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Development of Flipped Book Teaching Materials Based on Scientific Approach Classification of Living Things for Grade X at High School

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Abstract: The background of this study is based on the suboptimal biology learning process due to the limitations of teaching materials used in schools, which are generally still in the form of conventional textbooks and unguided online information searches. This study aims to develop digital teaching materials in the form of a flipped book based on a scientific approach on the subject of classification of living things for 10th grade high school students. This study employs the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model and was pilot-tested at SMA Kartika XX-1 Makassar, involving 33 students and 3 biology teachers. Data analysis included expert validation, student and teacher response questionnaires for practicality, and pretest-posttest scores to assess effectiveness. The expert validation showed a very high level of validity with a Content Validity (CV) of 1, falling into category D of relevance. The practicality test yielded an average student response of 80.9% and teacher response of 94.9%. The effectiveness test showed N-gain results with 90.91% of students in the high and moderate categories. Thus, the scientific approach-based flipped book is declared valid, practical, and effective for use as teaching material for biology in high schools.

Keywords: Effective; Flipped Book; Practical; Scientific Approach; Teaching materials; and Valid.

Introduction

The development of the 21st century brings new challenges in the world of education that demand changes and innovations, both in terms of curriculum, learning methods, and learning resources as learning needs (Cholilah, 2023). According to Angel (2023) the times that continue to develop make teachers need to carry out the learning process referring to predetermined standards, and create a more enjoyable learning process for students and teachers, also focusing on creating learning independence in students and creating character development not only cognitive but also social and emotional, learning needs to be designed that adapts to the times. As in its implementation there are several problems that teachers often encounter, namely one of the problems is choosing or determining teaching materials as an appropriate learning resource in helping students achieve learning objectives. Learning resources include reference sources, environments, media, tools and materials that are written more operationally, one of the things that teachers can do is use digital teaching materials (Istikharah, 2017).

Digital teaching materials or often referred to as electronic teaching materials are teaching materials that are used and published using digital formats, such as using text (writing), audio, visual, audio-visual content that is utilized as a learning tool designed to make it easier for students to understand learning anywhere and

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anytime and electronic teaching materials are also environmentally friendly and support the paperless movement. One of the electronic teaching materials that can support learning is flipped book teaching materials (Yulaika, 2020). One form of innovative learning that is relevant to these needs is flipped book teaching materials. Flipped book is a digital media that presents an interactive display resembling a printed book that can be equipped with text, images, audio, and video. This media allows learning to take place more flexibly, independently, and fun (Amanullah, 2020).

One of the approaches that corresponds to the student center or learning in favor of students is the Scientific approach, this approach can be an effective learning in learning. According to Permendikbud number 103 of 2014 states that the use of a scientific approach is carried out in the form of learning experiences which include questioning, gathering information, trying, reasoning or associating, and communicating. These activities can improve the ability of students to carry out learning, so that effective and optimal learning occurs in the classroom. Another advantage of this approach is that the scientific approach can prepare students to dare to innovate, therefore the scientific approach makes students think creatively. Based on this, the scientific approach is thought to be able to make effective learning in improving learning achievement, HOTS and character, so its application in learning is needed (Hidayati, 2018). The integration of *flipped book* based on *scientific approach* contains the stages of observing, questioning, gathering information, reasoning, and communicating can be an effective strategy in encouraging active involvement of students and strengthening understanding of biological concepts, especially in the material of classification of living things.

Classification of living things is one of the basic materials in biology that is important to master because it is the foundation in understanding biodiversity. However, learning this material is often abstract and less interesting when delivered only through textbooks. Based on the results of initial observations at SMA Kartika XX-1 Makassar, UPT SPF SMA Negeri 17 Makassar and UPT SPF SMA Negeri 1 Wonomulyo, information was obtained that learning was still dominated by the use of textbooks, searching for information on the internet without clear boundaries, using Artificial Intelligence (AI) such as GPT chat to answer questions instantly without going through a concrete learning process, which was deemed less than optimal and the low involvement of students in the learning process.

Previous research such as the application of using Flipped books in the teaching and learning process has received positive responses, this can be seen from previous research by Pixyoriza et al. (2019) which shows that the use of Flipbook media achieves a percentage of media results of 85% and a level of student response test results of 86%. This is also in accordance with the dissertation conducted by Karsim (2023) based on the analysis of the results of the mathematical communication ability test, the research data shows that 75% of students have a level of mathematical communication ability in the high and medium categories. This shows that 75% of students achieved mastery by obtaining the KKTP score set by the school, which is 75 in mathematical communication skills. It can be concluded that RME-based flipbook learning teaching materials are feasible to use and effective on students' mathematical communication skills, the development of innovative teaching materials will help students prepare new skills that are in line with their needs.

Responding to these problems, it is necessary to develop teaching materials that are innovative and in accordance with the characteristics of students. Therefore, this research was conducted with the aim of developing *flipped book* teaching materials based on the *scientific approach* on the material of classification of living things for class X SMA students, as well as to test its validity, practicality, and effectiveness in supporting the learning process.

Method

Time and Place of Research

This research was conducted at SMA Kartika XX-1 Makassar. A limited trial was carried out involving 33 tenth-grade students and 3 biology teachers.

Research Method

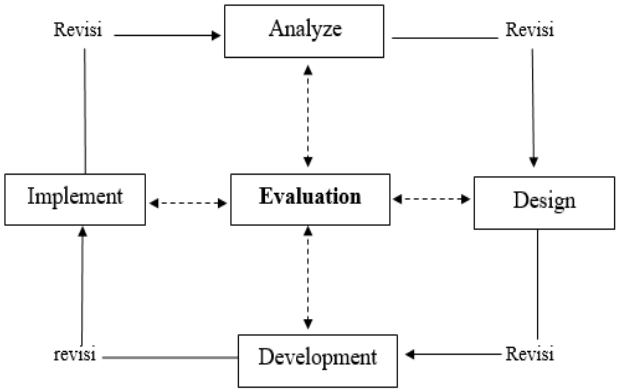
This study uses a Research and Development (R&D) method. According to Sugiyono (2019), the R&D method is used to produce and test a product. Borg and Gall (1983) also define R&D as a process used to develop and validate educational products. The development model used is ADDIE, which consists of Analysis, Design, Development, Implementation, and Evaluation. This model is selected for its systematic approach to instructional design that emphasizes students' knowledge, skills, and attitudes (Novianti, 2020).

Research Stages

The research followed five main stages according to the ADDIE model:

1. Analysis – Identifying the need for teaching materials and analyzing student characteristics.
2. Design – Designing the structure and interface of the flipped book.

3. Development – Creating and producing the flipped book based on the design.
4. Implementation – Conducting a limited trial at SMA Kartika XX-1 Makassar.
5. Evaluation – Evaluating the product through expert validation, practicality testing, and effectiveness testing.



Gambar 3.1. Skema Model ADDIE

Figure 1. Schematic of the ADDIE Model

Research Subjects

The research subjects included 33 students of Grade X and 3 biology teachers from SMA Kartika XX-1 Makassar who participated in the limited implementation of the developed flipped book.

Data Collection Techniques

The data collection techniques consisted of:

- Validity Test Instrument: A validation sheet was used to determine the validity of the product based on expert judgments.
- Practicality Test Instrument: Questionnaires for students and teachers were used, focusing on the clarity of instructions, scope of components, and language.
- Effectiveness Test Instrument: Pretest and posttest sheets consisting of 20 multiple-choice questions were used to assess the effectiveness of the product.

Data Analysis

The data analysis technique used aims to process the data obtained in the form of score analysis which is the research questionnaire criteria in the form of product validation sheets, practicality response sheets for product use by teachers and students, and assess the effectiveness of the products developed based on cognitive learning outcomes by calculating the N-gain score.

The validity of the scientific approach-based flipped *book* is obtained from the expert lecturer's assessment to obtain a validity test, then the validity is calculated using the Gregory formula. This validity uses the agreement of experts/lecturers to assess the products that have been developed by researchers to be assessed (Gregory in Setemen, 2018). The results of validation by experts will be analyzed for each aspect, there are 4 aspects, namely content aspects, presentation aspects, linguistic aspects and graphical aspects. calculation of content validity using the formula:

$$CV = \frac{D}{A+B+C+D} \quad (1)$$

(Gregory in Setemen, 2018)

Description:
CV: Content Validity
A: the number of items according to both experts is less relevant.
B: the number of items considered highly relevant by expert I and less relevant by expert II.
C: the number of items considered less relevant by the expert and highly relevant by expert II.
D: the number of items considered highly relevant by both experts.

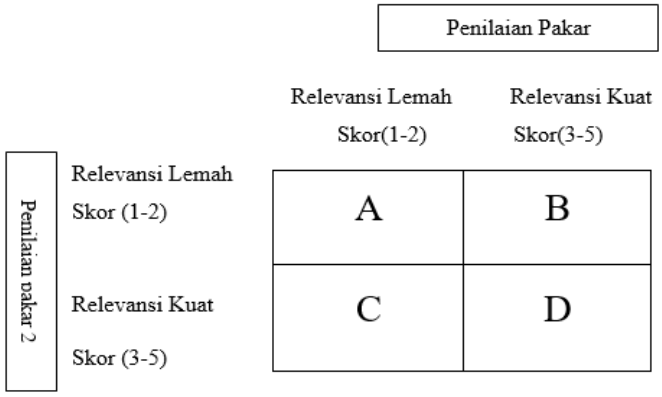


Figure 2. Gregory's formula for determining the value of A, B, C, and D.

The criteria for an instrument that is suitable for use if the results of the content validity coefficient have a strong relevance, namely those with content validity> 0.75, it can be stated that the results of measurements or interventions carried out by experts fall into valid criteria. If the level of validity achievement is low, it is necessary to make revisions according to the validator's suggestions and then carry out validation again and so on until a minimum level of validity is achieved.

The data analysis technique to test the practicality *of the scientific approach-based flipped book* is measured by calculating the questionnaire score using a Likert scale and then determining the percentage of respondents' assessment, using the following formula:

$$PPR = \frac{\sum Skor\ Responden}{\sum Responden\ x\ \sum Item\ x\ Skala\ Tertinggi} \quad (2)$$

Furthermore, the percentage score of the statement indicator is determined using the formula:

$$SIP = \frac{\sum Skor\ Aspek\ Penilaian}{\sum Aspek} \quad (3)$$

Description:
SIP: Assessment Indicator Score
∑ Assessment Aspect Score: Number of scores given by all respondents
∑ Aspects: Number of aspects

The effectiveness of using flipped book teaching materials based on the scientific approach developed is assessed based on student learning outcomes, by analyzing and calculating student learning outcomes. The test score data obtained was carried out twice, namely data before using the scientific approach-based flipped book teaching materials (pretest) and data after using the scientific approach-based flipped book teaching materials (posttest). The data on the acquisition of students' cognitive learning outcomes is then sought for the difference between the pretest and posttest scores by subtracting using the following gain test formula:

G = *posttest* score - *pretest* score (4)
(Hake, 1998)

Furthermore, calculations were carried out to determine the increase in cognitive learning outcomes using normalized gain analysis (*N-gain*) as follows:

$$Ngain = \frac{skor\ posttest + skor\ pretest}{skor\ ideal - skor\ pretest} \quad (5)$$

After knowing the category of the N-gain value, it is then seen its effectiveness if the results of the *N-gain* calculation of more than 76% of the students are in the medium and / or high category, the *flipped book* teaching material based on the *scientific approach* is effective for improving students' cognitive learning outcomes

Result and Discussion

The process of testing the developed product, namely the Flipped Book teaching material based on the Scientific Approach on the classification of living things in class X SMA, took place from November 07, 2024 - December 03, 2025. Flipped Book teaching materials based on Scientific Approach on the classification of living things in class X SMA are implemented at SMA Kartika XX-1 which is located at Jalan Sungai Tangka No.13 Makassar. The development model used in this research is the ADDIE development model with the Analysis stage, Design stage, Development stage, Implementation stage, Evaluate stage. The description of the results of activities at each stage is presented as follows:

Analyze stage

The *analysis* stage aims to identify the causes of problems in learning and pre-planning thinking or deciding about the subject or course to be given. This stage is also based on needs analysis, content analysis, structure analysis and goal analysis.

The needs analysis was conducted to find out the problems or obstacles obtained by students and teachers during biology learning and to find out what students and teachers need in an effective and optimal learning process. Observations and interviews conducted at SMA Kartika XX-1 Makassar, UPT SPF SMAN 17 Makassar, and SMAN 1 Wonomulyo on 3 biology teachers. The results of interviews with three high school biology teachers showed several obstacles in learning. At SMA Kartika XX-1 Makassar, learning still relies on textbooks and PowerPoint teaching materials, while searching for information on the internet has no clear boundaries. At UPT SPF SMAN 4 Makassar, learning is teacher-centered and relies on textbooks and *PowerPoint*. The use of AI such as ChatGPT to find instant answers is considered less effective because it does not go through an in-depth learning process. At SMAN 1 Wonomulyo, although students are given the freedom to learn through social media, their attention is often distracted by notifications and other content, which interferes with learning concentration. All three teachers revealed that students are very happy to use smartphones in class.

Interviews were also conducted with several students to find out the characteristics and needs of students from the three schools, obtained information that students feel that learning at school uses a lot of lecture methods using textbook teaching materials so that students often use smartphones to find answers indefinitely and without going through a concrete learning process, students feel happy to use *smartphones* and tablets. Based on the results of interviews conducted with teachers and students so that it becomes a consideration for researchers to develop teaching materials that can be accessed using smartphones and / or tablets to make it easier for students to understand learning.

The content analysis stage is carried out to analyze the content of the material that will be contained in the scientific approach-based flipped book teaching material. Content analysis is presented based on the independent curriculum and learning outcomes (CP) in phase E by analyzing the materials and activities that will be presented in the teaching materials. The results of the content analysis are presented in Table 1.

Table 1. Content Analysis Results

Phase/Class	: E/X	
Learning Outcomes (CP)	: At the end of phase E, learners have the ability to create solutions to problems based on local, national or global issues related to understanding the classification of living things, the diversity of living things and their roles, viruses and their roles, biological technology innovations, ecosystem components and interactions between components and environmental change.	
Material	Learning Objective (TP)	Sub-Matter
Classification of Living Things	Learners can understand the basic principles of classification of living things. Learners can make observations at school Learners can classify living things by using the determination key and dichotomy key Learners can apply the principles of the *scientific approach* Learners can display their observations	a. Purpose of classification b. Classification benefits c. Determination key d. Dichotomy key e. Scientific approach f. Observation activity

The content analysis stage is carried out to analyze the content of the material that will be contained in the scientific approach-based flipped book teaching materials. Content analysis is presented based on the independent curriculum and learning outcomes (CP) in phase E by analyzing the materials and activities that will be presented in the scientific approach-based flipped book teaching materials. Researchers conduct content analysis by paying attention to other teaching materials such as printed books/packages, journals, and other relevant teaching materials that can support the material compiled in the scientific approach-based flipped book teaching materials.

Design Stage

The Design stage is the stage with the design of the development of flipped book teaching materials based on the scientific approach. At this stage, the selection of the design format of the scientific approach-based flipped book product design is carried out. The development design design used is then used as a guide in the implementation of product development. The format or storyboard on the scientific approach-based flipped book teaching material is designed based on the appearance of the flipped book using canva and heyzine.com which is a web with a flipped book display. The storyboard components are shown in Table 2.

Table 2. Storyboard components of flipped book teaching materials based on scientific approach.

Components of flipped book teaching materials	Sub-components of flipped book teaching materials
Cover	a. Ministry of Education and Culture logo b. Merdeka Curriculum Logo c. Logo of Makassar State University d. Author's name e. The title of the flipped book teaching material in general f. Illustration g. Grade level
Foreword	a. Introduction b. Brief description c. Date of creation
Directions for use	a. Greetings b. Steps to use
Table of Contents	a. Title b. Page
Material	a. Reading material b. Images supporting the material
Additional References	a. Additional reading material b. Learning video c. Images supporting the material
Scientific approach	a. Explanation of the scientific approach b. Example of a scientific approach activity.
Observation Activity	a. Introduction to observation activities b. Title of observation c. Learning Objectives d. Tools and materials e. Observation instructions f. Observation activity description of meeting 1 g. Observation activity description of meeting 2 h. Observation activity description of meeting 3
Summary	a. Summary of material
Competency Test	a. Working instructions b. Multiple choice questions
Glossary	a. Glossary of words/terms b. Explanation of terms
Bibliography	a. Name of author b. Year c. Book/journal title d. Publisher
Author Biography	a. Author photo b. Author biography

Development Stage

This stage aims to realize the stage that has been done before, namely producing the final product of flipped book teaching materials based on the scientific approach of classifying living things in class X SMA which will be tested in the field. This product development on the display design uses the Canva application, then to make the flipped book use the heyzine.com web on flippedbooks. This stage is also carried out with various revisions and suggestions from expert validators.

The validation questionnaire assessment instrument was developed to assess the validity of the product that has been made and other instruments used in the study, namely: validation sheet of flipped book teaching materials based on scientific approach, practicality sheet in the form of teacher response questionnaire, student response questionnaire, effectiveness sheet in the form of test sheets, namely pretest and posttest. The aspects assessed on the product are content feasibility, presentation feasibility, language feasibility and graphic feasibility. Practicality instruments are developed based on aspects of content feasibility, appearance, language and benefits. The development of flipped book teaching materials based on scientific approach is carried out based on the results of the analysis and design that has been done previously. The description of the components of the scientific approach-based flipped book teaching materials developed can be seen in the following qr code:

Figure 3. QR Code Components of Flipped Book Teaching Materials Based on Scientific Approach

Before conducting trials with students, it is necessary to conduct validation, this is very important to do because it is to assess the weaknesses and strengths of the products developed, according to Wagenmann et al. The data from the validity assessment results were initially declared less valid by validator two which was due to the fact that the product instrument developed did not contain the scientific approach in its aspects, observation activities that needed to be detailed, activities that showed the *scientific approach* and small pictures needed to be added. Based on suggestions from expert validators, revisions and developments were made in accordance with the suggestions of the validators, then checked again and the development product instruments could be declared valid by both expert validators and could be used by researchers because they met quality standards. This research is also in line with research conducted by Ghazali (2016) that valid instruments are very important to do before implementing in order to ensure the effectiveness of the product in terms of appearance and content in order to increase confidence in the suitability of the instrument and objectives. This is also expressed by Abdulrahaman et al., (2020) that the instrument developed is valid because it fulfills the required aspects and shows product instruments with an attractive design and is relevant to the material, an attractive design can attract students' interest in the learning process. However, things are different in the results of research conducted by Jumiati (2023) the product developed is invalid, this occurs in the aspect of graphics due to the use of striking colors, fonts and the quality of very small images so that it is considered less attractive in the process of using it in class. The results of data analysis on teaching materials flipped book based on scientific approach are in the D relevance category, which means that many items are considered very relevant by both expert experts, and Content Validity (CV) in the aspect of content eligibility is 1, so it can be said that the validity of teaching materials Flipped Book based on scientific approach is very high validity.

Implementation Stage

At this stage the products and instruments that have been validated are then implemented by testing the flipped book teaching material products based on the scientific approach that has been developed previously. The trial process was carried out in class X SMA Kartika XX-I Makassar consisting of 33 students in 3 meetings on the biology subject of classification of living things. Practicality test activities are reviewed from the implementation of products that have been developed and the responses of teachers and students to products that have been developed and tested. The practicality of the product is assessed to determine the use of products that have been developed and used in the learning process. At the end of the learning process, a post-test of cognitive learning outcomes was conducted for students to determine the effectiveness of the scientific approach-based flipped book teaching materials that had been developed. The following describes the results of the implementation stage.

Analysis of teacher response data was carried out to find out field data about practicality and find out the teacher's assessment of the Scientific Approach-based Flipped Book Teaching Material product. Teacher response data was obtained by distributing to 3 biology teachers at SMA XX-I Kartika Makassar, which was reviewed from 5 aspects, namely aspects of content feasibility, presentation aspects, display aspects,

language aspects and benefit aspects. Based on the results of the data analysis of the teacher's response to the Scientific Approach-based Flipped Book teaching materials based on the five aspects described in more detail as follows.

Table 3. Results of Analysis of Teacher Response Questionnaires on Teaching Materials Flipped Book Based on Scientific Approach

Presentation Aspect	Percentage (%)	Category
Content eligibility	91.0	Very Practical
Presentation	93.0	Very Practical
View	97.0	Very Practical
Language	93.0	Very Practical
Benefits	100	Very Practical
Average	94.9	Very Practical

The results of the teacher's response to the scientific approach-based flipped book teaching materials obtained an average value of 94.89%, which means that the teacher's response to the scientific approach-based flipped book teaching materials developed can be categorized as "very practical" for use in learning. The results of the analysis of students' responses to the scientific approach-based flipped book teaching materials were carried out to determine the ease of students in using scientific approach-based flipped book teaching materials in learning. Learner response data was obtained from 33 learners who filled out a questionnaire after learning using flipped book teaching materials based on scientific approach. The results of the analysis of learner response data based on aspects of content feasibility can be seen in table 4.

Table 4. Results of Analysis of Learner Response Questionnaires to Teaching Materials Flipped Book Based on Scientific Approach

Presentation Aspect	Percentage (%)	Category
Content eligibility	82.2	Very Practical
View	79.0	Practical
Language	82.7	Very Practical
Benefits	80.0	Practical
Average	80.9	Practical

The results of students' responses to the scientific approach-based flipped book teaching materials obtained an average value of 80.9%, which means that students' responses to the scientific approach-based flipped book teaching materials developed can be categorized as "Practical" for use in learning. According to Fahruddin (2025) states that the effectiveness test is carried out to assess the extent to which the product that has been developed can work optimally and how much the effectiveness rate is used to see if the use of the product can improve the quality of learning. The effective test of flipped book teaching materials based on scientific approach is carried out to find out the effectiveness of using teaching materials based on scientific approach that has been developed by looking at the N-gain value of learning outcomes cognitive students after using flipped book teaching materials based on scientific approach material classification of living things. Data on the effectiveness of using teaching materials based on scientific approach flipped book obtained from cognitive learning outcomes multiple choice test of 25 items carried out at the time before the use of teaching materials based on scientific approach flipped book (pretest) and after the use of teaching materials based on scientific approach flipped book (posttest) it is done to measure the level of achievement of students after the learning process is carried out based on the material taught using teaching materials based on scientific approach flipped book. The results of the pretest and posttest of students after using the developed product are described in the following diagram:

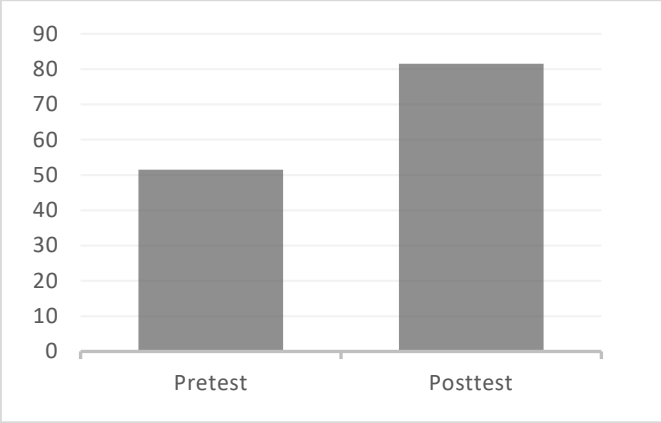


Figure 4. Diagram of Average Score of Pretest-Posttest Score

The analysis used to measure the effectiveness of N-gain analysis is calculated to determine the effectiveness of the use of flipped book teaching materials based on scientific approach. N-gain Data on students' cognitive learning outcomes can be seen in table 5.

Table 5. Data on Frequency Results and Percentage of Category *N-gain* Value of Cognitive Learning Outcomes of Students

Category	*N-gain* Score	
	Frequency	Percentage (%)
High	7	21.21
Medium	23	69.70
Low	3	9.09
Total	33	100

The results of the N-gain data analysis of students' cognitive learning outcomes were in the high category

as many as 7 people with a percentage of 21.21%, 23 people in the medium category with a percentage of 69.70% and 3 people in the low category with a percentage of 9.09%. Learners who are in the high category and moderate category total 90.91%. Based on the category of interpretation of the effectiveness of N-gain and the data in table 4.29, the flipped book teaching materials based on the Scientific Approach that have been developed can be categorized as effective in their use.

The scientific approach-based flipped book teaching materials are equipped with instructions for use, table of contents, learning outcomes (CP), learning objectives (TP), additional references, observation activities using a scientific approach, summary, competency test, glossary, and bibliography. The scientific approach-based flipped book teaching materials that researchers develop are independent teaching materials that can be accessed individually by students without the need for additional applications, only by scanning the qr code on the smartphone camera then flipped book based on scientific approach can be accessed by students and based on the results of data analysis effectiveness shows a positive student response. This is also expressed in research conducted by Roemintoyo (2021) which shows that students have a positive perception of the opportunity to develop and utilize flipbooks as teaching materials and digital learning media to facilitate the learning process. This teaching material contains the subject matter of the classification of living things which is compiled from various relevant references such as journals, grade X biology textbooks, and relevant literature with scientific approach-based observation activities.

The material presented in the teaching materials uses a scientific approach or scientific approach which is equipped with scientific activities contained in the developed teaching materials, so that it can require students not only to remember the material explained by the lecture method by the teacher, but students also carry out scientific activities in learning so that students can have constructive and meaningful learning so as to improve their learning outcomes in the classroom. This agrees with the results of research by Turangan (2020) which states that the implementation of the results of the product development of scientific approach-based science teaching materials can help students in independent learning and there is an increase in student learning outcomes. This is also expressed by Wieman, (2007) that the application of the scientific approach in science education shows interactive and evidence-based activities that are effective in increasing students' understanding. Bairagi (2019) also revealed that the integration of scientific approach such as data collection and analysis in learning can promote scientific abilities and principles in students. This is also in line with Blum (1955) that one part of the scientific approach is to analyze problems, test hypotheses through experiments that are carried out consciously and involve researchers directly so that it significantly improves the quality of learning. This is in line with research conducted by Shofiyah (2020) that the scientific approach is based on the use of scientific principles and is proven by increasing the cognitive abilities of students so that teachers are advised to use this approach. Overall, various research results show that the application of the *scientific approach* can contribute to improving the quality of learning.

The scientific approach-based flipped book teaching materials developed with the help of the canva application and the heyzine.com web to change the design display into a digital book display that can be flipped like a printed book, this teaching material is also equipped with videos, images, and embed file features that make it easy for users to access or download files in the flipped book with just one press on the download icon, and teaching materials can be accessed easily by scanning the qr code on the smartphone camera anytime and anywhere without time and number restrictions. usage. This is in accordance with the opinion of Hamid & Heffi (2022) that the use of flipped books that can be used anywhere and anytime using professional flip technology so that users feel like reading printed books with additional features such as videos, and images. This teaching material also has the advantage of having material in the form of writing, images, videos and observation activities that cover auditorial, visual, audiovisual, and kinesthetic learning styles.

Flipped book teaching materials based on the scientific approach are digital teaching materials that can support and enrich the application of science in learning, such as with the use of videos, images and easy access to teaching materials. According to Khotimah (2021), digital teaching materials can increase students' activities, especially in science learning, such as triggering students' curiosity by observing real life. The integration of digital teaching materials with a scientific approach can improve students' scientific skills because digital teaching materials contain images, animations, videos, and quizzes that can illustrate students in making observations, observing, analyzing so that it is very effective for improving the quality of learning (Rahma, 2024).

Based on all the stages that have been passed by researchers, the final result obtained is to produce the development of *flipped book* teaching materials based on *scientific approach* biology subject matter classification of living things even semester class X SMA declared valid,

practical, and effective so that it can be used by teachers and students as one of one of the teaching materials and learning resources in learning so that it can improve cognitive learning outcomes.

Evaluate Stage

The evaluation stage is carried out to provide a value for the Scientific Approach-based Flipped Book teaching materials that have been developed. Based on the results of the validity data analysis, it is obtained that the teaching materials for the Scientific Approach-based Flipped Book are categorized as valid, practicality by teachers is very practical and practicality by students is very practical, and the effectiveness of teaching materials that have been developed is obtained by the learning outcomes of students with *N-gain* values in the high category and medium category totaling 90.91% which means more than 76% so that it can be interpreted that teaching materials based on *scientific approach flipped book* are effective for improving students' cognitive learning outcomes.

Conclusion

Based on the results of research and product development of scientific approach-based flipped book teaching materials on the classification of living things, it can be concluded as follows: (1) Teaching materials flipped book based on scientific approach on the material of classification of living things even semester class X SMA that has been developed has met the criteria of validity with a valid category; (2) Teaching materials flipped book based on scientific approach on the material of classification of living things even semester class X SMA that has been developed is practical to use with a very practical practical category. This is based on teacher responses and student responses; (3) Teaching materials flipped book based on scientific approach on the material of classification of living things even semester class X SMA that has been developed has met the effectiveness criteria with a value of 90.91 in the effective category.

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Author Contributions

A.C.P contributed conceptualization, Method, Analysis, project administration, investigation, and writing original draft preparation. H & F contributed as a supervisor of research ideas and conceptualization.
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Conflicts of Interest

The authors declare that no conflict of interest mayaffect the objectivity and integrity of the results

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