Development of Interactive Media Using *Kodular* in The Learning Evaluation Course: Supporting the Implementation of the *Merdeka Curriculum*

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Abstract: This study addresses the lack of specific and interactive teaching media aligned with the Merdeka Curriculum in the Learning Evaluation course for Physics Education students. The research aims to develop and validate Kodular-based interactive media that facilitate independent and competence-based learning. The study employed the ADDIE development model consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation. Data were collected through interviews, expert validation sheets, and practicality questionnaires, and analyzed using descriptive statistics to determine validity and practicality levels. The validation results showed that the media achieved very high scores in content, language, and media feasibility, indicating strong validity. Implementation trials involving lecturers and students demonstrated high practicality, particularly in ease of use, clarity, and relevance of content. The Kodular-based media integrates quizzes, simulations, and collaborative features that enhance engagement and understanding of evaluation concepts. The findings conclude that the developed interactive media is both valid and practical for supporting the implementation of the Merdeka Curriculum and improving students' abilities in designing contextual and authentic learning evaluation instruments

Keywords: ADDIE development model; Interactive learning media; Kodular; Learning evaluation; Merdeka Curriculum; Physics Education

Introduction

In the era of rapid technological advancement, education is undergoing a profound transformation to meet the learning needs of the digital generation. The integration of technology into learning is no longer an option but a necessity to create more engaging, flexible, and effective learning environments. As education systems around the world transition toward digital transformation, the use of interactive and technology-based learning media has become an essential component in fostering students' active participation and improving the quality of learning outcomes (Angwaomaodoko, 2023; Chu et al., 2024; Kumar & Manjula, 2025). This global trend underscores the universal value of educational innovation as a driver of human resource development in the 21st century.

Learning media development is inseparable from the pedagogical shift from teacher-centered to student-centered learning. This transformation, which underpins the *Merdeka Curriculum* in Indonesia, emphasizes learner autonomy, creativity, and critical thinking. Learning evaluation, as one of the core components of the educational process, serves a strategic role in ensuring that learning objectives are achieved effectively (Haq, 2024; Mardiana & Emmiyati, 2024). According to Gilbert Sax (1980), evaluation is not merely measurement but involves decision-making by an evaluator; the National Education System Law Article 57 paragraph 1 reinforces that evaluation is a quality-control mechanism and a form of institutional accountability. Thus, educators must possess strong competencies in designing, implementing, and analysing learning evaluations as part of their pedagogical responsibilities.

Despite its importance, the implementation of learning-evaluation courses in teacher-education programmes often faces limitations. In the Tadris Physics Study Program at UIN Imam Bonjol Padang, observations and preliminary studies revealed several challenges in the *Learning Evaluation* course. Currently, there are no dedicated textbooks or technology-based teaching media specifically developed by the teaching team. Learning materials are mainly in the form of PowerPoint slides and general textbooks, which do not address evaluation in the context of the Indonesian curriculum or the evaluation of physics learning. Students also reported difficulties understanding the concepts, as the materials are new and not sufficiently interactive to support independent study. These conditions indicate that learning resources have not fully supported the objectives of the *Merdeka Curriculum*, which promotes student-centred and technology-integrated learning (Lorente-Catalán & Kirk, 2016; Ragil & Astuti, 2023; Syafrini et al., 2022).

Moreover, empirical studies in Indonesia confirm the need for interactive media: a meta-analysis in JPPIPA found that interactive media significantly improved science learning outcomes (Saputri et al., 2025).In addition, systematic literature reviews in higher education contexts indicate that mobile learning (m-learning) platforms retrieved from Scopus and Web of Science databases show significant transformational potential toward student autonomy, engagement, and are increasingly adopted in university settings (Naveed et al., 2023).

Recent studies highlight that interactive learning media can significantly enhance students' understanding, motivation, and engagement in the learning process (Hasanah et al., 2019; Rohmah et al., 2025). One promising approach is the use of Kodular, a visual programming platform that enables the creation of mobile applications without requiring extensive programming knowledge (Ummah & Azmi, 2024). Kodular-based media allow lecturers to design interactive and accessible materials compatible with students' mobile devices (Lubis et al., 2024). Although several studies have explored technology-based learning media, research on the integration of Kodular in developing interactive learning-evaluation media, particularly in the context of physics education and the *Merdeka Curriculum*, remains limited. For example, broader mobile-learning reviews point out that focus on higher-education evaluation media is still underexplored.

Therefore, this study aims to develop Kodular-based interactive learning media for the *Learning Evaluation* course in the Tadris Physics Study Program. The novelty of this research lies in its integration of learning-evaluation concepts specific to physics education with digital interactivity aligned with the *Merdeka Curriculum*. This development is expected to enhance students' understanding of learning evaluation, encourage independent learning, and contribute to the digital transformation of higher education in Indonesia.

Method

Type of Research

This research is a type of *Research and Development* (R&D) that aims to produce a valid and practical learning media product for the *Learning Evaluation* course in the Physics Education Study Program. The development model used is the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch & Varank, 2009). The ADDIE model is widely used in educational research because it provides a structured and iterative process that helps improve product quality through systematic evaluation (Aldoobie, 2015; Norouzkhani et al., 2025).

Time and Location of the Research

This research was conducted from March to September 2024 at the Physics Education (Tadris Fisika) Study Program, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri (UIN) Imam Bonjol Padang, Indonesia. The development and validation processes took place in the department's laboratory and classrooms, while data collection involving students and lecturers was carried out both offline (in-person class) and online (via Google Forms).

Population and Sample

The population consisted of all students of the Physics Education Study Program who had taken or were currently enrolled in the Learning Evaluation course. The sample was determined using purposive sampling, with one class of fifth-semester students (n = 25) selected for the limited trial. Additionally, three expert validators were involved to ensure the validity of the developed media: a physics education expert, a media and technology expert, and an Indonesian language expert. This approach is consistent with previous development studies in educational media validation (Mutmainnah et al., 2023; Winaryati, 2021)

Research Method and Stages

This research employed the ADDIE model as the guiding framework for product development, as described below.

a.   Analysis stage

At this stage, the identification of needs, problems, and objectives to be achieved is carried out. This analysis

involves identifying learning needs, analyzing students, and analyzing the context or environment in which the product will be used. The Needs and Context Analysis conducted on the learning evaluation course of the KKNI Curriculum Study Program is to ensure that the syllabus and RPS of the learning evaluation course in the Tadris Physics Study Program are in accordance with and aligned with the Merdeka Curriculum applicable at the high school level in Indonesia. At this stage, an analysis of the textbook for the Learning Evaluation course is also conducted as a reference in developing interactive media.

Interviews with colleagues and students were conducted to understand the real conditions in the field regarding the implementation of the Learning Evaluation course. Interviews with the course instructor were conducted directly, with the outline available in Table 1.

Table 1. Interview guidelines for lecturers teaching the physics learning evaluation course

Interview Aspect	Interview Question
Course	Is this course a mandatory or elective course?
Semester of Enrollment	In which semester must students take this course?
Topics Covered	What are the main concepts covered in the Physics Learning Evaluation course?
Student Difficulties	What are the biggest challenges faced by students in understanding this course?
Difficulty in Designing	Evaluation Instruments What difficulties do students face in designing evaluation instruments?
Limited Time and Resources	Are there any other limitations experienced by students?
Proposed Solutions	Are there solutions that can help students overcome difficulties in this course?

Interviews with students were conducted through the distribution of questionnaires using Google Forms. The questions on the Google Forms consisted of five main sections, namely: 1) General information, 2) Experience and Perception of Learning Evaluation, 3) Need for Interactive Media, 4) Understanding of the Curriculum in the Context of Learning Evaluation (2 items), and 5) Suggestions and Feedback.

b. Design Stage

At this stage, the prototype of the interactive media was designed using the Kodular platform, a visual-based mobile application builder that supports no-code development. The design included key course components—syllabus, objectives, RPS, materials, assignments, and evaluation modules. A unique feature allows students to provide comments and feedback on peers' submitted assignments, fostering collaborative learning. Kodular-based media development has been proven effective in increasing engagement and learning outcomes (Ghillanda & Simamora, 2024; Siregar et al., 2025a; Yani et al., 2025).

c. Development stage

In this stage, content, construct, and language validation were conducted by three expert validators. Feedback and recommendations from validators were used to revise and refine the media. The validation process follows R&D best practices as outlined by Gall, Borg, and Gall (Gall et al., 1996).

d. Implementation stage

After revision, the validated media were implemented in a limited trial involving one class of fifth-semester students. The purpose was to determine the practicality of the media by having both lecturers and students fill out a practicality questionnaire after using the media. Similar implementation steps are also found in prior studies on mobile-based learning media (Fitriyana et al., 2024; Saputri et al., 2025; Tarigan, 2025).

e. Evaluation stage

In the final stage, data obtained from validation and practicality tests were analyzed. The evaluation determined whether the developed product was valid and practical enough to be used as a learning resource in the Learning Evaluation course (Erviana et al., 2024).

Research Instruments

The instruments used in this research are shown in Table 2.

Table 2. Research Instruments

Type of Instrument/Data Collection Tool	Purpose of Instrument	Data Source
Validation Sheet	Used to determine whether the developed interactive media is valid or not	Validator
Practicality Questionnaire	Describes and analyzes the practicality of the developed interactive media	Students

Data Analysis Technique

Data were analyzed using descriptive quantitative analysis, calculating the mean and percentage of validation and practicality scores using the following formula:

$$P = \left(\frac{Score\ per\ item}{Maximum\ score}\right) x\ 100\ \% \qquad (1)$$

The criteria used for interpretation were adapted from Riduwan (2022).

Table 3. Criteria valid and practical

Percentage	Category
0–20%	Not valid / Not practical
21–40%	Less valid / Less practical
41–60%	Fairly valid / Fairly practical
61–80%	Valid / Practical
81–100%	Very valid / Very practical

Result and Discussion

The development of interactive media using the Kodular platform for the Learning Evaluation course was carried out through five stages of the ADDIE model. The process produced valid, practical, and effective learning media that support the implementation of the Merdeka Curriculum in the Physics Education Study Program at UIN Imam Bonjol Padang.

Analysis Stage
The needs analysis was conducted through interviews with lecturers and questionnaires distributed to students via Google Forms. The interview results revealed that the Learning Evaluation course is a core subject that presents conceptual challenges such as validity, reliability, objectivity, and evaluation standards. Students find it difficult to apply these abstract concepts in authentic contexts and face obstacles in designing valid and reliable evaluation instruments. The time limitation and lack of digital media for practice also affect their understanding.

Questionnaire data showed that all 56 respondents agreed that the course is important for prospective teachers, reflecting a high level of awareness about the role of evaluation competence in the teaching profession. These findings align with systematic reviews and empirical studies which emphasize that assessment literacy is a core competency for future educators and that strengthening preservice teachers' knowledge of assessment improves their readiness to design and implement assessment instruments (Atjonen et al., 2022; Pastore, 2023). Empirical investigations likewise report positive associations between students' awareness/knowledge of evaluation and their preparedness to develop valid assessment tools (Joachim et al., 2020).

Figure 1 illustrates the difficulties faced by students in attending the Learning Evaluation course. indicates that 58.9% of respondents felt competent in understanding curriculum relevance and designing evaluation instruments, while 23.2% struggled with

theoretical aspects and 32.1% with practical implementation. These results reinforce the principle of constructive alignment, where learning outcomes, teaching activities, and assessments must be congruent (Biggs & Tang, 2003).
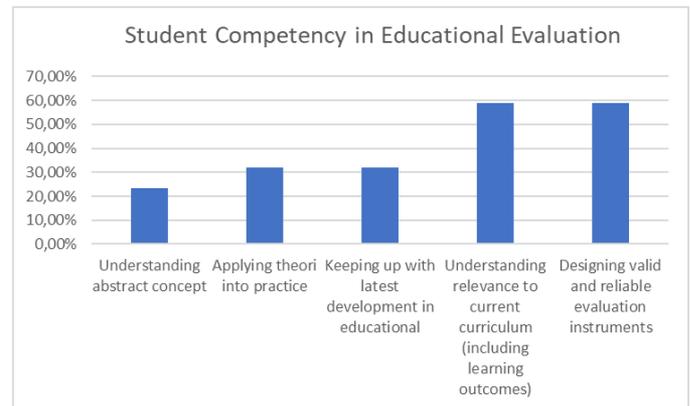
Figure 1. Difficulties Faced by Students in Attending Learning Evaluation Lectures

The data also indicate that many students require digital learning media that support active engagement and independent exploration. This need aligns with research showing that technology-enhanced learning environments encourage students to seek interactive features and self-directed learning opportunities (Pérez-Jorge & Martínez-Murciano, 2022). In the context of mobile learning development, block-based application platforms such as MIT App Inventor have been widely used to create interactive Android learning tools. Kodular, which adopts the same block-based programming paradigm as MIT App Inventor, functions similarly as a visual, drag-and-drop app-builder for developing educational applications. Evidence from empirical studies in physics and science education demonstrates that App Inventor–based learning media effectively enhance conceptual understanding through visual simulations and independent interaction (Priatna et al., 2022; Triyadi & Amarulloh, 2024; Yanti et al., 2022). These findings support the use of block-based platforms—including Kodular—as feasible tools for developing digital media that promote active learning and concept mastery.

Design Phase
The design phase focuses on determining the key elements of interactive media, such as learning outcomes, content/material, interactive features, and an interface design that is accessible and easy to use for students. The design of this interactive media also considers its relation to the Merdeka Curriculum. The Program Learning Outcomes (PLOs) and the Course Learning Outcomes (CLOs) can be seen in Table 3.

**Table 3.** The Program Learning Outcomes (PLOs) and the Course Learning Outcomes (CLOs)

PLOs	
PLOs -8	Designing, implementing, and evaluating physics education using IT
PLOs -10	Making decisions based on data/information in completing assigned tasks.
PLOs -13	Demonstrating pedagogical knowledge in designing, implementing, and evaluating learning
CLOs	
CLOs - 1	Able to demonstrate a critical and innovative attitude in designing physics learning assessments in accordance with 21st-century demands [S1]
CLOs - 2	Able to design and evaluate IT-based physics learning assessment instruments for the purpose of physics education (assessment instruments for the process and outcomes of learning, affective domain, knowledge, and skills in high school/MA, or vocational school physics subjects) in accordance with the Merdeka Curriculum to meet the demands of the 21st century [KU2].
CLOs - 3	Able to make decisions based on the results of the physics learning assessment design produced in accordance with the demands of the 21st century responsibly [KK2]
CLOs - 4	Able to make decisions based on the results of the physics learning assessment design produced in accordance with the demands of the 21st century responsibly [KK2]

The media was structured into eight main modules: (1) Basic Concepts of Learning Evaluation, (2) Assessment Aspects, (3) Test and Non-Test Techniques, (4) Cognitive Assessment Instruments, (5) Psychomotor Assessment Instruments, (6) Affective Assessment Instruments, (7) Instrument Analysis, and (8) Evaluation in the Merdeka Curriculum.

Development Stage

During the development phase, the designed materials were transformed into an interactive Android-based module using Kodular. The content was enhanced with quizzes, automatic feedback, and case-based simulations that promote self-regulated learning.
Validation was conducted by three experts: a physics education expert, a media and technology expert, and a language expert. The material validation results showed high feasibility scores between 84% and 95%. The alignment between learning objectives and materials received the highest score (95%), followed by clarity and accuracy (93%). These findings reaffirm the principles of constructive alignment (Biggs & Tang, 2003) and support Arikunto (2021) view that valid instructional content must be relevant, comprehensive, and

scientifically justified. The results of the material validation are as follows:
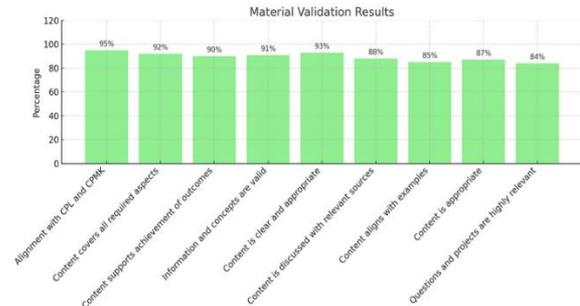
Figure 2. Material validation Result

Figure 2 presents the material validation results, which show consistently high feasibility ratings across all evaluated indicators, including clarity, accuracy, and alignment with learning objectives. The use of Kodular as the development platform is further supported by empirical evidence from previous studies. Lubis, Hurriyah, and Deswita (2024) reported that Kodular-assisted interactive media substantially improved students' digital literacy and facilitated active participation during physics learning activities. Their study also noted that Kodular—whose block-based development environment closely resembles MIT App Inventor—enables the creation of Android-based instructional applications that support autonomous learning through interactive features, visual components, and real-time feedback (Lubis et al., 2024).

These findings are consistent with constructivist perspectives, particularly the view that learners construct understanding more effectively when engaged in meaningful, hands-on interaction with learning materials. Block-based mobile learning media developed through platforms such as Kodular provide opportunities for students to explore concepts independently, manipulate visual elements, and receive immediate responses, thereby strengthening conceptual comprehension. The alignment between the validation results in this study and previous research confirms that such media can enhance the relevance, accessibility, and learner-centered nature of physics education materials.

The results of the construct validation are as follows: Figure 3 shows the construct validation results, indicating high validity across all assessed components with scores between 85% and 100%. Self-Contained, Consistency, and Organizational Aspects reached 100%, reflecting well-structured content, clear navigation, and consistent design. Space and Layout and Closing Structure obtained 90%, while Adaptive and Learning Structure achieved 85%. These findings are consistent with the results reported by Siregar et al., (2025b) who highlight that effective mobile learning media must

demonstrate coherent structure, organized layout, and stable navigational flow. The high scores across all criteria indicate that the developed media meets the essential standards of construct validity and is ready for further instructional use.
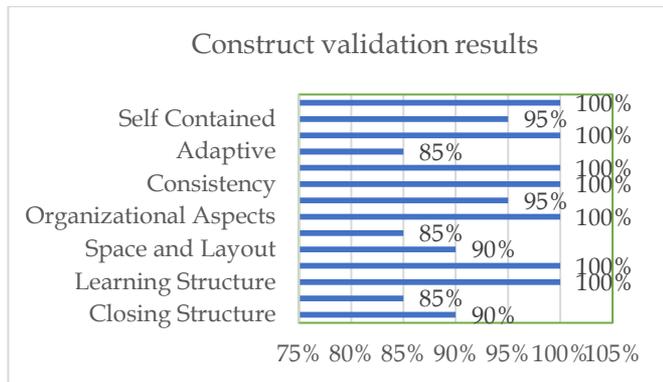

Figure 3. Diagram of construct validation results

The results of the language validation are as follows: Figure 4 presents the results of the language validation, with scores ranging from 85% to 100%. Compliance with PUEBI and clarity of sentences obtained the highest score (100%), indicating excellent linguistic accuracy and readability. The suitability of language and communicative language use scored 95% and 90%, respectively, while language facility achieved 85%, still meeting the criteria of high validity. Overall, these results demonstrate that the instructional language in the media is clear, accurate, and communicative. These findings are consistent with the principles of effective educational language described by (Tarigan, 2025) who emphasizes clarity, coherence, and communicative expression as key components of instructional texts.
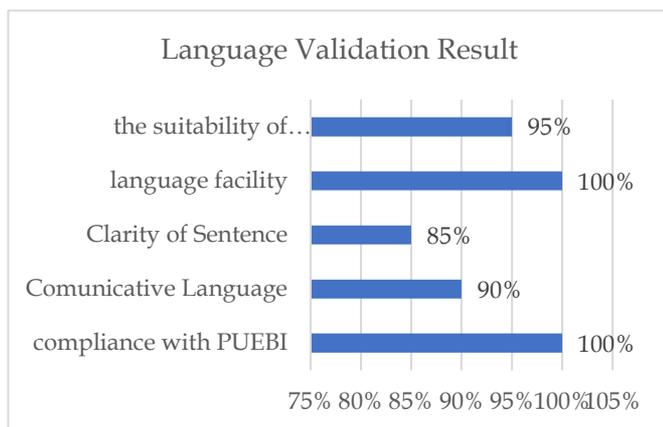

Figure 4. Diagram of Language validation results

The display on the interactive media that has been designed after validation can be seen in Figure 5.

Figure 5. Display of Kodular-assisted Interactive Media

Figure 5 is the display of the interactive media assisted by the codular that has been improved based on suggestions from experts.

Implementation Stage

The implementation stage is carried out after product validation is complete. At this stage, the practicality test of codular-assisted interactive media in Physics Learning Evaluation lectures was carried out on the lecturer teaching the Physics Learning Evaluation Course. A recap of the analysis of the results of the Lecturer Response Questionnaire in the use of the product can be seen in Figure 6.
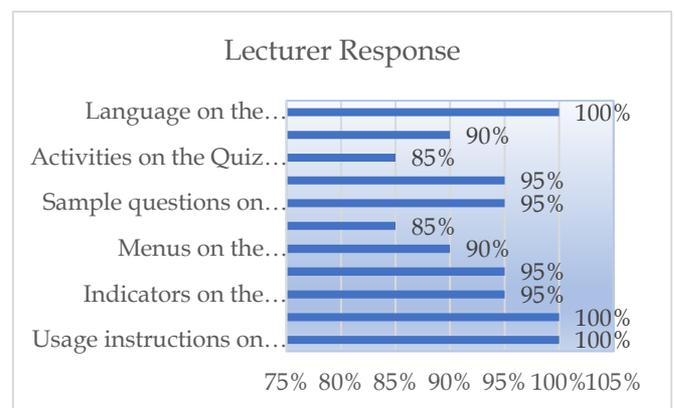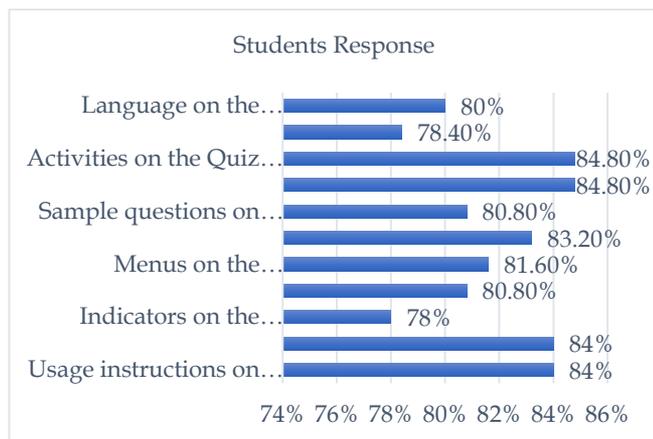

Figure 6. Recap of Analysis of Lecturer Response Questionnaire Results on the Use of Interactive Media

Figure 6 shows that the lecturers gave a very positive response to the Kodular-based interactive media, with very high scores (95–100%) on the aspects of usage instructions, learning objectives, and language

presentation. This is consistent with the user-centered design theory (Still & Crane, 2017), where the clarity of instructions and learning objectives are key factors in usability. Recent studies by Aulia et al., (2025) show that Kodular-based Android media significantly enhance student motivation and learning outcomes, indicating that aspects of use and clear objectives are directly related to engagement and learning effectiveness.

However, several aspects such as quiz activities (85%), content richness (85%), and project features (90%) received slightly lower scores, indicating potential for further development in interactivity and depth of material. This aligns with the principles of multimedia learning and adaptive guidance: recent research underscores the importance of interactive quiz content and branching scenarios so that the media can respond to individual needs and enhance conceptual understanding in a more thematic manner. The positive response from lecturers to learning objectives and instructions is also in line with the theory of constructive alignment (Biggs & Tang, 2003), which emphasizes the importance of aligning objectives, activities, and assessments. This implementation is highly relevant to the Merdeka Curriculum, which emphasizes essence-based and independent learning. The study by Simbolon & Silalahi (2023), shows that Kodular media in the Mechanics Engineering course is highly valid and practical indicating that this platform is effective for structuring media in line with learning outcomes.

Furthermore, the Practicality Test was also carried out on Tadris Physics students of the Faculty of Tarbiyah and Keguruan UIN Imam Bonjol Padang class A which amounted to 25 people. In Class A, the Cognitive Aspect Assessment Instrument material was tried. Recap of the analysis of the results of the student response questionnaire in the use of the product as in Figure 7.

Figure. 7. Recap of Analysis of Student Response Questionnaire Results on the Use of Interactive Media

Figure 7 displays the results of student evaluations of the Kodular-based interactive media, with response percentages ranging from 78.0% to 84.8%. The aspects that received the highest scores were activities on the quiz menu and images on the media (each 84.8%), followed by learning objectives and usage instructions (84%). This indicates that the developed media has met the criteria of ease of use and visual appeal, which are important in supporting student motivation and engagement. Research by Susanti et al., (2025) shows that the use of Android-based interactive media significantly increases students' interest in learning and concept mastery in educational courses, especially when visuals and quizzes are used as the main elements.

Important points such as content clarity (83.2%) and sample questions (80.8%) were also rated well by the students. This aligns with the principles in the multimedia learning theory updated byMayer (2024), where the integration of text, images, and logically organized interactive activities can enhance conceptual understanding and reduce cognitive load. This is increasingly relevant in the context of the Merdeka Curriculum, which emphasizes project-based, independent, and differentiated learning—making interactive and adaptive learning media one of the main necessities in its implementation.

However, aspects such as indicator presentation (78%) and project tasks (78.4%) received the lowest scores. This indicates that although the media is visually appealing and easy to use, there is still a need for development in providing more explicit achievement indicators and project task instructions. This is emphasized by the research of Andriani et al (2023), which states that the clarity of learning indicators is very important in achievement-based learning such as in the Merdeka Curriculum. Therefore, interactive media should continue to be improved to be more explicit in conveying assessment rubrics, expected outcomes, and contextual project-based tasks.

These findings are in line with a recent study by Simbolon & Silalahi (2023) that examined the development of Kodular media for higher education. They concluded that although the media is valid and feasible to use, adaptation to the needs of students as the primary users must continue to be considered to maintain its effectiveness. In this case, student involvement in user evaluation becomes an important approach in the user feedback loop-based development process, as emphasized in the design-based research model (Reinking, 2021).

Evaluation Stage

The evaluation revealed that the developed Kodular-based interactive media successfully met the criteria of validity and practicality. Observations showed that students were able to complete all activities within the given timeframe and expressed satisfaction

with the learning experience. The media effectively supports independent learning, assessment literacy, and competence development in accordance with the Merdeka Curriculum's philosophy.

Through interactive features such as simulations, quizzes, and feedback systems, the media encourages students to engage in meaningful learning activities while promoting reflection and collaboration. This aligns with the Design-Based Research approach (Reinking, 2021), which emphasizes iterative product improvement based on user feedback and contextual needs.

In summary, the Kodular-based interactive media developed in this research not only enhances student understanding of physics learning evaluation but also strengthens the pedagogical alignment between curriculum, instruction, and assessment. These findings contribute to the growing body of evidence supporting technology-integrated learning designs as effective tools in higher education.

Conclusion

The development of interactive media using Kodular in the Learning Evaluation course has proven to be valid and practical in supporting the implementation of the Merdeka Curriculum. The media addresses the absence of specific, accessible, and curriculum-relevant teaching tools by offering a flexible platform that enhances student engagement and understanding. Validation results indicate strong alignment with content, pedagogical, and technological standards. Moreover, this Kodular-based media facilitates independent learning, strengthens evaluation competencies, and integrates contextual features such as quizzes, simulations, and real-time feedback. Both lecturers and students responded positively, emphasizing its usefulness in clarifying complex evaluation concepts and promoting learning autonomy.

However, this study was limited to a small sample and focused only on one course within the Physics Education program. Future research should involve larger and more diverse samples across various courses and disciplines to test the generalizability of the findings. In addition, further studies can explore the long-term impact of Kodular-based media on students' higher-order thinking skills and digital literacy. Overall, this study contributes to the growing body of knowledge on technology-enhanced learning by demonstrating that Kodular-based interactive media can serve as an effective tool for integrating technology into curriculum implementation, particularly in courses requiring high levels of conceptual understanding and application.

Conflicts of Interest
No conflict of interest

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