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Development of Thermodynamics Law Electronic Book Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker Applications for Physics Education Students

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Abstract *- This research aimed to describe the development process and to figure out the validity level, practicality level, and effectiveness of the thermodynamics law electronic book using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker applications for Physics Education students at Alauddin Makassar State Islamic University. This study fell under the category of research and development (R&D). The research design followed the 4D development model: Define, Design, Develop, and Disseminate. A small-scale trial was conducted to 35 physics education students of the sixth semester in the academic year of 2022/2023. Research instruments included validation sheets, electronic book feasibility observation sheets, and questionnaires assessing responses from professors and students regarding the electronic book. The data were analyzed using descriptive statistics. The results of data analysis reveal that the electronic book's validity level obtained an Aiken's V index value of 0.68, categorized as highly valid, indicating suitability for use. Furthermore, the data from student observation sheets showed that 94% of students are in favor of the book, while professors' response was 100% positive, and students' response was 49% very positive and 40% positive, indicating that the electronic book was considered practical. Finally, the effectiveness level of the e-book through learning outcome test analysis achieved an 83% completion rate, indicating that the electronic book developed is effective to use.*

Keywords: *3d pageflip professional; electronic book; ispring quizmaker; macromedia flash; thermodynamics law*

I. INTRODUCTION

Technology is currently experiencing rapid development. In its development, technology also influences aspects of human life ranging from learning, working, and shopping to finding information, all done with the help of technology (Andriyani & Buliali, 2021; Ma'ruf et al., 2021). Technology is a means and infrastructure made by humans to facilitate their daily needs (Bahar & Afdholi, 2019; Diani & Hartati, 2018). The rapid development of technology has also affected the education system, especially in Indonesia. Starting from the increasingly sophisticated learning process, learning methods integrated with technology, curriculum changes that

adapt to the times and technology, and the use of advanced learning media (Widiyono & Millati, 2021; Bond & Bedenlier, 2019).

The problem that is often encountered now is the lack of students' interest in physics learning which resulted in low physics learning outcomes. The low interest and learning outcomes of students can be influenced by various factors such as monotonous teaching media used. The problem can be solved by the use of effective teaching materials such as ICT-based teaching materials that can assist lecturers in explaining material that is abstract and difficult to bring directly to the classroom (Indriana & Rohmadi 2021; Yelianti et al., 2020; Muchlisa et al., 2021).

Thermodynamics studies large-scale (macroscopic) quantities of systems that can be observed and measured in experiments, while small-scale (microscopic) quantities are studied in the Kinetic Theory of Gases or Statistical Physics. The coverage of thermodynamic material is quite complex and dense, making it sometimes difficult for students to learn and understand. For example, for the laws of thermodynamics that study the phenomena and equations of the state of gases. For this reason, in studying this course, various learning media are needed. The lecture process generally uses PowerPoint, Liquid Crystal Display (LCD) projector, and conventional books as media and learning resources. Then as the advance in technology, teachers began to create new media and learning resources integrated with technology. Electronic books are one example (Mindayula & Sutrisno, 2021; Said et al., 2021; Hidayat, 2017).

The problem can be solved by developing E-books by utilizing current technology. Some suitable applications used are Macromedia Flash and Ispring Quizmaker. Macromedia Flash is a software to create various forms of visual presentation that can interpret various media, such as video, animation, images, and sound (Milala & Agung, 2022; Susilawati et al., 2018). Thus, this program is quite reliable in making various kinds of interactive and interesting tutorial applications. While Ispring Quizmaker is software for making questions, quizzes, or tests online (web-based) (Astuti & Thaitama, 2022; Faradayanti et al., 2020). With this software, users can create and compile various forms and levels of different questions, namely true/false questions, multiple choice, word filling, quizzes with image areas, and others.

Indriana and Rohmadi (2021); Suntana (2018) found that E-books integrated with the Pageflip 3D application make it look more real. The 3D E-Book was based on the 3D PageFlip application on the Motion System material integrated with Islamic materials on class XI. The validity test conducted by material experts showed an average percentage of 80% or in *valid* category. In addition, from media experts and Islamic integration experts assessment we found that the 3D books was in *valid* category with the average percentage score of 76.6 % and 92.5 %, respectively.

Therefore, the objective of this research was to figure out the development process, the level of validity, the level of practicality, and the level of effectiveness of the Physics Ebook on Law of Thermodynamics material using the Pageflip 3D application, Macromedia Flash and Ispring Quizmaker for Physics Education Students of sixth semester at Alauddin Makassar State Islamic University (UIN) in the academic year of 2022/2023.

II. METHODS

This study was a research and development (R&D) research as it involved the development of a product and testing its effectiveness, validity, and practicality. The research design followed the 4D development model. The 4-D development model was a framework for developing instructional materials. The research and development model consisted of four stages: define, design, develop, and disseminate (Thiagarajan, 1974).

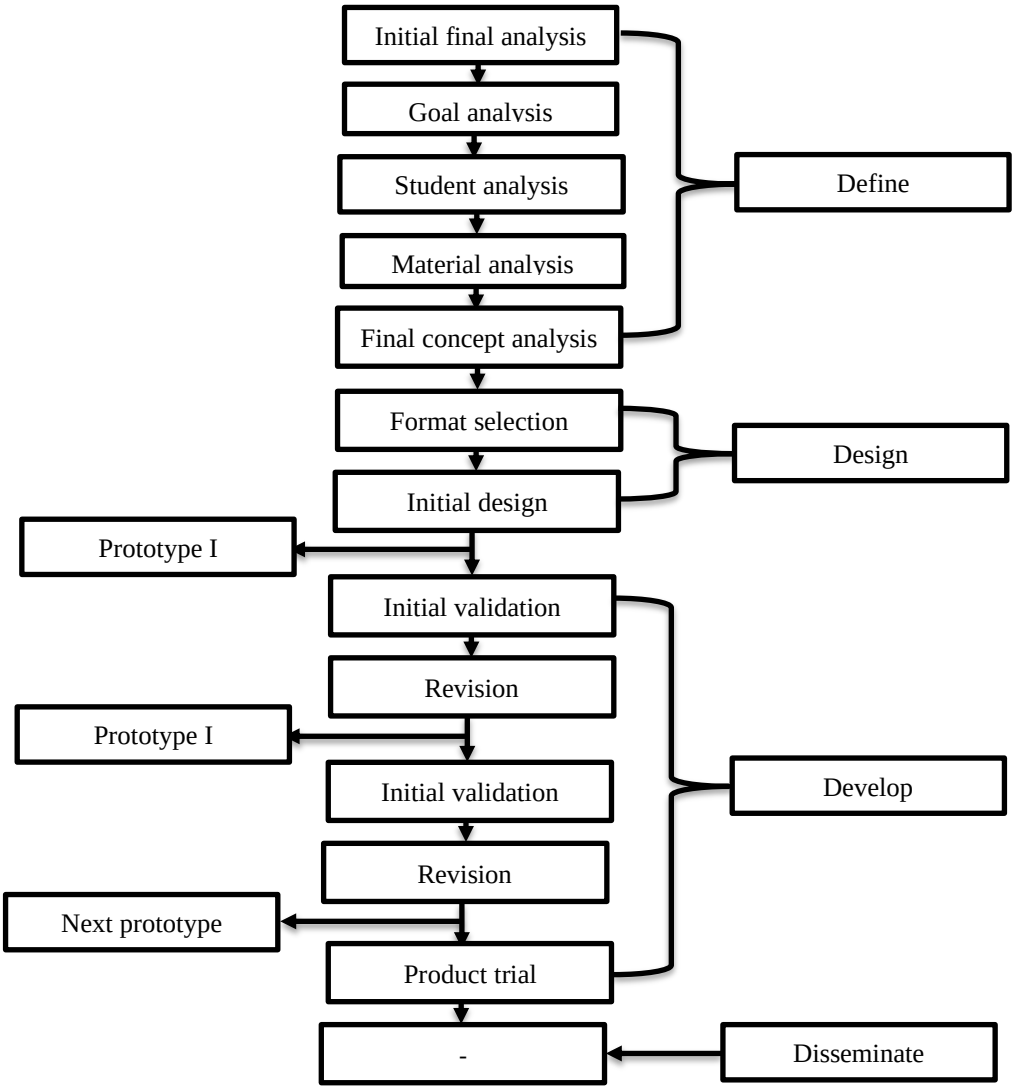

Figure 1. 4D development model

The subject of this study was a primary data subject, gained from 2 validators, namely, media expert validator or product and material expert validators and secondary data subjects, with 35 students using the electronic books. This research was conducted at Physics Education Study Program, Faculty of Tarbiyah and Teacher Training, UIN Alauddin Makassar Academic Year 2022/2023.

The research data were analyzed using descriptive statistical analysis. According to Arikunto (2013), descriptive statistics can use the form of bar graphs, pie charts, modes, medians, and measures of variability. Utilizing descriptive statistical analysis, the research data were analyzed as follows.

The data was analyzed using descriptive statistical analysis. Descriptive statistics can be in the form of bar diagrams, ceramic diagrams, modes, medians, and size variability.

The validity of the electronic book by experts, the practicality assessment instrument for the electronic book, and the effectiveness of assessment instrument was analyzed using the Aiken's Index (Retnawati, 2016).

Table 1. Aiken index criteria

Index Range	Category
< 0,4	Less valid
0,4 – 0,8	Valid
> 0,8	Highly valid

In the analysis of the electronic book's practicality level, we utilized an observation sheet for implementation, a questionnaire for professors' responses, and a questionnaire for students' responses. The data were obtained from observers who observed the researcher's activities during the learning sessions and from respondents who were students and professors using the electronic book (Retnawati, 2016). These data were analyzed descriptively in terms of percentage, using the following formula:

Table 2. Practicality criteria for electronic guides

Formula	Classification
$\bar{X} > \bar{X}_i + 1{,}8\ x\ sbi$	Very Good
$\bar{X}_i + 0{,}6\ x\ sbi < X \leq \bar{X}_i + 1{,}8\ x\ sbi$	Good
$\bar{X}_i - 0{,}6\ x\ sbi < X \leq \bar{X}_i + 0{,}6\ x\ sbi$	Adequate
$\bar{X}_i - 1{,}8\ x\ sbi < X \leq \bar{X}_i - 0{,}6\ x\ sbi$	Poor
$\bar{X} \leq \bar{X}_i - 1{,}8\ x\ sbi$	Very Poor

III. RESULTS AND DISCUSSION

A. Description of research results

This research is a development of physics electronic book on the law of thermodynamics material using the 3D applications: Pageflip, Macromedia Flash and Ispring Quizmaker at Physics Education of Islamic State University (UIN) Alauddin Makassar. The research aimed to produce an electronic book of physics metrics of the laws of thermodynamics combined with the 3D applications that met the criteria of validity, effectiveness and practicality using a four-D learning device development model through defining, design, developing, and limited trial stages.

Each stage of the instructional tool development activity carried out along with the analysis of the obtained data can be described as follows:

1. Define Stage

a. Initial Analysis

This activity aimed to establish the fundamental problem for the development of the physics electronic book, primarily within the thermodynamics course. The core issue to address was how to use media in the learning process. The comprehensive and dense nature of thermodynamics material often posed challenges for students to study and understand it, such as the laws of thermodynamics that delve into gas phenomena and equations.

In conventional lectures, presentation tools like PowerPoint, Projector Liquid Crystal Display (LCD), and traditional textbooks are typically used as the learning media and resources. With the advancement of technology in the current era, new learning media and resources that integrate technology are being developed, and electronic books are a prime example.

Observations conducted by the researcher among several physics students revealed that students tend to seek additional learning materials through electronic books accessible via smartphones or computers. However, the electronic books they found have ordinary appearances and lack engaging features. Given that comprehending physics concepts requires a deeper and more tangible understanding, electronic books should ideally emphasize on the sophisticated technology of the present era to offer a new dimension to learning. Today, numerous applications are available that can be integrated with learning media. According to the author, there are several applications suitable for updating the appearance and features of electronic books to make them more engaging and assist in the learning process. Some of these applications are 3D PageFlip, Macromedia Flash, and Ispring Quizmaker. 3D PageFlip is a flash flipbook application used to transform PDF, Word, PowerPoint, and Excel files into flipbooks. This software enables users to create stunning 3D e-books for a more realistic experience. Macromedia Flash is software used to create various visual presentations that can interpret different media, such as videos, animations, images, and sounds. Ispring Quizmaker is an authoring tool or application used to create interactive assessment content to support the learning process.

Based on the above initial analysis, these challenges can be addressed by developing the Thermodynamics Law Electronic Book Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker Applications.

b. Objective Analysis

The objective analysis was conducted to determine the purpose of developing the Thermodynamics Law Electronic Book Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker Applications. The purpose of this research was to s upport effective learning

through the utilization of electronic book learning media. Learning media, in itself, is a tool used to achieve effective communication and interaction between professors and students.

c. Student Analysis

Student analysis was performed to outline the development goals of this electronic book. This thermodynamics book is subjected to the fourth-semester students majoring in Physics Education at the Faculty of Tarbiyah and Teaching, State Islamic University Alauddin Makassar, who have undertaken the thermodynamics course programming.

Based on the researcher's findings during the teaching process, students who used electronic books as an additional learning resource tended to find it monotonous. This is often due to factors such as uninteresting appearance with common layout design. Students would be more engaged with electronic books featuring appealing layout designs, along with several features from applications like 3D Pageflip, Macromedia Flash, and Ispring Quizmaker, which bring additional features like videos and interactive quizzes to the electronic book. Thus, utilizing engaging learning media can enhance student motivation during the learning process.

d. Content Analysis

Content analysis was conducted to determine the specific aspects of the thermodynamics law material that can be incorporated into the electronic book. Based on this content analysis, several sub-topics are identified for inclusion in the electronic book. These include ideal gases, the zeroth law of thermodynamics, the first law of thermodynamics, and the second law of thermodynamics.

e. Final Concept Analysis

The final concept analysis was carried out to establish a fundamental concept framework that would be employed in the process of developing the physics electronic book on thermodynamics law, based on the preceding analyses.

In this phase, a concept was developed aligned with the instructional book referring to the thermodynamics course. The book would be divided into three chapters covering the thermodynamics law material. This content would then be converted into the 3D Pageflip application, giving the book a three-dimensional appearance akin to a conventional book. This conversion would also allow the book to provide access to instructional videos relevant to its content. The book would also feature interactive media created using the Macromedia Flash application, as well as evaluation features in the form of interactive quizzes using the Ispring Quizmaker application.

2. Design Phase Description

In this phase, the electronic book's design was generated. The design phase aimed to create the electronic book that would be developed while considering the outcomes of the definition phase.

The steps taken in this phase included selecting the electronic book format and initiating the initial electronic book design. These steps are detailed as follows:

a. Format Selection

The selection of the format was done by determining and choosing the type of format used in the electronic book. Format selection was based on considerations that encompass format, layout, font style, size, spacing, and accuracy.

b. Initial Design

In the electronic book design, the 3D Pageflip application plays a pivotal role in the development process. With numerous available features, the 3D Pageflip application allows for dynamic changes to the book's appearance similar to a physical book with a three-dimensional appearance. Additionally, the electronic book is enhanced with features that allow access to videos, which provide more in-depth conceptual explanations related to the material.

Another feature available in the 3D Pageflip application allows flash files to be embedded into the electronic book. These flash files are created using the Macromedia Flash application and contain concise material explanations found in the electronic book. The flash feature will be transformed into interactive media, offering brief explanations of the material, thereby providing users with an understanding of the content presented in the book.

In the creation of the electronic book, an evaluation feature was provided as well, using Ispring Quizmaker, situated at the end of each chapter. This feature enables users of the electronic book to practice answering questions related to the material. The questions are designed to be engaging, and after users respond, their answers are verified as correct or incorrect, accompanied by more detailed explanations of the answers. Upon completion of the questions, users can view the number of correct and incorrect answers.

With the aforementioned initial design, the designed electronic book was then subjected to limited testing with research subjects and validated by two validators. A validation sheet for the electronic book was included. This validation process was conducted to determine the suitability of the electronic book for further testing phases. The validation of the electronic book focused on four main aspects: content suitability, presentation suitability, language, and graphic suitability. The results of the electronic book in the initial design are referred to as Prototype I.

The electronic book that has been created and developed was then evaluated by experts/validators, and this activity was considered as Prototype Validation I. Additionally, the results of validation along with the suggestions and critiques from the validators was used as a reference for revising the development of the electronic book. The outcome of the initial review was referred to as

Prototype I, and the modified outcome of Prototype I (initial) is referred to as Prototype II (final).

As for the results of the development of electronic books:

1. Cover

Figure 2. Cover electronic books

2. Preface and table of contents

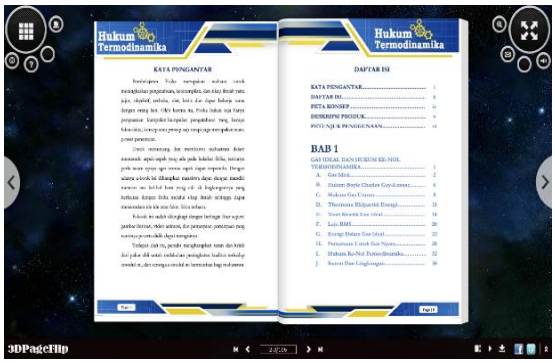

Figure 3. Table of contents electronic books

3. Chapter view

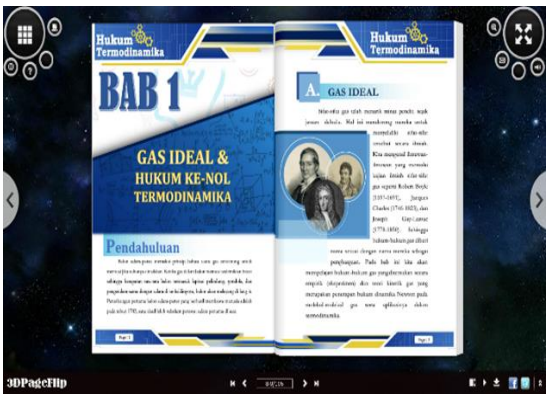

Figure 4. Chapter view electronic books

4. Video feature display

Figure 5. Video feature display

5. Layout

Figure 6. Layout electronic books

6. Evaluation feature

Figure 7. Evaluation feature electronic books

3. Development Phase Description

a. Expert Validation

Validation is carried out by two expert validators. The results of this validation determined the suitability of the electronic

book for use in the learning process. This assessment is typically presented in the form of small notes outlining improvements, opinions, and suggestions provided by the validators.

Table 3. Validation results of electronic book (protype II) on aspects

Item		V	Description
Aspects of content	4	0,67	Valid
Aspects of presentation	4,25	0,70	Valid
Language Aspect	4	0,67	Valid
Aspects of graphics	4,12	0,68	Valid
Average	4,09	0,68	Valid

Based on the analysis results in the table above, the average validity score for the Physics Electronic Book on Thermodynamics Law Using 3D Pageflip, Macromedia Flash, and Inspiring Quiz Maker is 0.68. This score was categorized as "valid" as it is within the range of 0.4-0.8. Therefore, considering all aspects, the developed Physics Electronic Book on Thermodynamics Law Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker has met the validity criteria.

b. Product Testing

1. Practicality Analysis of the Electronic Book

a) Analysis of Implementation Observation

On Wednesday, August 27, 2022, a small-scale trial was conducted with students from the Physics Education department of the 2022 cohort. The trial took place during one offline class session. The trial involved 35 students from the 2022 cohort of the Physics Education department. To observe the implementation of the learning process using the electronic book, three observers were assigned. During the trial session, the researcher also distributed observation sheets to the students to gauge their response levels while using the Physics Electronic Book on Thermodynamics Law Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker, as recorded on the distributed observation sheets.

Table 4. Recapitulation of observation data results

Range	F	%	Classification
X > 51	33	94	Very good
42 < X 51	2	6	Good
33 < X 42	0	0	Adequate
24 < X 33	0	0	Poor
X < 24	0	0	Very poor
Total	35	100	

After analyzing the data obtained from student observations and presented in a table, it can be seen that almost all of the students' responses can be categorized as "very good" and and the rest 6% was in "good" category.

According to Arsyad (2007) theory, if 70% of all test subjects answer with the classification "good" or "very good," or if the average score falls into the category "good", it is considered positive. Then based on the data analysis, it can be known that the students considered the electronic book as practical.

b) Analysis of Instructor Responses

The summary of instructor responses to the Physics Electronic Book on Thermodynamics Law Using 3D Pageflip,

Macromedia Flash, and Ispring Quizmaker is presented in the following table.

Table 5. Recapitulation of lecturer response questionnaire data results

Range	F	%	Classification
x > 51,94	0	0	Very good
38,98 < x≤ 51,94	1	100	Good
26,02 < x ≤ 38,98	0	0	Adequate
13,06 < x ≤ 26,02	0	0	Poor
x ≤ 13,06	0	0	Very poor
Total	1	100	

Based on the table and the information provided, the survey results indicate that the response of instructors to the electronic book, as calculated from the score data within the range of 1 to 4, falls within the range of 38.98 <x<51.94, obtained from the Thermodynamics course instructor. Consequently, it can be concluded that the respondent found the Physics Electronic Book on Thermodynamics Law Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker to be practical.

c) c) Analysis of Student Responses

The questionnaire sheets regarding student responses to the electronic book were completed by students using a rating scale of 1 to 4, resulting in the following data:

Table 6. Recapitulation of student's response questionnaire data results

Range	F	%	Classification
X > 27,2	17	49	Very good
22,4 < X 27,2	14	40	Good
17,6 < X 22,4	4	11	Adequate
12,8 < X 17,6	0	0	Poor
X < 12,8	0	0	Very poor
Total	**35**	100	

Based on the table, it can be observed that the analysis of the calculated scores for each statement item in the student response questionnaire, completed by 35 students, shows that 17 students provided a very good response with a percentage of 49%, 14 students provided a good response with a percentage of 40%, and 4 students provided a fairly good response with a percentage of 11%. Therefore, it can be concluded that the majority of students responded positively to the developed electronic book.

2. Effectiveness Analysis of the Electronic Book

After the Electronic Book of Physics "Laws of Thermodynamics" Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker was used, a learning outcome test was conducted to determine the level of effectiveness of using the electronic book. The learning outcome data can be presented as follows:

Table 7. Frequency distribution of learning outcome test

Xi	Fi
85	6
80	13
75	10
65	1
60	3
55	2
Total	35

Based on Table 7, the data was then analyzed using descriptive analysis. The results of the descriptive analysis can be seen in the following table:

Table 8. Descriptive analysis data of learning outcome test

Parameter	Value
N	35
Minimum Value	55
Maximum Value	85
Sum	2655
Mean	75.8571
Standard Deviation	8.53072
Variance	72.773
T Table	1.690
T Calculated	7.594

Based on Table 8, it is known that the maximum or highest score obtained by students after using the Electronic Physics Law Thermodynamics Book Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is 85, while the minimum or lowest score obtained by students in the learning outcome test is 55. The result of the analysis shows that the average learning outcome score using the Electronic Physics Law Thermodynamics Book with 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is 75.8571, where the total score of all students is divided by the number of students. To determine the measure that represents the level of spread of the average student scores, the formula for standard deviation is used, resulting in a value of 8.53072.

The table and frequency diagram of the student learning outcome test regarding the effectiveness level of the Electronic Physics Law Thermodynamics Book Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker are presented below.

Table 9. Analysis of learning outcome completeness

Value	F	%	Category
75	29	83	Successful
<75	6	17	Not Successful
Total	35	100	

Based on the table, it is observed that the distribution of learning outcomes proficiency using the Electronic Physics Law Thermodynamics Book with 3D Pageflip, Macromedia Flash, and Ispring Quizmaker falls within the "proficient" category with a percentage of 83%. After the proficiency of student learning outcomes is analyzed using descriptive analysis, the data is further processed with a one-sample t-test statistical analysis using the IBM SPSS Statistics 26 application. The one-sample t-test analysis can be seen in the following table:

Table 10. Category of student learning outcome mastery

Learning outcome test			
	Test Value = 65		
	T	df	Sig. (2-tailed)
Learning Outcome Test	7,594	34	.0001

The Electronic Physics Law Thermodynamics Book using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker can be considered effective when the significant value of the one-sample t-test is smaller than 0.05 or when the calculated t-value (T_{count}) is greater than the tabulated t-value (T_{table}). It is known that the obtained T_{count} is 7.594, while the tabulated T_{table} is 1.690. Based on the

comparison of the significant values where $T_{count} > T_{table}$, it indicates that the usage of the Electronic Physics Law Thermodynamics Book with 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is considered effective.

The effectiveness of using the Electronic Physics Law Thermodynamics Book with 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is supported by the significant level analysis in the one-sample t-test (table 4.11), which is 0.0001. This significant value is smaller than 0.05 (sig. < 0.05), so it can be concluded that the Electronic Physics Law Thermodynamics Book using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is significantly effective in improving students' learning outcomes.

B. Discussion

1. Development steps of the electronic book

The implementation of this research was limited only to the development stage, considering time constraints, cost, and effort. The stages involved in the procedure of this development research are the definition stage (define), the planning stage (design), and the development stage (development). In this research, the dissemination stage (dissemination) was not conducted as the researcher only performed feasibility, effectiveness, and practicality testing of the instructional media in the form of an electronic book.

The first stage in developing this electronic book is referred to as the definition stage (define). In this stage, several steps were conducted, including initial and final analysis, goal analysis, student analysis, material analysis, and final analysis. These analyses were conducted to determine the requirements for the development of the electronic book.

In the goal analysis, the objective of developing the electronic book was to support effective learning through the use of instructional media in the form of an electronic book. In the student analysis, the target development audience for this electronic book is 4th-semester students of the Physics Education Department, Class of 2020, Faculty of Tarbiyah and Teaching at Alauddin Makassar State Islamic University, who have programmed the thermodynamics course. In the material analysis, the components of the thermodynamics law material that can be included in the electronic book were identified. In the final concept analysis, an overview of the main concepts used in the development of the electronic book is obtained, considering the predetermined analyses.

The second stage was known as the planning stage (design), which involved the process of composing the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker Applications. The developed electronic book consisted of several components such as the electronic book cover, the book's initial pages, and the content of the

book, which is divided into three chapters containing materials and sequences of thermodynamics law concepts. The developed electronic book also features various elements, such as explanatory videos embedded in the book to aid in understanding the material. Additionally, there was interactive content in the form of brief explanations presented as bullet points within the book, created using Macromedia Flash. Furthermore, the electronic book included evaluation features provided by Ispring Quizmaker, allowing users to access and answer questions within the electronic book.

The third stage was referred to as the development stage (development), during which the first design of the research product (prototype I) was validated by two validators. The developed book was evaluated using an electronic validation guide containing four aspects subject to evaluation. Once the validation process is completed and the book is deemed valid, the next step is to perform a limited trial of the product. This product trial was carried out with 35 research subjects, who were students from of Physics Education Department cohort, in-room R4.01, Faculty of Tarbiyah and Teaching, Alauddin Makassar State Islamic University. The trial was conducted to determine the level of practicality and effectiveness of using the electronic book.

2. Validity Level of the Electronic Book

The use of the electronic book and instruments was considered to be in the valid category when validator and practitioner assessments prove that the development of these e-book was based on sound theory and possesses internal consistency, which means there is a connection between the different parts of the developed tool. A learning media product is considered valid if the average expert assessment scores, in terms of both content and media, meet the minimum criteria of "Good."

Based on the analysis of electronic book validation results using Aiken's V index analysis on the final research product (prototype II), an average assessment score of V=0.68 was obtained for all aspects, indicating that it falls within the valid category. Therefore, it can be concluded that both validators confirmed that the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker is valid and suitable for the learning process.

3. Practicality Level of the Electronic Book

The practicality level of the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker was determined based on student observation scores, and student and teacher response questionnaires regarding the book's usage. According to the research results obtained from distributing observation sheets regarding the use of the electronic book, students and teachers reported that the components of the learning process were well-implemented during the use of the electronic

book. Both students and teachers also provided positive responses to the developed book, categorizing it as good. This indicates that the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker has been well-received as it has met the fundamental principles of practicality.

4. Effectiveness of the Electronic Book

The effectiveness level of the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker can be determined from the learning outcomes test after using this guide. The test consisted of 20 multiple-choice questions. Based on the frequency distribution table, 30 students achieved passing scores, while 5 students scored below the passing criteria. The effectiveness of the electronic book on learning outcomes can be demonstrated statistically. Based on the calculation results using a one-sample t-test, $T_{count} > T_{table}$, meaning that the use of the electronic book is considered effective.

Based on the criteria, final scores are considered "good" if students' final scores reach classical mastery or at least 80% of the total number of students in the class achieve the minimum mastery criteria. A class is deemed to have achieved mastery (classical mastery) if at least 80% of the students in the class have achieved mastery.

Therefore, based on the results of the analysis obtained and the existing theories as explained by Ikbal et al. (2020); Pilendia (2020); Sriyanto & Sukarelawan (2021) regarding the learning module then, it can be concluded that the Electronic Book of Physics Laws of Thermodynamics Using 3D Pageflip, Macromedia Flash, and Ispring Quizmaker are effective for use.

Referring to research conducted by Indriana & Rohmadi (2021); Jafar (2017) who raised the research title "3D E-Book Development Based on 3D Pageflip Application". E-books integrated with the Pageflip 3D application make it look more real. The 3D E-Book based on the 3D PageFlip application on the Motion System material integrated with Islamic class XI was assessed for validity by material experts with valid categories by validators I and II with an average percentage score of 80%. The validity of 3D e-books from validators I and II media experts is with an average percentage score of 76.6% with valid criteria. From validators I and II Islamic integration experts obtained an average score of 92.5% with a valid category.

Finally, this research can be as a reference to the development of an e-book to obtain the validity, effectiveness, and practicality of this development product. For students, the products produced in this research and development can be an alternative learning resource for students to understand the material of the law of thermodynamics. Meanwhile, for lecturers, the products produced in this research and development can help or facilitate the learning process to

achieve learning objectives, especially on the material of the law of thermodynamics.

IV. CONCLUSION AND SUGGESTION

This research is a development research ratgeting an electronic book the law of thermodynamics using 3D page flip, Macromedia flash, and ispring quiz maker applications as a product to be used in physics class. The steps of developing the electronic book involved 4 main stages, namely the definition stage (define), the design stage (design), the development stage (develop), and the dissemination stage (disseminate). However, in its implementation, it only reaches the stage of the development stage (develop).

The level of validity of the physics electronic book of the law of thermodynamics using 3D page flip, Macromedia flash, and ispring quiz maker applications obtained an aiken index value of V = 0.68 which is in the high validity category which means it is feasible to use.

The level of practicality of using the physics electronic book of the law of thermodynamics using 3D page flip, Macromedia flash and ispring quiz maker applications obtained from the results of the recapitulation of student observation sheet data, student and lecturer response questionnaires stated that the electronic book is practical to use.

The level of effectiveness of using the physics electronic book of the law of thermodynamics using 3D page flip, Macromedia flash, and spring quiz maker applications seen from the analysis of learning outcomes tests shows a percentage of completeness of 83% so that electronic books are said to be effective to use.

The suggestions that can be given for further development of this electronic book include developing an electronic book using applications 3D pageflip, macromedia flash, and ispring quizmaker for other topics in physics learning.

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