

Development of a Heyzine Flipbook-Based Interactive E-Module for the Human Excretory System

Mirnawati¹, Ahmad Ali^{1*}, Andi Tenri Ola Rivai¹, Ainul Uyuni Taufiq¹

¹Pendidikan Biologi, Fakultas tarbiyah dan Keguruan, Universitas Islam Negeri Alauddin Makassar, Indonesia

*Correspondence email: ahmad.ali@uin-alauddin.ac.id

ABSTRAK

Penelitian ini bertujuan mengembangkan e-modul interaktif berbasis *Heyzine Flipbook* pada materi sistem ekskresi manusia kelas VIII MTsN 2 Jeneponto serta menguji kevalidan, kepraktisan, dan keefektifannya. Penelitian menggunakan metode *Research and Development* dengan model ADDIE yang meliputi *Analysis, Design, Development, Implementation, dan Evaluation*. Uji lapangan melibatkan 31 peserta didik kelas VIII E. Instrumen penelitian terdiri atas lembar validasi, angket respons pendidik dan peserta didik, serta tes hasil belajar berupa *pretest* dan *posttest*. Hasil penelitian menunjukkan bahwa e-modul memperoleh skor validasi rata-rata 3,7 dari dua validator dan termasuk kategori sangat valid. Kepraktisan memperoleh skor rata-rata 3,7 dari pendidik dan 3,6 dari peserta didik, yang termasuk kategori sangat praktis. Rata-rata hasil belajar meningkat dari 56 pada *pretest* menjadi 81 pada *posttest*. Nilai N-Gain yang diperoleh sebesar 0,60 dengan persentase N-Gain sebesar 60%; nilai tersebut termasuk kategori peningkatan sedang dan berdasarkan persentase N-Gain berada pada kategori cukup efektif. Selain itu, 29 dari 31 peserta didik (93,55%) mencapai KKM pada *posttest*. Dengan demikian, e-modul interaktif berbasis *Heyzine Flipbook* memenuhi kriteria sangat valid, sangat praktis, dan cukup efektif sebagai media pembelajaran pada materi sistem ekskresi manusia.

ABSTRACT

This study aims to develop an interactive e-module based on *Heyzine Flipbook* on the topic of the human excretory system for 8th-grade students at MTsN 2 Jeneponto and to test its validity, practicality, and effectiveness. The study employed the *Research and Development* method using the ADDIE model, which includes *Analysis, Design, Development, Implementation, and Evaluation*. The field test involved 31 eighth-grade students from Class E. The research instruments consisted of a validation sheet, teacher and student response questionnaires, and learning outcome tests in the form of *pretests* and *posttests*. The results showed that the e-module received an average validation score of 3.7 from two validators, placing it in the “highly valid” category. Its practicality received an average score of 3.7 from teachers and 3.6 from students, placing it in the “highly practical” category. Average learning outcomes increased from 56 on the *pretest* to 81 on the *posttest*. The N-Gain value obtained was 0.60 with an N-Gain percentage of 60%; this value falls into the moderate improvement category and, based on the N-Gain percentage, is classified as moderately effective. In addition, 29 out of 31 students (93.55%) met the minimum passing score on the *posttest*. Thus, the interactive e-module based on *Heyzine Flipbook* meets the criteria of being highly valid, highly practical, and moderately effective as a learning medium for material on the human excretory system.

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Introduction

The rapid development of digital technology has encouraged the use of more interactive learning media that are responsive to students' characteristics and learning needs. The integration of technology into the learning process enables teachers to present instructional content in more diverse and engaging ways, thereby supporting students' active participation in learning activities (Rusiadi, 2020). Therefore, selecting learning media that are aligned with instructional objectives and advances in information technology is essential for creating more meaningful learning experiences. One form of learning media that can be developed to address these needs is interactive digital learning material (Dani et al., 2023).

The role of teachers in digital learning extends beyond technological proficiency to include the ability to effectively integrate technology into the design of learning media that addresses students' needs (Rudini & Saputra, 2022). This is consistent with Regulation of the Minister of Education, Culture, Research, and Technology of the Republic of Indonesia No. 12 of 2024 concerning the Curriculum for Early Childhood Education, Primary Education, and Secondary Education, which emphasizes flexibility in learning according to students' needs and the characteristics of educational institutions. The Merdeka Curriculum also promotes the development of literacies relevant to contemporary demands, including digital literacy. In science education, the use of digital learning materials, such as electronic modules (e-modules), represents one way of integrating technology to facilitate the presentation and understanding of abstract concepts through text, images, videos, and interactive learning activities.

From an Islamic perspective, education encompasses both intellectual and spiritual development. Surah Al-'Alaq, verses 1–5, emphasizes the importance of reading, learning, and acquiring knowledge as integral components of the educational process (Al-Mahilli & As-Suyuti, 2018). This principle is relevant to efforts to provide learning resources that facilitate students' acquisition and understanding of knowledge through media aligned with technological advancements. One such resource is an interactive e-module that integrates textual content with various multimedia elements to support students' understanding of concepts and processes that are difficult to observe directly.

In the development of digital learning materials, platform selection should consider the capacity of the medium to present instructional content interactively, provide ease of access, and accommodate the characteristics of the subject matter. Heyzine Flipbook enables digital modules to be presented as interactive flipbooks enriched with images, audio, video, animations, hyperlinks, and interactive activities (Erawati et al., 2022). These features are particularly relevant to the human excretory system, which involves relatively abstract concepts related to internal organs and biological processes that cannot be directly observed and therefore require visual support to

facilitate learning (Elci et al., 2021). The e-module can be accessed online through a Heyzine link, while the downloaded flipbook version can be viewed offline using an application that supports the corresponding file format. However, features linked to external resources or content still require an internet connection.

At MTsN 2 Jenepono, interactive e-modules have not yet been implemented in classroom instruction, particularly in the Grade VIII human excretory system topic. Preliminary observations indicated that teaching and learning activities were still predominantly based on textbooks and lecture-based instruction. Survey results showed that 100% of the students perceived the human excretory system as difficult to understand. These difficulties were associated with the limited availability of visual learning resources, a lack of variation in instructional media, and the predominance of notetaking and listening activities during lessons. In addition, 59.4% of the students expressed interest in using more interactive learning media. These findings indicate a need for digital learning materials capable of presenting the content in a more visual and interactive manner to support students' understanding of the human excretory system.

Previous studies have demonstrated the use of Heyzine in the development of e-modules across various learning contexts. For example, Erawati et al. (2022) developed a Heyzine-based e-module for mathematical logic at the vocational high school level and reported that the product met the criteria for validity, practicality, and effectiveness. Although the study provides evidence of the potential of Heyzine as an e-module platform, its scope was limited to mathematics education and vocational high school students and therefore does not adequately explain its application in science education at the Islamic junior secondary school level. Moreover, the characteristics of the human excretory system, which involve internal organ structures and physiological processes that are difficult to observe directly, require forms of visual and multimedia representation that differ from those used in previously developed materials. Accordingly, an important gap remains in the development and evaluation of an interactive Heyzine Flipbook-based e-module specifically tailored to the characteristics of the human excretory system and the learning needs of Grade VIII students at the Islamic junior secondary school level.

Based on this research gap, the contribution of the present study lies in the development of an interactive Heyzine Flipbook-based e-module that integrates text, images, videos, animations, and interactive activities to facilitate the presentation and understanding of organ structures and physiological processes in the human excretory system. This study aims to develop an interactive Heyzine Flipbook-based e-module for the human excretory system and to evaluate its validity, practicality, and effectiveness as a science learning medium.

Methodology

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). The study was conducted at MTsN 2 Jeneponto, involving 31 Grade VIII E students as participants in the field trial. Prior to the main implementation, a small-scale trial was conducted with 10 students to obtain initial feedback on the developed product. The implementation stage was carried out over two instructional sessions in March 2025. The development process of the interactive e-module based on Heyzine Flipbook using the ADDIE model is illustrated in Figure 1.

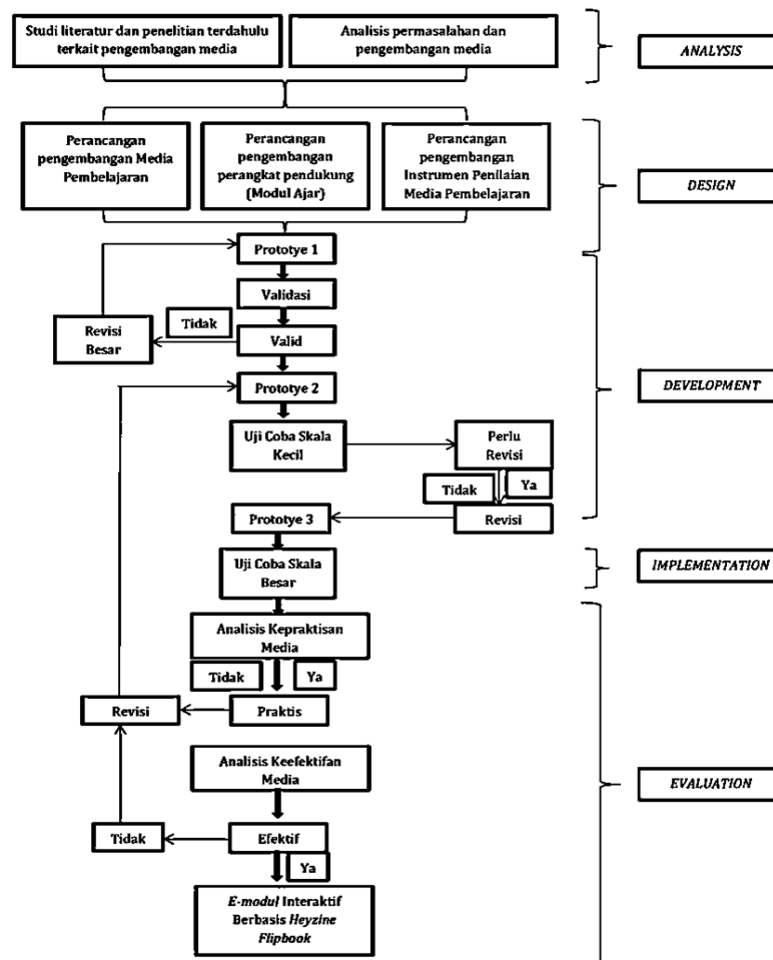


Figure 1. Development Procedure for the Heyzine Flipbook-Based Interactive E-Module Using the ADDIE Model

As shown in Figure 1, the analysis phase was conducted to identify learning problems, student characteristics, instructional media needs, learning materials, and learning objectives. The design phase involved the development of the instructional media, supporting learning materials, and assessment instruments, resulting in Prototype 1. During the development phase, Prototype 1 was validated by two expert lecturers in biology education. The validation covered several aspects,

including visual presentation, content, technical quality, language, and ease of use. The product was revised based on the validators' feedback, resulting in Prototype 2, which was subsequently subjected to a limited trial involving 10 students. The findings from this trial served as the basis for further product refinement, resulting in Prototype 3 prior to its implementation in the field trial.

The implementation phase involved 31 Grade VIII E students and was conducted over two learning sessions. The first session began with the administration of a pretest, followed by learning activities using an interactive e-module developed with Heyzine Flipbook. In the second session, learning activities using the e-module were continued, followed by the administration of a posttest and a student response questionnaire. A practicality questionnaire was also administered to two teachers. The evaluation phase was conducted based on the validation results, teacher and student responses, and changes in students' learning outcomes before and after the use of the e-module.

The research instruments consisted of a validation sheet, response questionnaires, and a learning achievement test. The validation sheet was used to assess the validity of the product, while the response questionnaires were administered to obtain data on product practicality. The learning achievement test consisted of 20 multiple-choice items administered as both a pretest and a posttest. The test items were developed based on the learning objectives, namely explaining the structure and function of the human excretory system, analyzing the mechanisms of the excretory system, and analyzing disorders of the human excretory system. Each test item was aligned with the specified learning objectives and underwent validity and reliability testing prior to its administration.

Validity data were analyzed using quantitative descriptive analysis based on the mean scores assigned by the two expert validators. The resulting mean scores were subsequently interpreted according to the criteria presented in Table 1.

Table 1
Criteria for Product Validity Levels

Score Range	Category
$V > 3.4$	Highly valid
$2.8 < V \leq 3.4$	Valid
$2.2 < V \leq 2.8$	Moderately valid
$1.6 < V \leq 2.2$	Less valid
$V \leq 1.6$	Invalid

Source: Hartanto (2020)

Practicality data were obtained from teacher and student response questionnaires. The scores obtained were converted into percentages using the following formula:

$$P = (\text{score obtained} / \text{maximum score}) \times 100\%$$

where:

(P) = percentage of the practicality level.

The resulting percentages were then interpreted according to the criteria presented in Table 2.

Table 2

Criteria for Product Practicality Levels

Percentage Range	Category
85–100%	Highly practical
70–<85%	Practical
50–<70%	Moderately practical
<50%	Less practical

Source: Leonardy & Arfiah (2022)

The effectiveness of the e-module was evaluated using a one-group pretest–posttest design. Changes in students' learning outcomes before and after the implementation of the e-module were analyzed using the Normalized Gain (N-Gain), calculated using the following formula:

$$\text{N-Gain} = (\text{posttest score} - \text{pretest score}) / (\text{maximum score} - \text{pretest score})$$

The resulting N-Gain values were subsequently interpreted according to the criteria presented in Table 3.

Table 3

Interpretation of N-Gain Scores

N-Gain Score	Category
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Moderate
$g < 0.3$	Low

Source: Susetyo et al. (2023)

The N-Gain scores were also converted into percentages to determine the level of effectiveness, as presented in Table 4. The categories in Table 3 indicate the degree of improvement in learning outcomes, whereas Table 4 is used to interpret effectiveness based on the percentage of N-Gain.

Table 4

Effectiveness Criteria Based on N-Gain Percentage

N-Gain Percentage	Interpretation
< 40%	Ineffective
40–55%	Less effective
56–75%	Moderately effective
> 75%	Effective

Source: Arikunto (2010)

Results and Discussion

This study produced an interactive e-module based on *Heyzine Flipbook* for the human excretory system through the stages of the ADDIE model. During the *analysis* phase, observations, interviews, and questionnaire data indicated that the learning process was still dominated by

textbooks and lecture-based instruction. Students also experienced difficulties in understanding the human excretory system due to limited visualization and a lack of variety in instructional media.

The *design* phase involved developing the e-module in accordance with the learning objectives, namely explaining the structure and functions of the excretory system, analyzing excretory mechanisms, and analyzing disorders of the human excretory system. The e-module included a cover page, user instructions, learning materials, images, videos, student worksheets, and interactive assessments. The content was initially prepared using Microsoft Word 2010, converted into PDF format, and subsequently developed using *Heyzine Flipbook*, with additional hyperlinks and educational games created through *Wordwall*.

During the *development* phase, Prototype 1 was validated by two expert lecturers in the field of biology and revised based on their feedback. The revisions resulted in Prototype 2, which was subsequently subjected to a limited trial involving 10 students. Feedback obtained from the limited trial was used to further refine the product, particularly in terms of the number of assessment items and the variety of educational games, resulting in the development of Prototype 3.

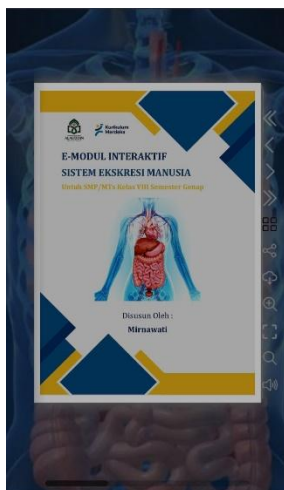


Figure 2. E-Module Cover



Figure 3. Learning Material Content



Figure 4. Student Worksheet

The *implementation* phase involved 31 students from Grade VIII E and was conducted over two instructional sessions. The first session began with a pretest, followed by learning activities using the e-module, while the second session continued with the learning activities, a post test, and the administration of a student response questionnaire. A practicality questionnaire was also administered to two teachers. The *evaluation* phase was carried out based on the results of expert validation, user responses, and the students' pretest and posttest scores.

Validity of the Heyzine Flipbook-Based Interactive E-Module

The validity of the developed product was assessed using a validation sheet covering several aspects, including visual presentation, content quality, technical quality, language, and ease of use. The assessment was conducted by two expert validators with relevant expertise. The results of the validation conducted by both experts are presented in Table 5.

Table 5
Expert Validation Results

Assessment Aspect	Validator 1	Validator 2	Mean	Category
Display	4.0	3.2	3.6	Highly Valid
Content	4.0	3.5	3.7	Highly Valid
Technical Quality	4.0	4.0	4.0	Highly Valid
Language	3.7	3.0	3.3	Valid
Ease of Media Use	4.0	4.0	4.0	Highly Valid
Overall Mean	3.9	3.5	3.7	Highly Valid

Based on Table 5, the *Heyzine Flipbook*-based interactive e-module achieved an overall mean score of 3.7 and was categorized as highly valid. The highest scores were obtained for technical quality and ease of use, each reaching 4.0, whereas the lowest score was found in the language aspect, at 3.3. These findings indicate that the product generally met the validity criteria, although the language aspect still required further refinement. This was also reflected in the validators' feedback, which highlighted the need to correct several writing errors and improve certain aspects of the product presentation.

Referring to the criteria proposed by Hartanto (2020), a mean score above 3.4 falls within the highly valid category. Therefore, the validation results indicate that the e-module met the required standards of content and media feasibility based on expert judgment and was considered appropriate for further field testing after revisions were made in accordance with the validators' recommendations. It should be emphasized that these validation results only reflect the feasibility of the developed product and should not be interpreted as evidence of improvements in students' motivation, interest, or learning outcomes.

Practicality of the Heyzine Flipbook-Based Interactive E-Module

The practicality of the instructional media was assessed during the implementation phase. The practicality of the e-module was evaluated using response questionnaires administered to students and teachers after the classroom learning activities had been completed. The results of the analysis of the teacher and student response questionnaires are presented in Table 6.

Table 6

Teacher and Student Response Results

Respondents	Number of Respondents	Mean Score	Percentage	Category
Teachers	2	3.7	92.5%	Highly practical
Students	31	3.6	90.0%	Highly practical
Overall	33	3.6	90.0%	Highly practical

Based on Table 6, the teachers' responses yielded a mean score of 3.7, equivalent to 92.5%, while the students' responses obtained a mean score of 3.6, equivalent to 90.0%. Both results were categorized as highly practical. The practicality of the product was assessed in terms of ease of use, presentation of learning materials, and attainment of learning objectives. These findings indicate that the e-module can be effectively used by both teachers and students during the learning process. This result is consistent with the findings of Milala et al. (2022) and Nadzeri et al. (2023), who emphasized that the practicality of instructional media is closely associated with ease of use, accessibility, and efficiency in supporting the learning process.

Effectiveness of the Heyzine Flipbook-Based Interactive E-Module

The effectiveness of the *Heyzine Flipbook*-based interactive e-module was assessed based on students' learning outcomes obtained from the pretest and posttest. To determine the level of effectiveness, the data were analyzed using gain scores. The average student learning outcomes based on the gain score analysis are presented in Table 7.

Table 7

Students' Pretest, Posttest, and N-Gain Results

Data	Pretest	Posttest
Highest score	75	100
Lowest score	30	65
Mean score	56	81

The mean N-gain score obtained was 0.60, equivalent to 60%. Based on the N-gain classification, a score of 0.60 falls within the moderate improvement category, while according to the N-gain percentage criteria of 56–75%, the result is classified as moderately effective. The distribution of N-gain scores showed that 29.03% of students were in the high category, 64.52% in the moderate category, and 6.45% in the low category. Therefore, the effectiveness of the product in this study was determined based on the N-gain percentage, indicating that the e-module can be categorized as moderately effective.

In addition to the N-gain results, the posttest findings showed that 29 of 31 students, or 93.55%, achieved the minimum mastery criterion ($KKM \geq 75$). This level of classical mastery was used as supplementary evidence of students' learning achievement and was not treated as equivalent to the N-gain, as the two indicators measure different aspects of learning outcomes. These findings can be compared with those reported by Erawati et al. (2022), who also found that students achieved

learning mastery after using a Heyzine-based e-module. However, their study used attainment of the minimum mastery criterion as the indicator of effectiveness, whereas the present study used the N-gain percentage. Consequently, the magnitude of effectiveness reported in the two studies cannot be directly compared.

Theoretically, the integration of text, images, and videos within the e-module has the potential to support information processing through verbal and visual channels, as described by the dual-channel processing theory (Mayer, 2021). In the context of the human excretory system, this combination provides visual representations of organ structures and physiological processes that are difficult to observe directly. However, the present study did not examine the contribution of each feature independently; therefore, the multimedia features cannot be identified as the direct cause of improvements in learning outcomes.

The findings of this study should be interpreted considering several limitations, including the use of a one-group pretest–posttest design without a comparison group, the relatively small sample of 31 students, and the implementation of the study in a single school. In addition, some interactive features of the e-module require an internet connection. Accordingly, the findings indicate that the e-module demonstrated a moderate level of effectiveness based on the percentage of N-Gain scores within the context of the conducted trial. However, these findings do not provide sufficient evidence to establish a causal effect or to support broad generalization to other populations and educational contexts.

Conclusion

Based on the research and development findings, the *Heyzine Flipbook*-based interactive e-module for the human excretory system in Grade VIII at MTsN 2 Jeneponto met the criteria of being highly valid, highly practical, and moderately effective within the context of the conducted trial. The product achieved a mean validity score of 3.7 based on assessments by two expert validators, while its practicality obtained a mean score of 3.6 based on teacher and student responses. Learning outcomes improved from a mean pretest score of 56 to a mean posttest score of 81, with an N-Gain of 0.60, or 60%, indicating a moderate level of improvement and a moderately effective category. In addition, 29 out of 31 students (93.55%) achieved the Minimum Mastery Criterion (KKM) in the posttest. Therefore, the *Heyzine Flipbook*-based interactive e-module is considered suitable for use as an alternative instructional medium for teaching the human excretory system in science education. However, because the study employed a single-group design without a comparison group, the findings are limited to the specific trial context and should not be interpreted as evidence of broad causal effects.

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