Feasibility Analysis of Interactive Evaluation Media Based on Higher Order Thinking Skills (HOTS) in a Basic Electronics Course

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Abstract. This study investigates the feasibility of interactive assessment media designed to promote Higher Order Thinking Skills (HOTS) in the Basic Electronics course. A Research and Development approach was employed using the ADDIE model, focusing on the implementation and evaluation stages. The media was validated by four experts, including two subject matter experts, one media expert, and one assessment expert, and further tested by one lecturer and 32 students. Data were collected through Likert-scale questionnaires assessing validity across content, construct, and criteria, as well as practicality in terms of ease of use, efficiency, accessibility, motivation, and effectiveness. Results indicate that the media is highly valid, with scores of 81% from subject matter experts, 82.75% from the media expert, and 83.25% from the assessment expert. Practicality results also fall into the highly practical category, with scores of 81.71% from the lecturer and 81.10% from students. These findings confirm that the media is feasible for higher education, supporting accurate HOTS-based assessment and enhancing evaluation efficiency.

Keywords: Higher Order Thinking Skills (HOTS); interactive assessment media; validity; practicality; Basic Electronics; ADDIE model

1 Introduction

Higher education today faces significant challenges in fostering students' Higher Order Thinking Skills (HOTS), which include the ability to analyze information, evaluate arguments and solutions, and create innovative approaches to complex problems [1], [2]. Traditional learning approaches that focus only on the transfer of factual knowledge are no longer sufficient to prepare students for the demands of modern academic and professional contexts. Research has shown that effective learning strategies must systematically integrate HOTS into curricula and instructional methods [3], [4]. Such integration enables students not only to memorize basic facts but also to develop critical and creative thinking skills that are essential for addressing increasingly complex global challenges,[5]. This shift requires comprehensive reform in

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curriculum design, instructional strategies, and assessment systems with a stronger emphasis on complex cognitive skills.

The rapid advancement of digital technologies has transformed the educational paradigm, particularly through the use of interactive learning technologies that enhance student engagement and learning effectiveness. Technology not only changes the way materials are delivered but also reshapes how students interact with content and construct their understanding. Recent studies highlight that the use of technology such as interactive e-modules and STEM-based platforms can stimulate students' critical and creative thinking through responsive and personalized learning environments, [6], [7]. Longitudinal studies also demonstrate that appropriate integration of technology can improve academic performance by offering more engaging and effective learning experiences, [8]. A key factor for successful integration is the alignment between teaching strategies and the technology being used. When both elements support each other, the development of students' HOTS can be optimized, [9], [10]. This requires a sound understanding of how technology can strengthen pedagogical approaches that focus on advanced cognitive skill development.

The Basic Electronics course has unique characteristics as it involves understanding complex concepts such as semiconductors, diodes, transistors, and fundamental electronic circuits. In this context, the use of technology in assessment becomes essential and strategic. The complexity of the subject requires an evaluation approach that measures not only memorization of formulas but also the ability to apply and analyze knowledge in real-world problem solving. Assessments designed on HOTS principles allow students to engage in deeper and more applied learning. Students are not only required to master fundamental theories of electronics but also to apply them in practical contexts relevant to industry. This approach fosters students' ability to analyze circuits, evaluate design efficiency, and generate innovative solutions for complex electronic problems.

The development of HOTS-based assessment instruments for the Basic Electronics course has been an important focus of research. Previous studies, such as "Trial of HOTS-Based Test Instruments in Basic Electronics", successfully developed and tested assessment instruments with good validity and reliability in conventional test formats. This provides a strong foundation for further development. Findings from [11], reinforce this by showing that HOTS-based assessment instruments demonstrate high validity and reliability, making them applicable across different subject areas. The use of interactive tools and digital technologies in assessment not only increases student engagement but also creates a more dynamic and attractive learning environment, [12]. Such technology-enhanced environments enable instructors to conduct more comprehensive evaluations of students' abilities to analyze electronic problems, evaluate alternative solutions, and design innovative electronic circuits.

Developing high-quality assessment media requires a feasibility analysis covering two main aspects: validity and practicality. Validity indicates the extent to which an assessment tool accurately measures what it is intended to measure, while practicality refers to its ease of use and efficiency in real learning contexts. Validity of assessment media includes three important aspects: content validity, which ensures alignment with HOTS learning objectives; construct validity, which examines the accuracy of measuring HOTS dimensions; and criterion validity, which compares results against existing standards, [13], [14].. Practicality concerns operational aspects such as ease of use for both lecturers and students, time efficiency, and suitability with

available learning infrastructures. Rustandi and Rismayanti (2021) showed that developing instructional media using the ADDIE model through literature and field studies resulted in feasible and effective learning tools.

Given the complexity of Basic Electronics, comprehensive evaluation of students' HOTS is essential. Such evaluation must go beyond measuring conceptual understanding and encompass application, analysis, evaluation, and creation based on electronic principles, [15], [16]. Comprehensive assessments should be able to capture multiple cognitive levels simultaneously, from applying formulas in new contexts, analyzing complex electronic systems, evaluating circuit design efficiency, to creating novel solutions for previously unencountered problems. Therefore, combining validated HOTS items with interactive media technology is a strategic step to create assessment media that not only enhances student engagement but also deepens their understanding and applied skills. Systematic HOTS development must be supported through the synergy of modern learning technologies, innovative pedagogical approaches, and collaboration among stakeholders in education, [17].

Building on previous research, there is a significant opportunity to integrate validated HOTS-based test instruments with interactive assessment technologies. Such integration can produce HOTS-based interactive assessment media that combines high-quality test content with engaging and user-friendly technology. However, this integrated media remains in the development stage and requires a comprehensive feasibility analysis through student trials, expert evaluations, and user feedback to ensure its validity and practicality before widespread implementation, [18], [19]. This validation process is essential to guarantee that the developed assessment media not only meets rigorous academic standards but is also effectively applicable in diverse educational contexts. It further helps identify aspects that require improvement prior to broader application.

Based on these needs, the present study aims to analyze the feasibility of newly developed HOTS-based interactive assessment media in the Basic Electronics course, with a focus on validity and practicality. This media integrates validated HOTS-based test instruments with previously developed interactive evaluation technology. The validity analysis includes content, construct, and criterion validity, while the practicality analysis evaluates ease of use, time efficiency, and technical implementation. The findings are expected to provide empirical evidence of the feasibility of HOTS-based interactive assessment media for use in higher education, as well as serve as a foundation for developing similar tools in other technical courses. The contribution of this study is both academic, in advancing educational technology research, and practical, in enhancing the quality of engineering education through more accurate, engaging, and applicable assessment innovations..

2 Research Method

This study employed a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model was chosen because it provides a systematic framework for designing, developing, and testing high-quality instructional media, [20], [21]. The research focused specifically on the fourth stage Implementation and the fifth stage Evaluation in order to analyze the feasibility of interactive

assessment media based on Higher Order Thinking Skills (HOTS) in the Basic Electronics course.

The Implementation stage was carried out through expert and user trials. The expert validation involved three categories of experts: two subject matter experts in Basic Electronics, one instructional media expert, and one educational assessment expert. These four experts were asked to evaluate the media using instruments that assessed content accuracy, instrument construction, and alignment with learning objectives. This stage was intended to ensure that the assessment media was not only academically appropriate but also pedagogically and technologically sound. Following expert validation, the media was implemented in a real classroom setting involving the course lecturer and students enrolled in Basic Electronics. This process provided practical insights into the usability and effectiveness of the media in actual learning contexts.

The Evaluation stage focused on analyzing validity and practicality. Validity was determined based on the average scores provided by the experts. Scores collected through Likert-scale questionnaires were converted into percentages and interpreted according to the following categories: 81–100% (highly valid), 61–80% (valid), 41–60% (fairly valid), 21–40% (less valid), and 0–20% (not valid). This categorization revealed the extent to which the interactive assessment media conformed to academic standards, media design principles, and HOTS assessment frameworks.

Practicality was assessed based on feedback from the lecturer and students after using the media during instruction. The practicality questionnaire measured ease of use, time efficiency, learning motivation, and technical implementation. The resulting average scores were interpreted using the following categories: 81–100% (highly practical), 61–80% (practical), 41–60% (fairly practical), 21–40% (less practical), and 0–20% (not practical) (Riduwan, 2015). These categories provided benchmarks for determining whether the media could be effectively applied by both lecturers and students in real instructional contexts.

In addition to quantitative data, qualitative data were collected through semi-structured interviews and classroom observations. Interviews were conducted with the lecturer and several purposively selected students to capture their experiences, challenges, and suggestions for improvement. Observations were carried out during the implementation process to record technical aspects and user behavior when operating the media. The qualitative data were analyzed to complement the numerical findings, thereby providing a more comprehensive understanding of the strengths and weaknesses of the interactive assessment media.

The HOTS-based interactive assessment media was deemed feasible if it met two primary conditions: first, expert evaluations indicated at least a “valid” category across all assessed aspects; and second, practicality evaluations by the lecturer and students showed at least a “practical” category. If both conditions were satisfied, the media could be recommended for broader implementation in the Basic Electronics course as well as in other technical subjects..

3. Result and Discussion

3.1 Implementation Stage (Interactive Assessment Media Implementation)

At the implementation stage, the interactive assessment media based on Higher Order Thinking Skills (HOTS) was tested on two main groups: experts and end-users (lecturer and students).

Expert trial.
Four validators, consisting of two subject matter experts, one instructional media expert, and one educational assessment expert, evaluated the media. The average percentage of validity scores indicated that the media was categorized as highly valid (81–100%). The subject matter experts highlighted the alignment of the items with the learning outcomes of the Basic Electronics course and the capacity of the instrument to stimulate students' analytical and problem-solving skills. The media expert emphasized the ease of navigation, readability of the interface, and visual design that supported focus and engagement. Meanwhile, the assessment expert confirmed that the instrument was consistent with HOTS principles and aligned with the revised Bloom's taxonomy.

User trial.
In the classroom implementation, the media was used by the course lecturer and students. The lecturer stated that the media simplified the evaluation process due to its systematic structure, while students found the media easy to use, engaging, and motivating for learning.

3.2 Evaluation Stage (Feasibility Analysis of the Media)

The evaluation stage focused on two main aspects: validity and practicality.

3.2.1 Validity Analysis

Expert validation involved four validators: two subject matter experts, one media expert, and one educational assessment expert.

Subject Matter Experts.
The results are presented in Table 1.

Table 1. Results of Validation by Subject Matter Experts

Indicator	Expert 1 (%)	Expert 2 (%)	Average (%)	Category
Alignment with learning outcomes	88	82	85.0	Highly Valid
Content accuracy	85	80	82.5	Highly Valid
Relevance to HOTS	83	84	83.5	Highly Valid

The results indicated that all indicators scored above 81%, falling into the highly valid category. Alignment with learning outcomes scored 85%, confirming that the developed items were relevant to course objectives and encouraged higher-level thinking skills. Content accuracy

scored 82.5%, showing the items were conceptually accurate, although experts suggested refining technical terminology to reduce misinterpretation. Relevance to HOTS scored 83.5%, demonstrating that the items effectively measured analytical and evaluative skills, though experts noted potential for improvement in items requiring creative problem solving.

Media expert.

The results are presented in Table 2.

Table 2. Results of Validation by Media Exper

Indicator	Percentage (%)	Category
Interface design	84	Highly Valid
Navigation	79	Valid
Readability	83	Highly Valid
Interactivity	85	Highly Valid
Average	82.75	Highly Valid

The media expert's evaluation indicated that most indicators were highly valid, with an overall average of 82.75%. Interface design scored 84%, reflecting an attractive and consistent layout that supported learning focus. Navigation scored 79%, categorized as valid, suggesting minor improvements were needed to streamline menu structure and user flow. Readability scored 83%, confirming that text and instructions were clear. Interactivity scored the highest at 85%, highlighting the media's ability to actively engage students through HOTS-based assessment features.

Educational assessment expert.

The results are presented in Table 3.

Table 3. Results of Validation by Educational Assessment Expert

Indicator	Percentage (%)	Category
Instrument construction	83.00	Highly Valid
Alignment with revised Bloom's taxonomy	84.75	Highly Valid
Clarity of instructions	82.00	Highly Valid
Average	83.25	Highly Valid

The educational assessment expert's evaluation showed all indicators were highly valid, with an overall score of 83.25%. Instrument construction scored 83%, indicating well-structured items, though further consistency in phrasing was recommended. Alignment with Bloom's revised taxonomy achieved the highest score at 84.75%, confirming that the items aligned well with analysis, evaluation, and creation levels. Clarity of instructions scored 82%, suggesting instructions were clear but could be improved for brevity and precision.

Across all three expert categories, the media was consistently rated as highly valid (≥81%). This finding confirms that the instrument met academic, pedagogical, and design standards. Minor revisions, particularly in navigation and clarity of instructions, were recommended. These findings align with [22], who noted that a Content Validity Index (CVI) above 80% is generally

accepted as evidence of strong content validity, and are further supported by ishak, [23], who emphasized the importance of expert input in developing reliable educational instruments.

3.2.2 Practicality Analysis

Practicality was assessed based on feedback from the lecturer and students on ease of use, efficiency, motivation, and technical implementation.

Lecturer practicality test.

The results are shown in Table 4.

Table 4. Lecturer Practicality Test Results

Indicator	Percentage (%)	Category
Ease of use	82.75	Highly Practical
Efficiency of implementation	80.67	Highly Practical
Average	81.71	Highly Practical

\The lecturer rated the media as highly practical with an average score of 81.71%. Ease of use scored 82.75%, confirming that the media was simple to operate without requiring special training. Efficiency scored 80.67%, showing that the media supported time-saving during preparation and implementation of assessments.

Student practicality test.

The results are shown in Table 5.

Table 5. Student Practicality Test Results (n=32)

Indicator	Average Percentage	Category
Accessibility	81.9%	Highly Practical
User experience	79.5%	Practical
Learning motivation	82.3%	Highly Practical
Media effectiveness	80.8%	Highly Practical
Overall Average	81.1%	Highly Practical

The practicality test involving 32 students indicated an overall average of 81.1%, categorized as highly practical. Accessibility scored 81.9%, suggesting that students could easily access the media using available devices with minimal technical issues. User experience scored 79.5%, categorized as practical, reflecting the need for improvements in navigation and interface design. Motivation scored highest at 82.3%, showing that students felt more engaged due to the interactive and challenging nature of the items. Media effectiveness scored 80.8%, confirming its contribution to learning comprehension and academic achievement.

Overall, both the lecturer and students perceived the media as highly practical, with strengths in accessibility and motivation. These findings are consistent with Araújo, [24], who highlighted the importance of accessibility in ensuring the success of digital assessment tools in modern learning environments

4. Conclusion

The results demonstrate that the HOTS-based interactive assessment media for the Basic Electronics course is both highly valid and highly practical. Expert validation yielded average scores of 81% from subject matter experts, 82.75% from the media expert, and 83.25% from the assessment expert, confirming the media's alignment with learning outcomes, content accuracy, and consistency with the revised Bloom's taxonomy. User testing further indicated high practicality, with scores of 81.71% from the lecturer and 81.10% from students, highlighting ease of use, efficiency, accessibility, and motivational impact. Overall, the media is feasible for use in higher education, offering a reliable tool for assessing higher-order thinking skills while providing a practical and engaging experience for both lecturers and students.

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