Development of an Android-Based E-Module in the Form of a Flipbook on Excretory System and Coordination System Material for Class XI SMA Students

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Abstract: Increasingly developing technology encourages educators to use it in the learning process as a learning medium in order to increase student's interest in learning. However, currently there are still many who do not optimally use technology-based learning media. The learning media used is monotonous and unable to visualize the material on the excretion system and coordination system in humans. This has an impact on student learning outcomes which are still below the school's Minimum Completion Criteria. Therefore, technology-based learning media such as e-modules in the form of flipbooks are needed. This research aims to produce an Android-based e-module in the form of a flipbook on excretion system and coordination system material that is valid, practical and effective. The type of research used is development research using the Plomp development model which consists of three stages, namely the initial investigation stage, the development stage (prototyping), and the assessment stage. The instruments used were teacher interview guide instrument sheets, student questionnaire sheets, self-evaluation sheets, and e-module validation sheets by experts, as well as e-module practicality assessment sheets in the form of flipbooks filled in by teachers and students. The subjects of this research were class XI high school students. The research object is an Android based e-module in the form of a flipbook on excretion system and coordination system material. The research results show that the Android based e-module in the form of a flipbook obtained very valid criteria validity results with a value of 86.76% and 89.06%, practicality results by teachers and students with very practical criteria with a value of 84.17% and 86.43%. Based on the T test carried out, there is a difference in value between the experimental class and the control class, namely a significance of 0.048 in the excretion system material and 0.003 in the coordination system material. Thus, Android-based e-modules in the form of flipbooks can improve students learning competence.

Keywords: Android; Coordination system; E-module; Excretion system; Flipbook

Introduction

Education is a conscious and planned effort carried out by educators to develop the physical and spiritual potential of students to reach maturity and be able to carry out their life tasks independently (Hidayat et al., 2019). Education is basically influenced by several things such as ideology, socio-economics, socio-culture and developments in science and technology (science and technology). One of the impacts of increasingly sophisticated technological developments is encouraging educators to utilize the results of

technology in the world of education, for example using it as a learning medium. This is in accordance with the demands of the 2013 Curriculum that educators must be initiative, innovative and creative in creating learning media by utilizing the surrounding environment including technology in the learning process (Mulyasa, 2015). Minister of Education and Culture Regulation No. 22 of 2016 states that learning media is a tool that can help teachers in presenting material in the learning process and has an important role in achieving learning goals. Using electronic based learning media is one form of utilizing technological advances in the learning process.

The development of learning media must follow specified rules, for example adapting it to learning strategies. This aims to ensure that the learning process can take place efficiently and effectively. The choice of learning strategies and media must adapt to the demands of the times, such as currently digitalization is increasingly developing due to increasingly advanced technology. One of the teaching materials that will be developed in this research is the development of an Android-based e-module in the form of a flipbook. Flipbook is media in the form of e-books, e-modules, e-paper and e-magazines, and includes teaching materials in the form of electronic media (Maf'ula et al., 2017).

Based on the results of interviews conducted with Biology teachers at 3 high schools in Padang, it is known that Biology learning has used learning media but is still limited. The learning media used include textbooks/package books, Student Worksheets Power Point slides, charts available at school, or using direct objects. The use of such learning media in the learning process makes students unable to visualize the excretion system and coordination system material. This happens because the excretory system and coordination system material contains a lot of Latin in the introduction of organs, rote material, and contains several abstract concepts such as the process of urine formation which cannot be observed directly.

Students difficulties in understanding the learning carried out has an impact on students learning competence. This is proven by the average daily test scores of students on Basic Competence 3.9 regarding the excretion system and Basic Competence 3.10 regarding the coordination system, which are still below the school's Minimum Completeness Criteria (school KKM). Based on the results of a questionnaire distributed to students in three schools regarding problems and needs for learning media, it shows that students need other, more interesting learning media. Biology learning activities in class. This is the reason researchers developed an e-module in the form of a flipbook.

The development of an e-module in the form of a flipbook was chosen because based on the results of observations in three schools it had never been used as a learning resource. Another reason is because e-modules in the form of flipbooks have advantages such as being practical to use, can be accessed using android, smartphone, laptop, notebook, and others. Students who prefer to use smartphones to search for learning resources rather than using printed books is also a driving factor in choosing to develop e-modules in the form of flipbooks. It is hoped that the development of an e-module in the form of a flipbook will generate interest in learning so that it can increase students' understanding and learning competence.

The results of research conducted by Ameriza et al. (2021) show that the use of flipbook e-modules for Simulation and Digital Communication subjects is stated to be very good, very practical and effective in improving student learning outcomes so that e-modules can be used as a material teach. This is also supported by research by Salsabela et al. (2022) that the development of flipbook-based e-modules is suitable for use as a learning medium in the very good category and is able to improve student learning outcomes. Similar research was also conducted by Mardiana et al. (2022) with the result that the development of flipbook based e-modules could increase vocational school students understanding of Customer Relations material.

Based on the problems and explanations that have been put forward, researchers have developed teaching materials in the form of e-modules. This development research is entitled "Development of an Android-Based E-module in the Form of a Flipbook on Excretory System and Coordination System Material for Class XI High School Students".

Method

This type of research is research and development which aims to produce an android based e-module in the form of a flipbook on excretion system and coordination system material for class XI SMA students that is valid, practical and effective. The development model used in this research is the Plomp model, which consists of three stages, namely the preliminary investigation stage, the development or prototyping phase, and the assessment phase (Plomp, 2013). The procedure for developing e-modules in the form of flipbooks using the Plomp model can be seen in figure 1.

Preliminary Research Phase

The initial investigation stage aims to get an idea of the characteristics of the product that will be developed for use in learning. The activities carried out at this stage

are: problem and needs analysis, curriculum analysis, concept analysis, and student analysis.

Development or Prototype Phase

The activity at this stage is designing solutions to the problems raised in the preliminary research. In the Development or Prototype Phase, the prototype is developed, evaluated and revised until a final e-module prototype is produced in the form of a flipbook that is valid, practical and effective.

Assessment Phase

The assessment stage is the final stage in development research. At this stage, a trial was carried out in a large group of one class to see the practicality and effectiveness of the prototype. The practicality test was carried out by filling out a practicality response questionnaire by students and teachers regarding the use of an Android based e-module in the form of a flipbook. The assessment of the effectiveness of the Android-based e-module in the form of a flipbook is seen from the students' learning outcomes (cognitive, affective and psychomotor).

The subjects of this research were class XI high school students. The research object is an Android based e-module in the form of a flipbook on excretion system and coordination system material. Validity and practicality data analysis techniques use Likert scale scoring and effectiveness using the T test using SPSS 26.

Figure 1. Procedure for developing e-module in the form of a flipbook

Results and Discussion

Initial Investigation Stage

This stage is carried out to determine the needs of students from the problems found. This initial investigation stage consists of five stages. The five stages are problem analysis, needs analysis, curriculum analysis, concept analysis, and student analysis.

Problem and Need Analysis

The results of the problem and needs analysis show that learning in schools has two main problems. First, the use of technology in creating learning media has not been carried out optimally. Technology has an important role in learning, especially in presenting learning media such as e-modules (Nurhasnah et al., 2023). This module, which is presented in electronic form, can provide users with interest and interest in learning (Nurhasnah et al., 2020). This was emphasized by Syahrial et al. (2019) that the use of e-modules can increase students interest, motivation and attention which has an impact on improving the quality of students learning. Using e-modules in learning can save time and save costs on using paper (Rindaryati, 2021). Apart from that, the use of e-modules is an embodiment of students and teachers facing the demands of 21st century education, namely mastering technology in learning (Laili et al., 2019; Sriwahyuni et al., 2019). Therefore, it is necessary to use technology in creating biology learning media, such as developing an Android-based e-module in the form of a flipbook.

Second, students find it difficult to understand the excretion system and coordination system material. This is caused by the presentation of material that is abstract and boring, making it difficult for students to understand (Syaiful et al., 2023; Syamsurizal & Ardianti, 2021). The ongoing learning is still focused on theory or concepts only, so that students' enthusiasm for learning and learning outcomes also decrease (Mantoviana et al., 2023). This can be seen from the results of interviews which show that students' learning outcomes are less than optimal and there are still many who get scores below the KKM. To overcome this, teachers should adapt learning according to the needs of their students. Through a student needs questionnaire, the results showed that students would be more interested if school material was delivered with the help of electronic learning media such as e-modules in the form of flipbooks. With this e-module in the form of a flipbook, learning will be more focused and interesting, so that it can encourage students thinking abilities and improve students' learning outcomes (Febrina et al., 2023; Umami et al., 2021; Zulhelmi, 2021).

The e-module in the form of a flipbook is also supported by several features such as images, videos,
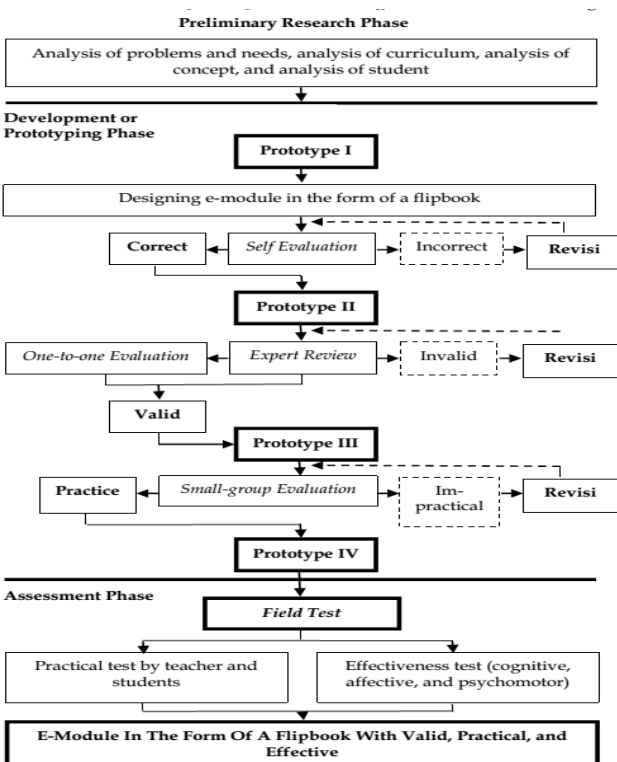
links and interactive evaluations, making it easier for students to understand the subject matter, especially the excretion system and coordination system (Sriwahyuni et al., 2019). Thus, this e-module in the form of a flipbook needs to be developed on excretion and coordination system material in order to improve student learning outcomes.

Curriculum Analysis and Concept Analysis

The results of the curriculum analysis show that there are indicators of achievement of competency in the excretion system and coordination system material. Competency achievement indicators are derived from basic competencies to make learning more focused. Analysis of curriculum achievement indicators can be used as a reference in organizing learning and achieving learning objectives (Nurhasanah et al., 2021). Apart from that, concept analysis is also needed so that the concepts of each material are clearer. The results of this concept analysis produce concepts that must be studied and understood in the excretion system and coordination system chapters. These concepts are presented in a concept map and arranged systematically and can identify the relationship between material and other materials (Astuti et al., 2020; Yahdiyani et al., 2022). So, curriculum analysis and concept analysis are needed to develop an Android based e-module in the form of a flipbook.

Learner Analysis

Based on the results of the questionnaire distributed to students, it was clear that students like and need learning media that is varied, practical, electronic, and uses Android. It is important to do student analysis before learning. As stated by (Septianti et al. (2020) and Deslauriers et al. (2019) state that before learning activities are carried out, educators should know the characteristics of their students first. By knowing the characteristics of students, educators can choose the right learning resources and organize the class to make learning more interesting. Educators can create lessons that can involve students directly, either in discussions or conducting experiments. The results of this analysis are one of the reasons why it is important to develop an Android-based e-module in the form of a flipbook.

Development or Prototyping

This stage was carried out to design an Android based e-module in the form of a flipbook and produce an e-module that was valid, practical and effective. This prototyping stage consists of the development stage and the prototype stage. The first result is an Android based e-module design in the form of a flipbook. This e-module was developed in accordance with the analysis of student needs. Based on the results of the needs analysis, it is necessary to develop an Android based e-module in the form of a flipbook to improve students' learning competence. The e-module is designed completely according to module manufacturing standards. The components in the e-module are designed in such a way as to support the achievement of learning objectives.

This e-module contains a cover, foreword, table of contents and list of images, concept map, introduction, learning activities, evaluation, and bibliography. This e-module contains a cover containing the title, subject identity, core material, supporting images, author's name, and class level. This is in line with the research results of Darling (2019) which states that a cover should contain the title, author's name and logo. This e-module also contains material accompanied by supporting simulations, photos and videos. This is in accordance with the 2010 ICT-based teaching materials guide which explains that explanations of abstract material can be clarified with the help of software containing videos and simulations (Ministry of National Education, 2010). Thus, the e-module developed is complete and in accordance with existing guidelines.

The second result is the results of the prototype stage analysis. The prototype stage itself contains self-evaluation, expert review, one to one evaluation, and small group evaluation.

Self-Evaluation Stage

At this stage the researcher reads and independently checks the completeness of the e-module design that has been developed. Based on the results of the analysis of the self evaluation stage, it can be explained that the design of the android based e-module in the form of a flipbook that has been designed is complete in terms of construction, content, language and graphics. Researchers found several minor errors such as typing errors and color contrast in several parts of the e-module. In developing e-modules, researchers must pay attention to writing composition and color so that the e-module presented looks attractive. Therefore, researchers must correct these writing and color errors so they can proceed to the next stage.

Expert Review Stage

At this stage, expert validation was carried out by three lecturers at Padang State University. The results of this expert validity test show that the Android based e-module in the form of a flipbook is in the very valid category, which can be seen in Table 1.

The Android-based e-module in the form of a flipbook has been designed to be as attractive as possible and revised according to validator suggestions. This is what makes the e-module suitable for field testing. This

e-module is said to be worthy of being measured based on four indicators. These four indicators include construction, content, language and graphics (Wulansari et al., 2023). It is feasible in terms of the construction in question, namely containing the correctness of the material, ease of use of e-modules, ease of understanding the material, and facilitating students in building their understanding, motivation and learning outcomes (Nurhasanah et al., 2021; Sriwahyuni et al., 2019). Therefore, an Android-based e-module in the form of a flipbook can be said to be feasible in terms of construction.

Table 1. E-Module Validity Test Results

Material	Assessment Aspects	Validity Value (%)	Criteria
Excretory System	Construction	78.33	Valid
	Contents	91.67	Very Valid
	Graphics	77.11	Valid
	Language	100	Very Valid
Amount		347.11	Very Valid
Average		86.76	
Coordination System	Construction	83.33	Very Valid
	Contents	91.67	Very Valid
	Graphics	81.25	Very Valid
	Language	100	Very Valid
Amount		356.25	Very Valid
Average		89.06	

It is appropriate in terms of the content in question, namely that the material prepared is in accordance with the objectives to be achieved, contains important concepts from the excretion system and coordination system material, and contains videos and images to make it easier for students to understand the material (Putranadi et al., 2021). It is appropriate in terms of the graphics in question, namely that the graphic design of the e-module is clear, attractive and proportional (Marsela et al., 2022; Nurutami et al., 2022). Appropriate in terms of the language in question, namely the language used in the e-module is in accordance with EYD, clear, easy to read, easy to understand, and communicative (Azizah et al., 2023; Syamsurizal, Syarif, et al., 2021). Thus, an Android-based e-module in the form of a flipbook is considered feasible after meeting the four feasibility indicators.

One to One Evaluation Stage

At this stage, the e-module that has been validated is then evaluated on three students with low, medium and high abilities. The results of the one to one evaluation stage analysis show that the e-module is practical to use. E-modules are considered practical because they are easy to use, communicative, the display is proportional, the language used is in accordance with EYD, and can be used anywhere. This e-module is a form

of adapting education to the challenges of the 21st century.

Small Group Evaluation Stage

The small group test involved nine students with the same ability level as the one to one evaluation stage. The results of the small group evaluation analysis show that the e-module is practical to use and is in the very practical category. The results of the small group test can be seen in Table 2.

Table 2. E-module Practicality Test Results by Small Group

Assessment Aspects	Practicality Value	Criteria
Ease of Use	86.11%	Very Practical
Learning Time Efficiency	85.42%	Very Practical
Benefit	88.19%	Very Practical
Amount	259.64%	Very Practical
Average	86.55%	

The use of learning media such as Android based e-modules should be able to build students interest, motivation and interest in studying biology subjects, especially material on excretion systems and coordination systems. This Android based e-module is considered practical because it is interesting, easy to use, time efficient, and very useful for students in building understanding to improve their learning outcomes (Afifah et al., 2018). Therefore, Android based e-modules are practical to use.

Assessment Stage

At this stage, an assessment of the product that has been developed is carried out. The product is tested in the field to determine its practicality and effectiveness.

Practicality Test

The practicality test at the assessment stage was carried out by large group students and biology teachers who taught in experimental classes in the 2023/2024 academic year. The practicality of e-modules measured consists of several indicators, including ease of use, efficiency of learning time, and usefulness. The results of the practicality test by students and teachers showed that the e-module was very practical to use, which can be seen in Table 3 and Table 4.

Table 3. Field Test Student Practicality Test Results

Assessment Aspects	Practicality Value	Criteria
Ease of Use	87.62 %	Very Practical
Learning time efficiency	85.36 %	Very Practical
Benefit	86.31 %	Very Practical
Amount	259.29 %	Very Practical
Average	86.43%	

Table 4. Practicality Test Results by Teachers

Assessment Aspects	Practicality Value	Criteria
Ease of Use	87.50 %	Very Practical
Learning Time Efficiency	75.00%	Practical
Benefit	90.00%	Very Practical
Amount	252.50%	Very Practical
Average	84.17%	

Figure 2. Completion of the learner's practicality questionnaire by a large group

Figure 3. Practicality questionnaire filling by teacher

E-modules are said to be practical when they are easy to use and attractive in terms of appearance. This attraction is because the e-module is equipped with animations and videos so that the material studied is easy to understand (Arafah et al., 2023). The efficiency of using e-modules can be seen from saving time in learning and being able to use e-modules anywhere and anytime (Chatri et al., 2023; Sari et al., 2021). E-modules can also provide students with the opportunity to study material independently. Therefore, the use of Android based e-modules in the form of flipbooks in practical learning is used by students and teachers.

Effectiveness Test

The effectiveness of this e-module is measured based on student learning outcomes. Student learning outcomes consist of three domains, namely the cognitive domain, affective domain and psychomotor domain.

Table 5. T-Test Calculation Results for Students Cognitive Domain

Learning outcomes	Class	Average	Sig.	Note
Excretory System	Experiment	83.20	0.04	H_0 is rejected and
	Control	80.36		
Coordination System	Experiment	83.77	0.00	H_1 is accepted
	Control	81.21		

Based on the table above, it can be seen that the use of Android-based e-modules is effective in improving students' cognitive domain. This is evident from the results of the analysis of the cognitive scores of students in the experimental class which have a higher average than those in the control class. The cognitive domain is one of the benchmarks for students in achieving learning goals (Fachri, 2018). E-modules are equipped with learning videos that can explain abstract material, making it easier for students to learn the material (Suharyat et al., 2023; Valfa et al., 2023). The appearance of videos in e-modules is closely related to the use of several human senses, especially the senses of sight and hearing (Rahman et al., 2023). By seeing and hearing this information, students will remember it longer than just reading it (Hochberg et al., 2020). This e-module can also increase students' interest and enthusiasm for learning because it looks more attractive and is supported by evaluations that are presented interactively (Annisa et al., 2022; Roemintoyo et al., 2022). Increasing students' interest and motivation to learn will have a positive impact on their cognitive domain (Asrizal et al., 2022; Subari et al., 2022).

The use of Android based e-modules is also effective in improving students affective domain (Chaerunisa et al., 2023). This can be proven through the results of the t-test calculation of students learning outcomes in the affective domain which shows that the average affective score of students in the experimental class is higher than the control class. The results of the affective domain t-test can be seen in the table 6.

Table 6. T-Test Calculation Results for Students Affective Domain

Learning outcomes	Class	Average	Sig.	Note
Excretory System	Experiment	71.37	0.03	H_0 is rejected and
	Control	67.89		
Coordination System	Experiment	69.72	0.00	H_1 is accepted
	Control	65.02		

E-modules can be used anytime and anywhere, so they can train students' independent attitude in learning (Saparuddin, 2022). By studying the working systems of the human body, students will be more grateful for what they have. Students can also learn that their bodies can still be used with a wealth of operating systems such as

knowledge about the excretory system and coordination system. This e-module trains students to learn independently, so that students are more honest with the tasks they do. With online systematics, it makes students more disciplined both in completing or collecting assignments, time discipline, and so on. This e-module also makes students more responsible individuals, both in carrying out personal and group tasks. So, this e-module has a significant influence on improving learning outcomes in the affective domain of students.The use of Android-based e-modules, apart from being effective in improving the cognitive and affective domains, is also effective in improving students' psychomotor domains (Asrizal et al., 2023; Eugara, 2022).

Table 7. T-Test Calculation Results for Students Psychomotor Domain

Learning outcomes	Class	Average	Sig.	Note
Excretory System	Experiment	73.57	0.02	H_0 is rejected
	Control	71.20		
Coordination System	Experiment	71.90	0.03	and H_1 is accepted
	Control	68.94		

Based on the table above, it can be seen that the results of the hypothesis test carried out obtained significance values of 0.02 and 0.03, which means <0.05. This shows that H_0 is rejected, which means that classes that use e-modules in the form of flipbooks have a positive influence on the students skills domain, compared to classes that do not use e-modules in the form of flipbooks. Students psychomotor assessments are assessed based on cooperation, understanding of the material, and flexibility in making presentations. Through this project assessment, student learning outcomes from the psychomotor domain can be seen (Lestari et al., 2020).

Conclusion

Based on the research that has been conducted, it can be concluded that the Android-based e-module in the form of a flipbook that has been developed has validity in the very valid category based on assessments by validator lecturers, is practical based on assessments by students and teachers, and has effectiveness from cognitive, affective and psychomotor aspects. students in the very effective category.

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Conflicts of Interest
The author has no conflict of interest.

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