
		Valid Information					✓
	Content fits with the Media Form	The Main Role of Metahuman KAGURI 0.1 as an informator to the student					✓
		Suitability interaction between Metahuman and Student					✓
		Up-to-date information				✓	
		KAGURI 0.1 helps students explore the performance art				✓	
		Content delivered by using an app from learning media			✓		
Score Total			58				
Average Score			5,27				

3. Development Phase

a. Analyse and Evaluate Concerning The Earlier Relevant Studies.

The most significant source of inspiration for creating Metahuman KAGURI 0.1 was the mobile application developed by Amalia (2020) as part of her thesis project. Additionally, both Amalia and this present study conducted research that shares a common goal of creating interactive media as a learning resource that incorporates the local culture of Pasuruan, although each study employs a different technological approach and pursues distinct objectives in the development of interactive media. Below is a comparison of the two studies.

Based on the research goals of Amalia, it was discovered that this thesis intends to create mobile application-based learning tools that emphasise the local culture of Pasuruan. The main objective is to leverage mobile technology to enhance junior high school students' understanding of their local culture. Amalia aims to develop engaging and easily accessible interactive media to educate students about the cultural heritage of Pasuruan through the devices they commonly use, specifically cellphones. Amalia utilises mobile application technology that is user-friendly and can be readily employed by students within their educational environment. The interactive media developed in this study is crafted to provide easy access to information regarding Pasuruan culture, featuring engaging components such as 2D images and text. Its application is primarily educational, focusing on direct engagement with local cultural learning resources.

In contrast, this present study employs more sophisticated technology through digital character creation using Metahuman, a cutting-edge application of the Unreal Engine that enables the development of lifelike human avatars. These avatars can be utilised to share information about local arts in a more interactive and immersive manner, fostering a deeper emotional connection with the audience. The technology implemented offers a more futuristic experience and is likely to attract older or more tech-savvy individuals.

Regarding the target user segment, Amalia's study specifically focuses on junior high school students, a youthful demographic that is beginning to require more engaging and enjoyable learning resources. By utilising mobile phones as a medium, she guarantees that the developed media is readily available to students beyond the classroom, enhancing the flexibility of the learning experience. While not explicitly mentioned, a more advanced application of Metahuman technology would likely resonate with a broader audience, potentially encompassing the general public or students interested in art and technology. Featuring highly lifelike characters and a more engrossing interactive experience, this medium has the potential to attract a diverse age range, particularly those with an affinity for emerging technology and digital art.

In the realm of implementation and application, Amalia's study primarily emphasises the use of learning media within formal educational settings, where this mobile app can facilitate teaching and learning processes in schools. By incorporating the local culture of Pasuruan into the educational framework, this

application assists students in recognising and valuing their cultural heritage in an enjoyable and easily digestible manner. Conversely, this present study can also be integrated into formal education, while still allowing for the potential creation of media that could be utilised in diverse contexts, such as art exhibitions, informal educational settings, and broader community engagement with local Bangil art. The employment of digital characters and interactive media offers greater adaptability, enabling their application in venues like museums, cultural festivals, or individual applications that encourage people to explore traditional art through contemporary technology. The benefits of Amalia's research stem from the ease of use and low cost of the technology, making it highly appropriate for educational requirements at the junior high school level. However, the difficulty lies in making sure that these applications are available to all students, particularly those with limited access to devices or the internet. On the other hand, this present study benefits from its ability to deliver more profound and immersive experiences through the use of advanced technology. Incorporating Metahumans has significant potential to engage a broader audience and deepen cultural comprehension. Nevertheless, the primary obstacles are the substantial expenses and restricted accessibility for most individuals, given the necessity for more advanced hardware and technical know-how to develop or use the technology.

Alongside Amalia's research and other researchers mentioned before, there is another product design that was discovered that aligns with KAGURI 0.1. This product was developed by Subekti et al. (2020) and was similarly distributed in junior high schools throughout the Pasuruan City region. The study's findings revealed that this revitalisation highlights the significance of reintroducing the art of Terbang Bandung, which has been overshadowed by modernity and digitalisation. Many residents of Pasuruan City lack an understanding of this art form due to the absence of performances showcasing Terbang Bandung, making it essential to revitalise the art for the community (Subekti et al., 2020). The researcher's revitalisation efforts aim to bring Terbang Bandung back to life through interactive learning media in the form of an android application targeted at high school students in Pasuruan City. The researcher hopes that this media will facilitate comprehension and help preserve the art of Terbang Bandung among the younger generation, specifically high school students in Pasuruan City.

It is recommended that the results of revitalising Terbang Bandung be embraced by the entire community of Pasuruan City, particularly urging the local government to create opportunities for showcasing revitalised performances at official city events (Babaran, 2023). Young artists are encouraged to contribute to the preservation of Pasuruan's cultural heritage, inspiring more young people to engage with this art form for future generations. Looking ahead, there is hope for a comprehensive revitalisation of the Terbang Bandung performances in Pasuruan (Prasetyo & Kasiyan, 2024)

b. Developing a 3D Scan of a Real Human Face as The Metahuman Character

Additionally, researchers conducted experiments using a 3D scanning application called Polycam, which is available for download on the Play Store for Android users, to scan various real human faces employing the Masking Technique. The hope is that this could eventually lead to the development of a method for converting the scanned faces into Metahuman characters. Furthermore, if feasible, there are plans to integrate these characters into Motion Capture technology. Two individuals volunteered to participate in this experiment: A.M., a 9-year-old, and P.K.P., an 18-year-old (Figure 8-10).

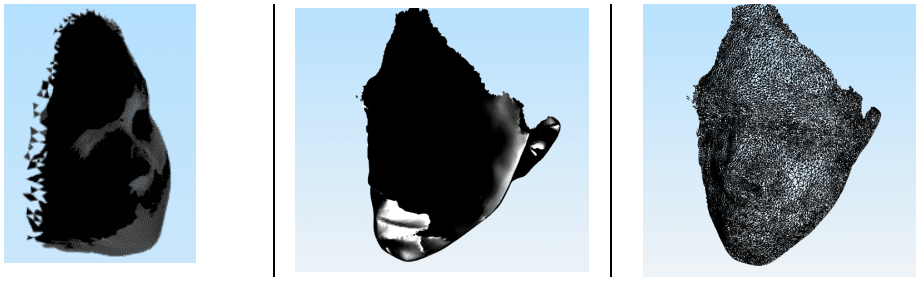

Figure 8-10. Experiment Preset Metahuman KAGURI 0.1 with Real Human Face Scan

Regrettably, this stage did not operate efficiently due to the limitations of the technology available to the researcher (the tool's cost is high, or it is not readily accessible in Indonesia). Consequently, the researchers were only able to investigate the development of Metahuman at the physical preset form stage, without progressing to the animation aspect or the future interaction with users. In light of these challenges, the researchers ultimately decided to assemble a team to assist in bringing Metahuman KAGURI 0.1 to fruition. The recruitment process proved to be quite difficult, as finding suitable and capable individuals in Surabaya City was a significant challenge. Several unusual and unfortunate recruitment experiences were encountered, such as when researchers successfully reached out to some other university lecturers in relevant fields of study (Game, Programmer, and Technology) and promoted this Metahuman project.

4. Implementation Phase

a. Reactions of Educators as Facilitators of Learning Media

During the pilot phase, the KAGURI 0.1 Metahuman learning media included five teachers who acted as validators to offer feedback on the media's quality and effectiveness in introducing and explaining local culture, particularly the Terbang Bandung Dance. Overall, the teachers' feedback was very positive, with an average score of 4.00 out of 5 on a Likert scale. Most teachers rated it highly. They noted that this media provided a clear and thorough understanding of the Terbang Bandung Dance, making it easier for students to recognise and appreciate local cultural values. The teachers commended the media for successfully merging culture with modern technology, which piqued students' interest in learning. Visual and graphic quality also scored quite high,

with an average of 4.27. Teachers praised the visualisation of the digital characters created with Metahuman Creator, especially in terms of the details of the traditional clothing and the realistic look of the dancer characters. However, some teachers noted that the animation of the dance movements could still be refined to get closer to the authenticity of the Terbang Bandung Dance movements.

In terms of student usability, KAGURI 0.1 Metahuman media was assessed as outstanding. Educators evaluated the interface as easy to use, featuring straightforward navigation and clarity even for students who may not be well-versed in digital technology. This aspect is deemed crucial for facilitating a more effective learning experience. Regarding linguistic quality, the media garnered positive feedback with an average rating of 4.00. Teachers felt that the language utilised in the narrative and instructions was extremely clear and accessible for students. The language employed is also regarded as appropriate, simple, yet still reflects politeness and respect in line with local cultural norms. The educators also mentioned that this media succeeded in boosting students' enthusiasm for learning about local culture. The use of interactivity and digital technology in showcasing culture is viewed as very effective in capturing students' interest, particularly the younger generation, who are more accustomed to digital media. They believe this media could serve as an innovative approach to preserving traditional culture while making learning enjoyable. In general, teachers concurred that Metahuman KAGURI 0.1 achieved an impressive score of 5.27 and can be utilised as a learning resource in both classroom settings and for self-directed study. Educators also recognise significant potential for this media to be implemented across various educational levels, especially within cultural arts curricula. Below is an example of the Teacher Response Sheet. And Table 4 is the teachers' responses.

Research Name	:	Development of Interactive Media "Metahuman KAGURI 0.1" in Exploration of Local Arts Bangil Pasuruan
Content	:	Teachers' Responses
Product Developer	:	AV
Respondent's Name	:	RW
Date Of Response	:	05 January 2025
Assessment Purpose	:	Knowing the teachers' responses when becoming a user of the Learning Media "Metahuman KAGURI 0.1" for junior high school students in grade VIII.
Direction	:	1. This questionnaire is intended to find out your opinions and assessments about the Learning Media "Metahuman KAGURI 0.1" for junior high school students in grade VIII, which is being developed. 2. Answers are given in the assessment scale column that has been provided with the following assessment scale: • SA: Strongly Agree • A: Agree • QA: Quite Agree

- LA: Less Agree
- D: Disagree

3. Please provide a checklist in the assessment scale column according to your opinion. Please provide comments or suggestions in the space provided.
4. Thank you for your willingness to fill out this validation sheet. May you always be given health and happiness

Table 4. Teachers' responses

No.	Indicator	Teacher's Opinion				
		SA	A	QA	LA	D
1	The use of the learning media "Metahuman KAGURI 0.1" is something new and interesting for me	✓				
2	The use of the learning media "Metahuman KAGURI 0.1" makes it easier for me as a facilitator for the Arts and Culture subject, especially the topic of Local Arts Terbang Bandung Dance.		✓			
3	The use of the learning media "Metahuman KAGURI 0.1" can attract students' attention and interest in learning	✓				

b. Reactions of Students as Users of Educational Resources

Following the evaluation of the KAGURI 0.1 Metahuman educational media with a group of high school students, the overall feedback gathered indicated very favourable outcomes. The students showed a keen interest in the incorporation of Metahuman technology and animation into their learning about the Terbang Bandung Dance from Bangil Pasuruan. Here are some important points from the students' feedback: Generally, students believed that this media made it easier for them to grasp the Terbang Bandung Dance. Many who were initially unfamiliar with the dance expressed a newfound curiosity to learn more after engaging with the learning media. Students indicated that the depiction of digital characters, traditional attire, and the explanations regarding the significance and history of the Terbang Bandung Dance enhanced their understanding of the material. On average, students mentioned that they were able to comprehend this cultural aspect more effectively than through traditional educational methods.

Many students expressed great interest in the graphic quality showcased by Metahuman KAGURI 0.1. They believed that the lifelike digital characters and dance animations created an experience akin to watching a live performance. However, a few students recommended that the dance movements could be more fluid and better aligned with the performers' original gestures. Overall, most felt that this medium was far more captivating than traditional text resources or educational videos.

Students expressed their appreciation for the user-friendliness of this media. They noted that the straightforward interface and clear guidance made the app accessible, even for those who are not well-versed in high-tech applications. The

interactive elements that enable them to view the characters from various angles and grasp the dance movements in detail were deemed very beneficial for their learning experience. On average, students reported that they found the learning journey to be more enjoyable and engaging due to these interactive features. They also felt that the language used in this learning medium was very comprehensible. The narration clearly describes each aspect of the dance, avoiding confusion for the students. The tone of the language feels relaxed yet remains respectful and suitable for the cultural learning context. Several students commended the straightforward yet thorough explanation of specific dance terminology.

One of the most encouraging reactions from students was their heightened interest in local culture. Several students confessed that before engaging with this media, they were not very keen on traditional dance topics. However, after experiencing Metahuman KAGURI 0.1, they find themselves more inclined to learn various dances and have a greater appreciation for local cultural heritage. This media is viewed as effectively igniting students' curiosity and passion for the arts and culture. Students also mentioned that this media significantly aids their independent learning. They believe that with this media, they can study whenever and wherever they like without needing to constantly rely on their teacher. The interactive features and visualisation of dance assist students with a visual learning preference in grasping the content more effectively. Numerous students indicated that they felt more self-sufficient and inspired to explore further after utilising this media. Table 5 show the student responses.

Research Name	:	Development of Interactive Media "Metahuman KAGURI 0.1" in Exploration of Local Arts Bangil Pasuruan
Content	:	Students' Responses
Product Developer	:	AV
Respondent's Name	:	NS
Date Of Response	:	05 January 2025
Assessment Purpose	:	Knowing the students' responses when becoming a user of the Learning Media "Metahuman KAGURI 0.1" for junior high school students in grade VIII.
Direction	:	1. This questionnaire is intended to find out your opinions and assessments about the Learning Media "Metahuman KAGURI 0.1" for junior high school students in grade VIII, which is being developed. 2. Answers are given in the assessment scale column that has been provided with the following assessment scale: • SA: Strongly Agree • A: Agree • QA: Quite Agree • LA: Less Agree • D: Disagree 3. Please provide a checklist in the assessment scale column according to your opinion. Please provide comments or suggestions in the space provided.

4. Thank you for your willingness to fill out this validation sheet. May you always be given health and happiness

Table 5. Students' responses

No.	Indicator	Teacher's Opinion				
		SA	A	QA	LA	D
1	The use of the learning media "Metahuman KAGURI 0.1" is something new and interesting for me		✓			
2	The use of the learning media "Metahuman KAGURI 0.1" makes it easier for me as a user of the Arts and Culture subject, especially the topic of Local Arts Terbang Bandung Dance.		✓			
3	The use of the learning media "Metahuman KAGURI 0.1" can attract students' attention and interest in learning	✓				

5. Evaluation Phase

a. Prospective Optimism Or Guidance

The main goal of this study is to assess the effectiveness of the Metahuman KAGURI 0.1 as a tool for educating students about local arts and culture. It is anticipated that students who interact with the avatar will demonstrate heightened interest and a better understanding of cultural topics, as the engaging nature of the experience is likely to create a stronger connection to the content. Moreover, the research also seeks to uncover any challenges associated with the use of Metahuman-based education, such as technological hurdles, educator resistance to innovation, or constraints in content creation.

Furthermore, the study seeks to demonstrate the broader impact of digital avatars in cultural education. By leveraging the capabilities of Metahuman technology, this research will contribute to the growing body of knowledge about how digital media can be used to preserve and share cultural knowledge in a rapidly evolving world.

The integration of Metahuman KAGURI 0.1 into educational settings represents an innovative and promising path for the future of cultural education. This study will not only contribute to the understanding of how digital avatars can be used to enhance learning but also provide a valuable framework for the development of future learning media in local arts and culture exploration. By merging advanced technology with traditional cultural education, the Metahuman KAGURI 0.1 has the potential to transform how we engage with, learn about, and preserve the rich cultural heritage of our communities.

b. Research Limitations

The focus of research and development generally centres on examining two aspects: the processes involved and the effects of the product that results, as well as the overall design and development procedure or merely selecting

specific components of that process (Richey & Klein, 2009). From this definition, the constraints regarding the scope of the issues in this study are outlined as follows:

This research results in the development of an Android OS Application named "Metahuman KAGURI 0.1," along with a User Guide or Manual that will assist teachers in guiding students as they utilise this application during classroom learning. The local arts presented to students represent one of the cultural heritages of the Bangil Pasuruan City area. The local arts referenced include performances of traditional music, dance, and theatre. The specific local art being studied is the Terbang Bandung Dance, created by Mr. Harjoto Tojib, which has since been adapted over time to appeal to local school students by Mrs. Intrasminah's family from the Sanggar Dharmabudaya Pasuruan.

The "Metahuman KAGURI 0.1" application will be utilised within the Arts and Culture subject, aligned with the principles of the (Yatim, Jamilah, Sahnir, & Abduh, 2023) Including a variety of Traditional Regional Songs, a selection of Traditional Regional Musical Instruments, the Philosophical Content of Values, various Traditional Dances, Appreciation of Works, the creation of Realistic Play Scripts, and Artistic Arrangement. Nevertheless, since the product of this research is still in the prototype stage, the researcher will initially select one sample topic from the dance branch of traditional regional art for the first experiment.

This Android application will undergo testing with eighth-grade students at SMPN 3 Bangil Education Unit, UPT. This educational institution is a public school situated at Jalan Dokter Soetomo No.1, Sukalipuro, Dermo, Kec. Bangil, Pasuruan Regency, East Java Province. Finally, "Metahuman KAGURI 0.1" is utilised for students' learning activities in individual study conditions, although all students remain in the same classroom.

CONCLUSION

This research concludes that the process and quality of developing the Metahuman KAGURI 0.1 learning media aim to introduce, explore, and comprehend the local culture of the Terbang Bandung Dance from Bangil Pasuruan through a digital media technology approach. The findings indicate that this Metahuman-based learning media has effectively created interactive and immersive visual representations that support local cultural education. The media's quality is evaluated as satisfactory regarding aesthetics, interactivity, and accessibility, which can enhance students' understanding of the dance and its cultural significance. By utilising Metahuman technology, the preservation of culture in a digital format is made possible, ensuring it is accessible to the younger generation.

Besides, the aspiration for future researchers is to enhance the development by improving the interactivity and precision of cultural representation through the addition of vivid visual, audio, and dance movement elements. Exploring supplementary technologies such as real human motion scanning with Motion Capture cameras, virtual reality (VR), or augmented reality (AR) could elevate the immersive experience. It is important to engage and collaborate with more cultural

experts, dancers, and traditional arts practitioners to ensure that each aspect of this educational media aligns with cultural values and authentic dance movements. Trials should be conducted on a larger scale, encompassing both formal and non-formal educational settings, to assess the effectiveness of this educational media in diverse environments and contexts. Lastly, broadening the cultural learning content will help introduce the richness of Indonesian culture to the younger generation via innovative digital media.

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Developing Students' Speaking Performance through Mastering Question Words in Islamic University Setting

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Abstract
This study aims to identify students' speaking performance at English Department students of State Islamic University of Datokarama Palu could be developed through mastering question words method. It was designed as a collaborative classroom action research and divided into two cycles. Data came from class observation, field notes, questionnaire, and speaking test over six meetings of speaking lesson. The research included 22 students. The researchers identified the students' speaking performance based on the criteria of success established. The findings showed that the use of questions in the teaching and learning process helps to increase students' motivation, responsiveness, and enthusiasm, as well as, of course, their courage to speak English. This method can also be used to encourage students to understand the question's content before they respond to it and to offer them the chance to verbally express their ideas. Only five students who received a score of at least were detected in the first cycle's assessment of students' speaking performance. It meant that only 23% of the students met the success criteria. The students' achievement was then discovered in the second cycle by seventeen students or 77%. It suggests that the success requirements have been met or that the question words technique can improve students' speaking performance.
Keywords: EFL Students; Question Words Method; Speaking Skill

INTRODUCTION

There are two accentuations in fostering students' speaking performance overall. Firstly, it emphasizes the importance of communication in everyday relational and situational contexts. Secondly, it highlights the significance of conveying meaning even through brief and monologic texts within daily life settings. In English language classrooms, this point becomes essential in demonstrating how the target language can function as a medium for real communication. This view aligns with the argument that language learning should not be limited to theoretical understanding, but should also foster the ability to use the language effectively in real-world or classroom-based contexts (Khan, 2018; Ali, 2018; Ali et al., 2019). As noted by Roza et al. (2019), integrating authentic and contextual communication practices into the classroom can significantly improve learners' engagement and

comprehension. Similarly, Khairunnisa et al. (2022) emphasize the role of meaningful interaction in enhancing learners' communicative competence.

Lecturers, therefore, serve as crucial influencers in this transformation. They are responsible for adopting and implementing pedagogical shifts to move beyond traditional teaching models, which often rely on a lecturer-dominated approach that emphasizes control and authority. As pointed out by Jay-ar and Lasaten (2018), the persistence of such conventional methods can inhibit students' interest and participation. Zhu et al. (2019) further argue that a lack of varied instructional techniques may reduce students' motivation to learn English. In contrast, a more interactive and student-centered learning environment fosters deeper understanding and retention. Al-Jarf (2021) supports this by showing that the integration of technology and multimodal resources in English instruction leads to more dynamic learning experiences. Moreover, Kadnawi (2021) highlights the necessity of adapting teaching strategies to accommodate diverse learner needs in order to avoid classroom monotony and disengagement.

In view of the researchers' past perception, the issues found in the researchers' classroom where the majority of them seeing as challenging to communicate their sentiments, thoughts, assessment and they didn't be aware to respond to the inquiry words. This is on the grounds that they didn't comprehend the reason for question, and they were not bold to communicate or answer by utilizing the materials they have learned. In view of these realities expressed already, the researchers are keen on applying the method of inquiry words in showing educational experience.

Moreover, the researchers in this research will zero in on speaking performance. In light of researchers' involvement with showing educational experience, the researchers observed that there were 85% of these students who didn't be aware to address the question, for example, to respond to address expressions of what, why, and how. Also, obviously, impacts their comprehension since they are as yet confounded in the event that the speaker poses some questions. They didn't have the foggiest idea about how to address the question like 'wh' question words in English. For models: What do you are familiar past tense? For what reason is this strained significant? How would you utilize this strained? When do you utilize this strained? They just replied "yes/no" or "stay quiet", and never responded to the question or offer their viewpoint since they misread the lecturer's question. What's more, their vocabulary authority was very need. This is on the grounds that the researchers now and again didn't have a clue about the reason for the question that he/she ask to his/her students (Bangun, 2018; Bouzar, 2019; Hammad, 2020; Hasan et al., 2021;.

To get fulfilling reactions, the researchers should know how to pose a legitimate inquiry word to their students on the grounds that by understanding the reason for the question, it will be simple for the speaker to coordinate the question that empower the students to excitedly answer them (Irfani, 2018; Wang et al., 2018; Marzuki & Kuliahana, 2021).

The researchers are intrigued to beat the issues above via completing a logical examination with the utilization of inquiry words to effectively foster their

speaking performance. For this situation, question words could animate the method of what the students think and furthermore to allow the opportunity for the students to talk. This method is favorable for the researchers to know how to communicate question words that made the students comprehend, and furthermore the students would be bold to give their reactions and feelings as per the lecturer's question. The researchers picked question words in this examination since this strategy can animate the students' method for figuring how to utilize the language particularly to respond to the question and offer their viewpoints orally by utilizing yes-no endlessly question words particularly: what, why, which, who, where, when and how.

METHODS

In this exploration, the researchers applied Classroom Action Research. The meaning of CAR is given a type of aggregate self-intelligent request embraced by members in friendly (counting instructive practice) circumstance to work on the reasonableness and equity of (a) their own social or instructive practice, b) how they might interpret their training, and(c)the circumstance in which practices are done (McTaggart et al., 2017; Wulandari et al., 2019; Meesuk et al., 2020; Nurhasanah et al., 2020).

In this action research, the researchers planned the action based on the problem faced in learning. They planned the action, implement it, and observe the effects of the implementation to students' progress in learning. At the end, the researchers carried out a reflection in order to recognize the effects of implementation whether it has satisfied of the criteria of success or not, and then decide to stop or to continue the action. If the researchers decided to continue the action to the next cycle, they first revised the plan based on findings in the previous cycle.

This research was conducted at English Department students of Islamic State University of Datokarama Palu who take speaking course. It consisted of three classes and the subject of this research was TBIG-1 class which consists of 22 students in 2022/2023 academic year. To obtain accurate and reliable data, the researchers carried out field research by employing some instruments, i.e. observation checklist, field notes, questionnaire, and test. The data analysis is done through reflection where both collaborator and researchers analyzed the data which gather from observation sheet, field note, questionnaire, and the test. At the end, if they gained data meet the criteria of success, the cycle can be stopped. On the contrary, if the data do not meet the criteria of success yet the cycle would be continued.

RESULT

Observing in Cycle I

The researchers and the collaborator engaged in extensive observation in order to establish accurate data from teaching and learning. During this period, researchers kept watch while teaching and learning activities were taking place. The researchers' teaching style and the students' involvement in the teaching and

learning process were both observed. In order to gather trustworthy data from the field, the researchers and their collaborator closely watched the two components.
Finding from observation sheet and field notes in cycle I
1). First meeting
According to data gathered from observation sheets, the majority of students have not yet actively responded to questions posed by the researchers, particularly for question word answers. But if the researcher used a closed question with a Yes or No response, the students responded enthusiastically, according to data gathered in the field.
In the while-activity, the researchers provided a brief introduction to the subject before assigning the job. After they had a chance to think about it and understood the discourse, they were instructed to voice their opinions orally. The field notes indicate that most of them still needed a lot of time to give each unique oral description before being delivered verbally.
2). Second meeting
The information gleaned from the observation sheet indicates that the students actively engaged in responding to the questions and voicing their opinions in light of the lesson case. Before starting the first task, researchers provided an example of how to communicate an opinion while using an expression during the while-activity. According to the statistics, eight students participated in this exercise and provided oral responses to the questions. When they responded to questions 1 and 2, they erred in both grammar and pronunciation. The researchers provided input after responding to all queries, and the meeting came to an end.
3). Third meeting
It was cycle I's final meeting. The researchers made their assessment based on the information they gleaned from the observation sheet. The researchers provided eight questions for this activity. Although the researchers gave clear instructions, not all of the students paid attention to them because they were perplexed and spoke more slowly. In order to ensure that the students understood the instruction, they should translate it into Bahasa Indonesia if necessary. They didn't fully respond to all of the questions as a result of their fear of speaking in front of the class. Twelve students actually presented their questions and answers one at a time in front of the class as the evaluation's outcomes.
The Result of Speaking Assessment
Before the activity began in this phase, the researchers delivered the evaluation sheet and gave clear instructions to make it easier for participants to respond to the questions. In this instance, she demanded that they complete the assignment and understand the questions' content before expressing themselves orally in front of the class. Their use of question phrases to express themselves had a significant impact on the researchers' and the collaborator's ability to determine the students' academic success.
In this case, the researchers evaluated each student's oral presentation of the case when it was brought up in front of the class. As the first step in capturing the value, the researchers called each participant individually to make a presentation in front

of the class in accordance with their requests. The following table tabulates and presents the results of the speaking test from cycle one.

Based on the gain data, the Cycle I mean score for the Result of Speaking Assessment was 67. The detailed data revealed that just 5 students (or 23%) were classified as successful since they met the success criteria and had scores of 70 or higher. While 17 students (or 77%) failed to achieve the success criteria. In this instance, 17 (77%) of the students did not learn what was intended. As a result, the following cycle needs to have a plan.

Reflection in cycle I

Action researchers and their collaborator could look back on past classroom activities during reflection and conduct analysis of the findings. to assess if the treatment has resulted in a significant improvement and to decide whether to continue the treatment once the kids' performance has reached the success criteria. By assessing and validating the information gleaned from the observation sheet and field notes, the researchers and their collaborator engaged in reflective work.

Having discussed the data gathered in first cycle, then, it seems more appropriate for the researchers and the collaborator to draw a reflection because it enables us to provide explanation for why the students did not meet the criteria of success which have been established. The researchers and the collaborator made a reflection based on the data and information that have been collected where Only 5 students were determined to have received a score of or above in the speaking assessment of the students, according to the finding result above. It indicated that only 23% of the students met the success condition, and as a result, the success criterion was not met. Finally, it was discovered through observation and field notes that the students' speaking abilities needed to be improved in the following cycle.

Observing in cycle II

The observation was carried out during a teaching and learning session. The observation encompassed the researchers' performance in carrying out classroom action research as well as the students' participation in the teaching and learning process as well as their performance in speaking and listening activities.

Finding from Observation sheet and field notes

Based on the observation, beginning in meeting 1 and continuing through meeting 3, the majority of the students started responding to the researchers' queries, even if their speech was still imperfect and they had not yet actively spoken. If the researchers were prodded to ask questions during the pre-activity, they would directly respond in chorus to the queries, such as "Are you ready for study now? How much of the subject did you learn yesterday? It indicates that they have already grasped the questions' meaning.

Field notes indicate that when she asked the students to group their sentences into paragraphs using sequence terms, they were able to complete the assignments. The students appeared more enthusiastic during all of cycle II's events than they had during cycle I. It suggests that even if they were still pronouncing incorrectly when the researchers asked them, they had already responded. This is based on observations made and field notes made while instruction was taking place.

According to the information in the field notes, it became simpler for the majority of students to express their opinions orally in response to the researchers' queries. They all used the necessary gestures, which make their oral presentation effective.

Finding from Questionnaire

The purpose of the questionnaire was to learn whether or not the students enjoyed and were interested in the teaching model that the researchers had presented. The researchers asked participants to respond to ten questions. The results of the questionnaire are shown in the following table for clarity. According to the results of the questionnaire below, 17 students, or 77% of the class, admitted that they find it simpler to learn speaking by employing question words. The lowest number was 23% at which point only 5 students expressed interest in speaking English to a stranger.

The Result of Speaking Assessment

The researchers also administered the test to the students following the implementation of the action in cycle II and any necessary adjustments. Its goal was to gauge how many the students' speaking abilities had improved. The second cycle of testing focused, like the first, on the students' spoken ability to ask and respond to questions. The test's outcome for this cycle is shown below.

According to the data, 17 out of 22 students, or 77%, met the success criteria. The 17 students who earned points scored between 70 and 74. Only 5 students received the lowest grade, thus. Comparatively speaking, only 23% of the students failed cycle II.

Reflection in Cycle II

The researchers and the collaborator undertook reflection after talking about the data collected during the second cycle. The results showed that 17 students received scores of 70 or better. The fact that 77% of students met the requirement indicates that the success conditions have been met. In other words, the majority of students succeed because they actively participated in the teaching and learning process and showed courage when they asked and answered questions.

Furthermore, given that the results from cycle II were similar to those from cycle I and the students' exam scores had increased, the classical achievement had also been attained in cycle II. It indicates that the standard of academic performance was fully met. They then made the decision to break the cycle. One could draw the conclusion that the method was deemed successful.

DISCUSSION

In this stage, the researchers discussed their key findings, particularly those that pertain to the teaching of speaking skills. It deals with question-based speaking skill development for students in the eleventh grade. The primary topics covered six areas: (1) research planning; (2) question implementation in speaking instruction; (3) researcher performance in teaching learning process; (4) student responses to questions; (5) question impact on students studying speaking; and (6) speaking assessment outcome.

1. The Preparation of the Research

The lesson plan, test, field note, observation sheet, questionnaire, and success criteria were all created before the research was conducted by the researchers and their partner. To ensure that the research is well-prepared, it is crucial to prepare such tools.

Research tools were useful for gathering trustworthy data that the researchers needed to assess. If the instrument is already well-established, published proof of both its validity and reliability for the study's purpose is provided. This means that properly constructed research instruments help researchers establish the validity and dependability of their findings. It is crucial because the need of the researchers or the availability of appropriate tools would greatly influence the validity and dependability of the data.

The researchers believed that they had the developed appropriate researcher instrument based on research need when preparing their research instruments. It indicates that before beginning the investigation, the researchers had prepared the necessary research tools.

2. The Implementation of Question in Teaching Speaking

The finding of this research showed that the implementation of question in teaching speaking should the following steps:

a. Choosing the right inquiries. In this instance, the researchers used the image as a medium for posing the right question about the subject to pique the students' interest and stimulate their prior knowledge, such as open-ended questions. In order to establish an interactive speaking classroom, this was intended to get the students involved. A key component of interactive education is the question. It indicates that throughout the teaching and learning process, the researcher always sought to foster classroom interaction by including the students in activities like question-and-answer sessions, where it was important to stimulate active participation from the students.

b. How to phrase the inquiries. The researchers asked the students what they should do and how to construct or complete the assignment related to the lesson's objective during this phase, giving them a brief explanation of the topic to ensure their understanding. The researchers used simple inquiries with a yes-or-no response or question words to get the students involved.

c. Providing time for reflection. In the task activity, the researchers gave the students the ability to reflect on the questions' answers while still controlling or guiding them. It implies that if the researchers presented the questions verbally, the students may look for their responses.

d. Selecting students. In this case, the researchers chose the students whose to present as the first speaker to answer the question.

e. Feedback. It was necessary in question-and-answer sessions because it allowed students to reflect after responding or giving an answer. According to Frazee and Rudnitski (1995), redirecting to a different student or acknowledging the effort of other students may be more productive replies. In this instance, the researchers gave an opposite or response to the students' responses. When they have learned, it would be better for them to correct the students' incorrect speech.

3. The Researchers' Performance in Teaching Learning Process

One of the essential elements examined by the researchers was their own teaching performance during the learning process. This performance encompassed three main aspects: the lecturers' ability to pose appropriate and meaningful questions, their understanding of different types of questions, and their provision of model questions as examples for students. These components were systematically integrated into each stage of the lesson to ensure pedagogical clarity and engagement.

Firstly, during the pre-activity, the researchers and collaborator began the lesson by activating students' prior knowledge. Several open-ended questions were posed to initiate discussion and assess students' existing understanding of the topic. This approach aligns with the findings of Ali (2018), who emphasized that eliciting prior knowledge through targeted questioning contributes to more meaningful learning and helps students connect new information with existing cognitive structures.

Secondly, in the while-activity, the researchers provided elaborated explanations to clarify content. Clear and structured instructions were given before tasks were distributed. Activities included confirming instructions through follow-up questions, encouraging student inquiries for clarification, and offering the researchers' perspectives to stimulate discussion. Key instructional moves involved task distribution, individual or group engagement, peer feedback, and researchers' correction. This method resonates with Roza et al. (2019), who advocate for interactive questioning and active classroom involvement as effective strategies to develop critical thinking and oral communication skills.

Lastly, during the post-activity, the session was concluded by revisiting key points. Open-ended reflective questions were used to help students recall and synthesize their learning. Small talk was also employed as a motivational tool, fostering a relaxed and encouraging environment before dismissing the class.

4. The Students Responses during Teaching Learning Process

Observation data indicate a clear progression in student responsiveness between Cycle I and Cycle II. In Cycle I, only 5 out of 22 students (23%) successfully responded to the questions posed during lessons. In contrast, Cycle II showed a significant improvement, with 17 students (77%) actively and correctly participating in classroom questioning.

The shift suggests that the interactive questioning strategy implemented in Cycle II was more effective in engaging learners. The increase in participation aligns with the findings of Zhu et al. (2019), who reported that student-centered questioning not only enhances participation but also cultivates a deeper sense of accountability in learners. Al-Jarf (2021) also supports this notion, indicating that well-structured questions can serve as scaffolding tools that help learners navigate through complex speaking tasks.

5. The Development of Speaking Skill through Question

The collected data clearly demonstrate that the use of question-based instruction contributed positively to the students' speaking skill development. From Cycle I to Cycle II, there was a noticeable increase in student interaction, particularly in asking and answering questions. In Cycle I, the students' scores reflected a low level of

speaking proficiency, and the performance did not meet the predetermined success criteria. However, in Cycle II, there was a remarkable improvement, and the students' scores met the success threshold set by the researchers.

This development indicates that strategic questioning can significantly enhance learners' oral fluency and confidence. Kadnawi (2021) affirms that meaningful questioning practices promote linguistic output and critical reasoning, both of which are vital to oral language development. Furthermore, the improvement reflects what Khairunnisa et al. (2022) emphasized in their study—that communicative questioning techniques foster student engagement and help build speaking competence through interactional scaffolding. Ultimately, the researchers concluded that the consistent use of questions throughout the learning process not only improved students' speaking performance but also contributed to their self-confidence and sense of responsibility toward their own learning outcomes.

Finally, the researchers thought that the question may boost students' self-assurance because they bore complete responsibility for their academic success. It is evident from the classroom activities used to teach and learn.

CONCLUSION

Findings indicating question words are employed to entice students to speak lead to the conclusion. The steps involved in asking questions when teaching speaking are: first, choosing the right questions based on the topic; second, framing the questions; third, giving students time to consider their answers; fourth, choosing students; and last, providing feedback on the students' responses. The use of questions in the teaching and learning process helps to increase students' motivation, responsiveness, and enthusiasm, as well as, of course, their courage to speak English. This method can also be used to encourage students to understand the question's content before they respond to it and to offer them the chance to verbally express their ideas. Only five students who received a score of at least were detected in the first cycle's assessment of students' speaking performance. It meant that only 23% of the students met the success criteria. The students' achievement was then discovered in the second cycle by seventeen students or 7%. It suggests that the success requirements have been met or that the question words technique can improve students' speaking performance.

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INDEKS PENGARANG

INDEKS SUBJEK

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Judul singkat, jelas, lugas menggambarkan isi keseluruhan yang berfokus pada inovasi pembelajaran [Maksimum 14 Kata, TNR, BOLD, Sentence Case]

Penulis 1[1)*], Penulis 2[2)] dst. [TNR 12, tanpa gelar dan tidak boleh disingkat]

[1]Nama Institusi, Alamat, Nama Kota, Negara. [penulis 1, TNR 10]
[2]Nama Institusi, Alamat, Nama Kota, Negara. [penulis 2, TNR 10]

penulis _1@abc.ac.id*; penulis _2@abc.ac.id; penulis _3@abc.ac.id [TNR 10]
*Penulis Koresponden

No. Handphone : .....

ABSTRAK [Times New Roman 10pt, bahasa Indonesia]

Abstrak ditulis dalam bahasa indonesia berisikan latar belakang umum, tujuan penelitian, metode/pendekatan penelitian, hasil penelitian dan kesimpulan/saran. Abstrak ditulis dalam satu alenia, tidak lebih dari 200 kata. Bahasa penulisan sesuai PUEBI/tata bahasa Indonesia [Times New Roman 10, spasi tunggal].

Kata kunci: Kata kunci mencerminkan kandungan esensi artikel, disusun Alfabetis, jumlah 3-5 kata/frase dipisahkan dengan tanda koma.

ABSTRACT [Times New Roman 10pt, bahasa Inggris]

Abstrak ditulis dalam bahasa Inggris yang berisikan latar belakang umum, tujuan penelitian, metode/pendekatan penelitian,hasil penelitian dan kesimpulan/saran. Abstrak ditulis dalam satu alenia, tidak lebih dari 200 kata. Bahasa penulisan sesuai tata bahasa Inggris [Times New Roman 10, spasi tunggal].

Keywords: Kata kunci mencerminkan kandungan esensi artikel, disusun Alfabetis, jumlah 3-5 kata/frase dipisahkan dengan tanda koma.

diunggah: , direvisi: , diterima: ,dipublikasi:

Cara sitasi: Penulis. (Tahun). Judul. JINoP (Jurnal Inovasi Pembelajaran), Vol(No), Halaman. doi:https://doi.org/10.22219/jinop.v?i?.ID Artikel

PENDAHULUAN [TNR 12 Spasi 1]

Pendahuluan (berisi latar belakang, permasalahan sesuai konteks penelitian, hasil kajian pustaka, yang semuanya dipaparkan secara terintegrasi dalam bentuk paragraf-paragraf, dengan persentase 15-20% dari keseluruhan artikel) Tinjauan pustaka yang relevan dan pengembangan hipotesis (jika ada) dimasukkan dalam bagian ini. [Times New Roman, 12, normal spasi 1].

Paragraf kedua disarankan untuk mengulas penelitian terdahulu yang relevan dengan topik penelitian, jelaskan kekurangan pada penelitian terdahulu, sehingga perlu adanya penelitian yang saudara lakukan. Tunjukkan adanya bagian yang menyebutan kebaharuan/ keunggulan inovasi pembelajaran dalam naskah artikel ini. Bandingkan. Bagian ini harus mencakup tentang tujuan penelitian dan sumbangsih hasil penelitian yang diharapkan nantinya.

Gunakan tinjauan pustakan yang relevan serta terbaru minimal 5 tahun. Penulisan rujukan diwajibkan menggunakan software mendeley dengan metadata yang sudah dibenahi aturan penulisannya sesuai *APA Style*. Menggunakan bahasa penulisan yang harus sesuai dengan tata bahasa/ PUEBI.

METODE [TNR 12 spasi 1]

Metode menjelaskan paparan dalam bentuk paragraf tentang rancangan penelitian, sumber data, teknik pengumpulan data, jenis data rancangan penelitian dan teknik analisis data yang secara nyata dilakukan peneliti**,** dengan persentase 10-15% . Menggunakan bahasa penulisan yang harus sesuai dengan tata bahasa/ PUEBI**.** [Times New Roman, 12, spasi 1].

HASIL DAN PEMBAHASAN [TNR 12 spasi 1]

Sub heading 2 [TNR 12 spasi 1, sentence case]

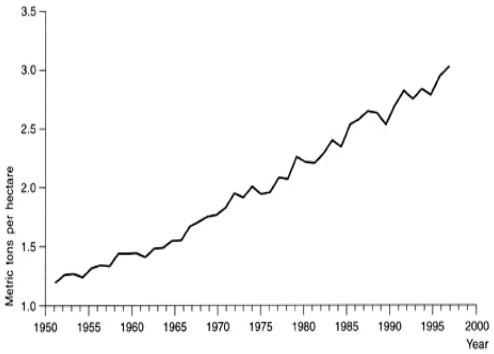
Hasil penelitian berisi paparan hasil analisis yang berkaitan dengan pertanyaan penelitian, sedangkan pembahasan berisi pemaknaan hasil dan perbandingan dengan teori dan/atau hasil penelitian sejenis, dengan persentase 40-60% dari keseluruhan artikel.

Dalam pembahasan diulas tentang temuan pemtinng sesuai tujuan penelitian. Hasil penelitian dan kejelasan data digambarkan dengan gambar yang gharus disebutkan pada badan naskah. Hasil penelitian digambarkan dengan tabel 1 (tabel berikut:), grafik/gambar 1 (grafik/gambar berikut:) , dan/atau bagan 1 (bagan berikut:). [Times New Roman, 12, spasi 1].

Tabel 1. Nama tabel [contoh tabel 1 TNR 12]

		95%CI	
Condition	*M*(*SD*)	LL	UL
Letters	14.5(28.6)	5.4	23.6
Digits	31.8(33.2)	21.2	42.4

[isi tabel TNR 10pt, spasi 1]



Gambar 1. Nama gambar [contoh gambar 1, TNR12, Spasi 1]

Hasil analisis harus berkaitan dengan tujuan penelitian, serta dilakukan Pemaknaan hasil/temuan , dibandingkan dengan penelitian sejenis sebelumnya dn teori yang ada. Kemungkinan tindak lanjut kegiatan dapat juga disampaikan pada bagian ini.

SIMPULAN **[Huruf TNR 12, Spasi 1]**

Berisi temuan penelitian yang berupa jawaban atas pertanyaan penelitian atau berupa intisari hasil pembahasan, yang disajikan dalam bentuk paragraf . Saran / rekomendasi tindak lanjut penelitiann dapat disampaikan pada bagian ini [Times New Roman, 12, spasi 1].

DAFTAR PUSTAKA **[WAJIB MENGGUNAKAN MENDELEY]**

Penulisan pustaka hanya yang disitasi hanya dalam naskah ini dan diurutkan secara alfabetis dan kronologis. Sejumlah 80% daftar pustaka WAJIB dari Jurnal yang bereputasi baik, dan dapat dilacak. Pustaka minimal 7 tahun terakhir (85%) dengan jumlah Minimal 25 referensi. Penulisan daftar pustaka wajib menggunakan mendeley/Endnote yang sudah diedit metadatanya, pilih *APA Style* untuk model penulisan referensi.

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1. Bahasa yang digunakan dalam penulisan naskah adalah Bahasa Indonesia atau Bahasa Inggris.
2. Naskah diketik di atas kertas A4 dengan margin kiri 4 cm, margin atas, bawah dan kanan 3 cm, menggunakan tipe huruf Times New Roman, ukuran huruf 12, dan spasi 1.
3. Jumlah halaman naskah adalah 10 sampai dengan 15 halaman.
4. Sistematika Penulisan:

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Penulisan judul menggunakan kalimat singkat, namun cukup untuk menggambarkan isi (substansi) naskah secara keseluruhan. Judul tulisan berbahasa Indonesia terdiri dari maksimal 14 kata, sedangkan apabila berbahasa Inggris terdiri dari maksimal 12 kata.

b. Nama Penulis [Times New Roman 12 bold]
Nama penulis dicantumkan tanpa gelar, kemudian disertai alamat korespondensi (instansi), dan alamat surat elektronik (email). Apabila terdapat lebih dari satu penulis maka dituliskan seperti penulis Utama. Untuk penulis utama harap menyertakan nomor HP yang bisa dihubungi.

c. ABSTRAK dan Kata Kunci [Times New Roman 10 bold]
Abstrak terdiri dari maksimal 200 kata. Abstrak mencerminkan permasalahan, tujuan, metode penelitian, hasil dan saran. Abstrak ditulis dalam Bahasa Indonesia dan Bahasa Inggris, menggunakan huruf jenis Times New Roman ukuran 10, spasi 1. Kata kunci disusun secara alfabetis, mencerminkan kandungan esensi artikel, dibuat sejumlah 3-5 kata/frase.

d. PENDAHULUAN [Times New Roman 12 bold]
Pendahuluan (berisi latar belakang, konteks penelitian, hasil kajian pustaka, dan tujuan penelitian, yang semuanya dipaparkan secara terintegrasi dalam bentuk paragraf-paragraf, dengan persentase 15-20% dari keseluruhan artikel) Tinjauan pustaka yang relevan dan pengembangan hipotesis (jika ada) dimasukkan dalam bagian ini. [Times New Roman, 12, normal].

e. METODE [Times New Roman 12 bold]
Metode menjelaskan paparan dalam bentuk paragraf tentang rancangan penelitian, sumber data, teknik pengumpulan data, dan analisis data yang secara nyata dilakukan peneliti, dengan persentase 10-15% [Times New Roman, 12, normal].

f. HASIL dan PEMBAHASAN [Times New Roman 12 bold]
Hasil penelitian berisi paparan hasil analisis yang berkaitan dengan pertanyaan penelitian, sedangkan pembahasan berisi pemaknaan hasil dan perbandingan dengan teori dan/atau hasil penelitian sejenis, dengan persentase 40-60% dari keseluruhan artikel); Kemungkinan tindak lanjut kegiatan dapat juga disampaikan pada bagian ini Hasil penelitian dapat dilengkapi dengan tabel 1 (bukan tabel berikut:), grafik/gambar 1 (bukan grafik/gambar berikut:) , dan/atau bagan 1 (bukan bagan berikut:). [Times New Roman, 12, normal].

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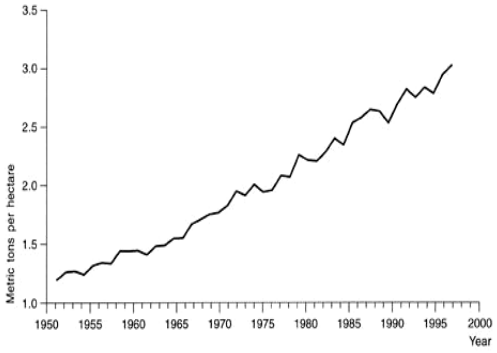

Gambar 1. Nama gambar [contoh gambar 1, TNR12, Spasi 1]

g. SIMPULAN [Times New Roman 12 bold]
Berisi temuan penelitian yang berupa jawaban atas pertanyaan penelitian atau berupa intisari hasil pembahasan, yang disajikan dalam bentuk paragraf . Saran dapat disampaikan pada bagian ini [Times New Roman, 12, normal].

h. Daftar Pustaka.
Daftar Pustaka ditulis dengan sistematika dan ditulis secara berurut sesuai abjad. Tanda baca koma diganti dengan tanda baca titik; tidak dicantumkan halaman kutipan; kutipan yang ada dalam batang tubuh (artikel) wajib dicantumkan di daftar pustaka begitu juga sebaliknya kutipan yang ada dalam daftar pustaka wajib ada di batang tubuh (artikel). 80% daftar pustaka **WAJIB dari Jurnal dan** 20% bisa dari buku dengan memerhatikan keterbaruan daftar pustaka minimal 7 tahun terakhir.

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Mulyana, Yoyo. 2015. *Keefektifan Model Mengajar Respons Pembaca dalam Pengajaran Pengkajian Puisi*. Disertasi tidak Diterbitkan. Bandung: Fakultas Fakultas Bahasa dan Seni Universitas Pendidikan Indonesia.

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5. Pustaka acuan yang digunakan adalah maksimal 7 tahun terakhir dengan jumlah minimal 15 buah dan minimal 80 % diantaranya berasal dari jurnal ilmiah.
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