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Flipbook-Based E-Book Learning Media: Strengthening Literacy in Education Early Childhood

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Abstract: This research is based on the importance of innovative and communicative learning media such as e-books in the use of technology in the future to improve students' literacy skills because instilling the habit of reading fondly from an early age is still minimal. The purpose of this study was to produce a proper and effective e-book for improving student learning outcomes at Medan Methodist 5 Kindergarten. The development procedure used in this study is the development model from Borg and Gall and the instructional design step from Dick and Carey which is divided into 4 stages including the needs analysis stage, the product design stage, the validation and evaluation stage, and the final product stage. To see the effectiveness of the E-book, it can be analyzed through the normality test, homogeneity test, and hypothesis testing. Product validation results show a score percentage of 92.94% for material expert validation, 91.76% for media expert validation, 95.55% for design expert validation, and 98.26% for student response results. The results of the normality and homogeneity tests show that the research data has been declared normal and homogeneous. The results of the hypothesis test show that the value of t count is 2.37 and the value of t table is 1.66, where t count > t table. The results of this study indicate that flipbook-based e-books are feasible and effective in improving literacy skills and student learning outcomes in Medan Methodist 5 Kindergarten.

Keywords: e-book; flipbook; learning media

1. INTRODUCTION

Literacy ability is the ability to understand and utilize scientific knowledge as a solution to problems in everyday life, as well as to acquire new knowledge related to scientific phenomena [1]. Literacy skills focus on developing students' knowledge in applying science concepts significantly, and thoroughly, and being able to make decisions to overcome problems related to students' daily lives [2].

The cause of the low ability of scientific literacy in students is that the science learning process does not provide opportunities for students to develop critical thinking skills Science learning is still characterized by memorizing material and limited use of learning media. Mastery of literacy skills has benefits in developing students' cognitive abilities so that they can process information effectively and efficiently. There is a need for innovations in the learning process in children [3]. Early childhood is in the age range 0-6 years. This age range is a very good period for stimulating children. This time is often referred to as the window of opportunity. This period is referred to as a critical period where if the child does not get the right stimulus, such as the learning process or practice, the child can experience difficulties in his developmental stages at a later age [4].

Learning media is a means to assist in teaching and learning activities and influences learning situations, learning conditions, and the learning environment developed by the teacher [5]. One of the components that need to be considered in learning design is the selection or development of learning media that is suitable and by the material to be conveyed and attracts students' interest in the learning process. Learning media is very important to be applied in the learning process in the classroom because it can trigger the enthusiasm of students in understanding the subject matter provided by the teacher and the learning process will become more varied and not make students bored.

According to the Regulation of the Minister of Education and Culture (Permendikbud) of the Republic of Indonesia Number 137 of 2014 concerning National Standards for Early Childhood Education there are six aspects of development in early childhood that need to be achieved, one of which is the language aspect, the literacy sub-aspect (Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 137 of 2014 concerning National Standards for Early Childhood Education, 2014). Therefore, it is necessary to provide a stimulus that is responsive to early childhood literacy development and to develop reading, writing, and arithmetic skills according to their stage and development [6]. Some experts recommend that a curriculum that can integrate technology and authentic experiences can support early childhood participation, motivation, and knowledge of the material to be taught.

The use of this infographic e-book is declared valid to be applied in science learning [7]. But until now no one has published the test of flipbook-based e-books as a strategy to strengthen literacy skills in early childhood education.

In this regard, it is necessary to investigate the feasibility and effectiveness of flipbook-based e-books in the literacy skills of early childhood education. This research is important because, through the use of smartphones or computers, teachers can create learning media that are creative and the needs and characteristics of users (students). The e-book will be developed in line with the support from the teacher's acceptance attitude. The teachers also agreed on the use of e-books as a solution in increasing students' literacy levels. Next, an experiment will be carried out to test the feasibility and effectiveness of developing flipbook-based e-books as a

strategy to strengthen literacy skills in early childhood education.

1.1 Early Childhood Education Literacy

Literacy is a complex process that builds on previous knowledge, culture, and experiences to develop new knowledge and deeper understanding. The term literacy is defined as the ability to understand linguistic signs or literacy skills. In its original sense, literacy was conceptualized in terms of the primary domain, namely the primary reading and writing domain. From its original scope, literacy is a condition of literacy, literac,y and numeracy. Literacy terminology in the field of language is also developing [8].

Based on the descriptions and opinions of the experts above, it can be concluded that literacy is not only reading and writing, but also includes other fields, such as economics, mathematics, science, society, environment, finance, and even ethics. However, the most important thing for literacy is that one must be illiterate or, more simply, know how to read and write.

Children who learn to read from an early age tend to do better than at school (Dhieni, Nurbiana, et al. 2007). This is reinforced that one of the aspects that must be developed in childhood is the ability to read and write (Moleong, 2005). So the development of reading and writing skills for early childhood can be carried out as long as it is within the limits of preschool rules and by the characteristics of the child, especially learning through play to teach reading skills to preschoolers, the teacher needs to know the stages of children's reading development.

The development of reading skills in children aged 4-5 years goes through 5 stages, namely as follows: (a) Fantasy Stage (Magical Stage), (b) Self-Concept Stage, (c) Image Reading Stage (Bridging) Reading Stage), (d) Reading Introduction Stage (Take-off Reader Stage), and (e) Fluent Reading Stage (Independent Reader Satge) [9].

According to Clay and Ferguson [12], literacy consists of several components including (1) Early literacy. In the Indonesian context, early literacy is a basic effort to acquire abilities at a later stage. Early literacy is listening, hearing, and communicating through images and environmental interactions; (2) Basic literacy. Basic literacy is the ability to speak, listen, write, and do, arithmetic related to the ability to describe and communicate based on personal conclusions; (3) Library literacy. Library literacy is the ability to understand fiction and non-fiction as well as the ability to understand writing or research work; (4) Media literacy. Media literacy is the ability to understand and know the form and use of the media in the form of print, electronic, and other media; (5) Technology literacy. Technological literacy is the ability to understand various software and hardware technologies and understand the purpose of their use, and (6) Visual literacy Visual literacy is the ability to understand the information in the form of visuals and can be communicated in the form of reading.1.2 Hakikat Elektronic Book (E-book).

E-books, also known as digital books, are publications consisting of text, images, and sound and are published in digital form that can be read on computers and other electronic devices. Digital books are usually electronic versions of printed books, but it is not uncommon for a book to only be published in digital form without a printed version.

Cumaoglu, Sacici, & Torun [13] say that an e-book is Any kind of electronic text regardless of size or composition (digital objects), but excluding journal publications, available electronically (or optically) for any device (handheld or desk) included in a screen/monitor.

E-books have two interesting features from an educational point of view. First, e-book text is hypermedia. Readers may use the included hyperlinks to jump to related topics, and the text may contain graphic, audio, and video elements. Second, the content of e-books can be easily changed to suit the needs of readers by uploading new books and removing unwanted text. Teachers can compile a collection of information on their computers and ask students to download it if needed [14].

Electronic books function as learning media that can increase learning productivity and as a tool to help educators in making learning time more effective and efficient. Based on what was conveyed by Fatah [15] some of the functions of e-books as learning media are that they can increase learning productivity. The learning process is inseparable from learning resources in the form of reading books such as e-books. E-books also have unlimited references, so you don't get stuck on one learning resource. E-books help educators streamline and streamline learning time. Educators have to carry a lot of reading books in a heavy physical form. E-books in the form of digital data are very easy to carry in many files, so educators don't run out of learning materials for students.

E-books can reduce the burden on educators in presenting information, information provided through e-books is more concrete and allows individual learning because it does not depend on the information provided by educators, students can learn according to their needs, abilities, talents, and interests, learning more directed, can provide direct knowledge of the results of reading, allows the provision of broader information to students. Based on hammercomputer.com, the function of e-books is like other books, whose main function is as a learning medium (to seek knowledge from e-books or share knowledge into e-books). You can get a lot of knowledge from e-books that have been made by many people.

1.3 The Nature of Flipbooks

Electronic modules in the form of flipbooks are learning aids designed to achieve certain competencies which contain material, methods, and learning limitations as well as ways to measure learning outcomes that are structured and presented by utilizing information and communication technology in the form of the internet and electronic devices. 16].

Flipbook is a book published in digital format containing writing, and pictures, which can be read through a computer or other digital device. Digital books have many benefits. As a teacher, digital books are media that can be applied to learning which can certainly attract students' interest in learning.

Exposure to Suryani, Nunuk, Setiawan, and Putria [17] that the e-book developed in this study is based on a flipbook maker, which is a software that can change the appearance of books or other teaching materials into a digital book in the form of turning pages. This program is designed to convert packaging files from PDF, PowerPoint, Word, and Excel formats to be like a booktoo produce a more attractive appearance and can be published digitally. Various features such as zoom to enlarge view, word search, bookmarks, and thumbnails are available in this application [18].

This Flipbook teaching material was innovated using the Flip PDF Professional Pro software. Flip PDF Professional is

software that has editing functions and various interesting features and can create book pages that can be flipped [19]. Through Flip PDF Professional, books can be created that are more interesting because this software is equipped with various features such as hyperlinks, images, videos, and YouTube, and has various design templates, backgrounds, control buttons, and navigation bars. Online.flipingbok.com software is software that can be used to support learning activities because in this software you can add videos, pictures, moving animations, and audio which can become interactive media that can attract students' interest so that they can make the teaching and learning process become not monotonous [20].

Figure 1. Display of Flipbook e-books

Figure 2. Learning with the Flipbook e-book

1.4 Development of Flipbook-Based E-books in Improving Literacy in Early Childhood Education

E-book development is an attempt to improve the learning process, learning outcomes, and quality of education. In meeting the demands in this technological era, the development of teaching media must continue to be carried out to meet educational needs that continue to develop in line with the rapid pace of technology. The existence of relevant learning materials will be a necessity for every level of education to facilitate the delivery of information to students/students so that it is easy to understand and understand and that learning does not get boring quickly.

Flipbook in this case will function as a tool to clarify the message conveyed by the teacher. In addition, flipbooks also function for individual learning so that students will think broadly and be able to solve a problem in the learning process, as emphasized that the flipbook used has a position as an aid in the process of teaching and learning activities, namely as a teaching aid for teachers/lecturers (teaching aids).

Increasing literacy in early childhood education is a conscious and planned effort to prepare students to have good literacy skills, and flipbooks are one of the teaching materials to make it easier for students to learn independently, but most teaching materials are only in the form of printed modules so they cannot stimulate students. teach through video shows and animations. With the development of advancements in the field of technology, researchers have developed flipbook-based e-books to improve literacy in early childhood education.

The research problem is formulated as follows: (1) Is the developed flipbook-based e-book learning media suitable for use as a strategy to strengthen literacy skills in early childhood education; and (2) Is the developed flipbook-based e-book learning media used effectively to improve literacy skills in early childhood education?

2. METHOD

This type of research is a type of development research, commonly called development (Research & Development). Development research is research that aims to produce a product through the development process [21]. According to Sugiyono [22] research and development is research that

produces products and also other activities, namely testing the effectiveness of the products to be produced. To be able to produce a certain product, namely research that needs analysis in nature and to test the effectiveness of the product so that it can function to a large audience, research must be carried out to test the effectiveness of the product that has been produced. According to Borg and Gall [23], development research is a process used to develop and validate products.

To produce an e-book development product based on the flipbook application for Methodist 5 Medan Kindergarten students, the development steps from Borg and Gall and the instructional design from Dick and Carey were used.

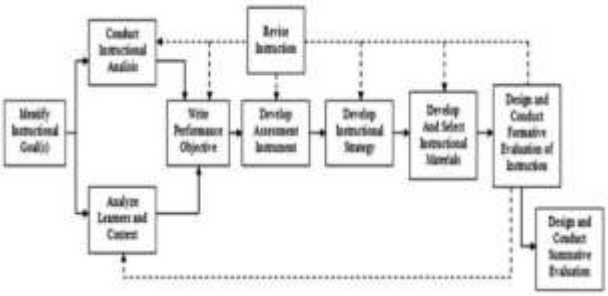

Figure 3. Dick and Carey's Instructional Design Model

This research was conducted at Medan Methodist 5 Kindergarten, Jln. Lake Semayang, Sei Agul Kec. West Medan, Medan City, North Sumatra Province. In Kindergarten Class B for the 2022/2023 Academic Year. The subjects of this study were 32 students of Medan Methodist 5 Kindergarten as the experimental class and 32 students of Medan Sriwijaya Kindergarten as the control class. The selection of the sample in this study used a purposive sampling technique, namely the determination of the research sample based on the consideration of the researcher who considered the desired research elements already exist in the members of the sample taken and suggestions from the subject teacher.

The development procedure used in this study adapts the Dick and Carey instructional development steps and the Borg and Gall product development steps with the following development steps:

1. Needs Analysis Stage: (1) Assess the objectives of the product to be developed, namely in the form of an e-book based on a flipbook application; and (2) Conduct curriculum analysis in determining products that are in bye demand of the curriculum.
2. Product Design Stage: (1) Making drawings or charts to be used as a guide in assessing and making products; and (2) Determine the concept of an e-book based on the flipbook application, the concept of delivering and organizing material, evaluation, pictures, and e-book storyboards.
3. Validation and Evaluation Stage: (1) Validate material experts, media experts, and design experts. After being validated by an expert/expert in their field; and (2) If the validators no longer provide input for improving the e-book, then this is a sign that the e-book is suitable for use; (3) Conducting product trials to Medan Methodist 5 Kindergarten students which include individual trials, small group trials, and field trials; and (4) The results of assessments and contributions from several experts, practitioners, and potential users become the basis for revising the product.
4. Final Product Stage. Producing the final product in the form of an e-book flipbook which has been revised based on criticism and suggestions from the validation and evaluation stages. The final product is ready to be produced and used as learning media

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and student responses. The respondents assessed the quality of the e-book with the provisions of the research criteria in Table 1 below:

Table 1. Questionnaire Sheet Table

Criteria	Score
Very good	5
Good	4
Enough	3
Not good	2
Very bad	1

(Source: Arikunto [24])

Table 2. Expert Validation Questionnaire Assessment Qualification Criteria, and Student Response Instruments to flipbook-based e-books media

Percentage of Achievement Level	Eligibility	Description
80% ≤ X < 100%	Very Valid	No Need Revision
60% ≤ X < 79%	Valid	No Need Revision
40% ≤ X < 59%	Valid Partial	Partial Revision
20% ≤ X < 39 %	Less Valid	Revision
0% ≤ X < 19%	Very Invalid	Revision

(Source: Arikunto [25])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
x_i : Score the highest answer
P : Presentation of eligibility level

The feasibility and effectiveness criteria achieved for use in media development are described in the following table.

Table 3. Media Eligibility Criteria

No	Score in Percentage (%)	Eligibility Category
1	80 ≤ P < 100	Very Eligible
2	60 ≤ P < 80	Eligible
3	40 ≤ P < 60	Adequate
4	21 ≤ P < 40	Inadequate
5	0 ≤ P < 21	Very Inadequate

Flipbook-based e-book learning media improves literacy skills that are developed to get a positive response from students if the percentage obtained from the student response questionnaire reaches a score of ≥ 60%, then the learning media is categorized as feasible and effective.

Product Effectiveness Test Data Analysis Techniques. The effectiveness test aims to obtain information about whether or not the product development being tested is effective in the learning process.

Based on the formulation of the first problem, namely whether the developed flipbook-based e-book learning media is feasible to use. Flipbook-based e-book learning media can be said to be feasible to use based on the results obtained from expert validation regarding suggestions and improvements related to the developed flipbook-based e-book learning media. The next step was to do an individual trial of 3 students, and a small group test of 9 students to find out the response to the flipbook-based e-book learning media that was made.

Based on the formulation of the next problem, namely whether the developed flipbook-based e-book learning media is effective for increasing literacy. Learning is said to be effective if there are significant differences in learning outcomes between classes that are given treatment in classes that are not given treatment. The hypothesis uses the mean difference test or t-test. The t-test is the average difference to find out whether there is a significant difference at the 0.05 significance level with Microsoft Excel 19

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The hypothesis formulated is:

Ho: μ1 = μ2 (there is no mean difference between the treated and untreated classes).

Ha : μ1 ≠ μ2 (there is an average difference between the treated and untreated classes).

Decision-making Ho is accepted if the significance is greater than 0.05. The following is the calculation using the 2nd difference test for the population average according to Sudjana [26]:

$$t = \frac{\bar{X}1 - \bar{X}2}{s\sqrt{\frac{1}{n1} - \frac{1}{n2}}}$$

Where:

$\bar{X}1$ = total average score of the experimental class sample

$\bar{X}2$ = total average score of the control class sample

s = standard deviation

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop e-book learning media based on literacy skills flipbooks. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is as follows:

Table 4. The average percentage of the results of the assessment of flipbook-based learning media for literacy skills

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	92,94	very feasible
2.	Media Expert Validation	91,76	very feasible
	Learning Design Validation	95,55	very feasible
3.	Individual Trial	94,00	very feasible
4.	Small Group Trial	95,66	very feasible
5.	Field Testing	98,26	very feasible
The average		94,70	very feasible

Flipbook-based e-book learning media shows that: Material Expert Validation is 92.94% very feasible category; Media Expert Validation of 91.76% very feasible category, Learning Design Validation of 95.55% very feasible category; Individual Trial of 94.00% very feasible category, Small Group Trial of 95.66% very feasible category; Field trials of 98.26% very feasible category, an average of 94.70% very feasible category. which means the use of flipbook-based e-book learning media meets the needs of students

Based on the learning outcomes of students who were taught using the e-book at Medan Methodist 5 Kindergarten, the lowest score was 55 and the highest score was 100. The mean score was 81.25, mode 80, median 79.5, and standard deviation 13.50. To see student scores, class intervals are used, namely scores between absolute frequencies (the number of students who have learning achievement scores) and relative frequencies (the number percent of learning achievement scores). A complete description of learning outcomes using e-books is shown in Table 5.

Table 5. Frequency Distribution of Experiment Class Student Learning Outcomes

Class	Class Intervals	F. Absolute	F. Relative %
1	55 – 62	4	12,5
2	63 – 70	6	18,75
3	71 – 78	1	3,12
4	79 – 86	8	25
5	87 – 94	5	15,62
6	95 – 100	8	25
	Total	32	100

Based on the learning outcomes of students who were taught using printed books in TK Sriwijaya Medan, the lowest score was 20 and the highest score was 100. The mean score was 69.53, mode 88, median 70.5, and standard deviation 24.37. A complete description of learning outcomes using printed books is shown in Table 6:

Table 6. Frequency Distribution of Control Class Student Learning Outcomes

Class	Class Intervals	F. Absolute	F. Relative %
1	20 – 33	3	9,38
2	34 - 47	3	9,38
3	48 - 61	5	15,62
4	62 – 74	3	9,38
5	75 – 87	8	25
6	88 - 100	10	31,25
Total		32	100

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 7 below:

Table 7. Summary of Data Normality Test with Liliefors

No	Data	Class	L_{count}	L_{table}	Conclusion
1	Pretest	Experiment	0,09	0,16	Normal
2	Pretest	Control	0,06	0,16	Normal
3	Posttest	Experiment	0,08	0,16	Normal
4	Posttest	Control	0,11	0,16	Normal

Based on Table 7, it can be seen that the results of the pretest data normality test in the experimental class obtained $L_{count} < L_{table}$ (0.097 < 0.16) and in the control class also obtained $L_{count} < L_{table}$ (0.060 < 0.16). The same thing also happened to the posttest data normality test results for the experimental class with $L_{count} < L_{table}$ (0.082 < 0.16) and in the control class obtained $L_{count} < L_{table}$ (0.105 < 0.16). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes are normally distributed at the significance level $\alpha = 0{,}05$

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{Varian\ terbesar}{Varian\ terkecil} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 8 below:

Table 8. Summary of Data Homogeneity Test with Fisher's Test

No.	Data	Class	F_{count}	F_{table}	Conclusion
1	Pretest	Experiment	0,41	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	0,31	1,83	Homogeneous
4	Posttest	Control			

Based on Table 8, it can be seen that the results of the calculation of the pretest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained $F_{count} < F_{table}$ (0.41 < 1.83), it can be concluded that the pretest data in the two classes have the same or homogeneous variance. Then in the posttest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained $F_{count} < F_{table}$ (0.31 < 1.83), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

The following is the formulation of this statistical hypothesis, namely:
Ho : μA1 ≤ μA2
Ha : μA1 > μA2

Information:
μA1 : the average learning outcomes of students taught using flipbook-based e-book learning media increase literacy
μA2 : the average student learning outcomes taught without using flipbook-based e-book learning media increase literacy

The t-test is used as a hypothesis-testing tool because the research data is normally distributed and homogeneous. The hypothesis in the research is:
Ho: Flipbook-based e-book learning media is not effective in increasing literacy.
Ha: Flipbook-based e-book learning media improves literacy

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there is a significant difference between learning outcomes in classes taught using e-books (experimental class) and learning outcomes taught using printed books (control class) with the provision that if $t_{count} > t_{table}$ then H0 is rejected and Ha accepted.

The calculation results obtained t_{count} = 2.37 and t_{table} = 1.66 so that $t_{count} > t_{table}$ at a significant level α = 0.05. Based on these results, that H0 is rejected and Ha is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using e-books have differences from the learning outcomes of students who are taught with printed books and are declared tested for feasibility.

To test the effectiveness of the e-book being developed, the following calculations are performed:

$$X = \frac{total\ score\ obtained}{total\ ideal\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{27}{32}\ x\ 100\%$$
$$= 84{,}37\%$$

The value of the effectiveness of the Print Module can be seen as follows:

$$X = \frac{total\ score\ obtained}{total\ ideal\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{19}{32}\ x\ 100\%$$
$$= 59{,}37\%$$

Based on the calculation of the effectiveness test on both, the result is that the learning outcomes of students who are taught by e-books are higher than the learning outcomes of students with printed books (84.37% > 59.37%). Thus it can be concluded that e-books are more effectively used in early childhood learning at Medan Methodist 5 Kindergarten compared to using printed books at Sriwijaya Kindergarten Medan.

3.2 DISCUSSION

The product developing flipbook-based e-book learning media for early childhood learning is a product that is developed by taking into account aspects of learning and also learning principles, both design, media, and also the material or content in it. This development research is directed to produce a product in the form of flipbook-based e-book learning media for early childhood learning in Medan Methodist 5 Kindergarten to improve literacy skills and student learning outcomes as well as the competence of teachers and students in the use of information technology in today's technological era.

Research by Amrulloh [27] explains that to produce theoretically feasible media, the media must be reviewed by media experts, subject matter experts, and teachers. The

theoretical feasibility of the media is reviewed from (1) the feasibility of the material which includes the suitability of the media content with the concepts and learning objectives; and (2) media feasibility which includes media format, media quality, and suitability of the concept. (3) design feasibility which includes program design, design quality, and design concept. Based on the feasibility of these three aspects, learning media are produced that are theoretically feasible and suitable for use in the learning process.

Arsyad [28] explains that if the media is designed as an integral part of the learning process, then the assessment of the learning design also includes an assessment of the media used. The criteria provided by Walker & Hess in Arsyad's book [29] regarding reviewing learning media based on quality, namely: (1) quality of content and objectives, which include accuracy, importance, completeness, balance, interest, and suitability for student situations; (2) instructional quality, which includes providing learning opportunities, assistance for the learning, quality of motivation, instructional flexibility, quality of tests and assessments, impact on students and teachers; and (3) technical quality, which includes readability, ease of use, display quality, management, and documentation.

Based on the results of the validation that has been carried out, the e-book product is declared feasible to be continued in field trials. The developed e-book meets standards based on the standard design for the development of learning materials and learning media. For the assessment of learning material experts, a score of 92.94% was obtained which was categorized as very appropriate, for an assessment from learning media experts a score was obtained of 91.76% which was categorized as very feasible, and an assessment from learning design experts obtained a score of 95.55% which was categorized very worth it.

After the experts stated that this e-book product was very feasible to be tested in the field, field trials were carried out according to the procedure, namely individual trials, small group trials, and field trials. The score of student responses in individual trials was 94% (Very Eligible), small group trials were 95.66% (Very Eligible), and field trials were 98.26% (Very Eligible). Based on the results of the questionnaire, which were validated by material experts, media experts, and design experts and then continued with product trials, it can be concluded that e-books in early childhood learning are stated to be very suitable for use as learning media for Methodist 5 Kindergarten students in Medan.
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Testing the effectiveness of the product on the developed e-book has been carried out by comparing the average value of student learning outcomes taught using e-books with those using printed books. From the results of research data processing, there were differences in learning outcomes between students who were taught using e-books and those who used printed books (84.37% > 59.37%).

This is in line with Gonca Cumaoglu, Esra Sacici, and Kerem Torun [30] who stated that reading habits, accessing resources and material preferences change rapidly in the digital world. Changes in reading habits on a large scale have led to differentiation in resource accessibility, archiving, and the use of related technologies. So the use of e-books can be said to be effective in learning at school.

The same thing was said by Nisa [31] who stated that e-books that had been validated by product technology experts showed very valid results for use by students. This means that there is a significant difference in the average learning outcomes between the experimental class and the control class when using this e-book in early childhood education. Furthermore, Indraswari, Putri [32] also stated that the e-book developed as a result was deemed feasible to be used as an alternative learning resource in learning early childhood education.

Then Birgili, Seggie & Oğuz [33] stated that in principle the flipbook learning model asks students to study material at home before taking lessons in class. In the classroom, learning is truly more student-centered, students are allowed to be actively involved in the learning process in class. Therefore, the use of flipbook-based e-books developed in this study is effective for improving students' speaking skills in improving early childhood literacy skills. The effectiveness of flipbook learning is not only implemented for one, two, or more subjects, but for the whole school, it is very useful for today's new educational paradigm.

From Arsyad's explanation [34] about the benefits of media, it can be concluded that e-books can be called true learning media if these learning media can improve student learning outcomes. The use of e-book media allows students to more easily understand learning and master learning material, therefore this e-book media can improve student learning outcomes. From the explanation above, it can be concluded that e-book media is effective for improving student learning outcomes of Medan Methodist 5 Kindergarten. In addition, the teacher's ability to act as a motivator also greatly influences student learning outcomes because students must be motivated to be fully responsible for their learning assignments.

4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of the research on the development of e-book learning media previously described, the following conclusions can be drawn:

1. The e-book product developed for Medan Methodist 5 Kindergarten students meets the requirements and is suitable for use as a learning medium.
2. The effectiveness of the developed flipbook-based e-book is considered more effective than printed books. The results of testing the hypothesis prove that there is a significant difference between the learning outcomes of students who are taught using e-books and the learning outcomes of students who are taught using printed books.

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Utilization of Digital Marketing Tools by Small Businesses: A Case for Zimbabwe

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Abstract: A sample of one hundred small companies found in Zimbabwe was randomly selected from LinkedIn database and an online questionnaire was administered to find out the digital marketing tools and platforms they use in their organizations to market their products and/or services. Form the data that was collected it was established that WhatsApp is the most popular application when it comes to daily communications that are done B2C. B2B Communication was mostly done using the email. For promotion of different kinds of products and/or services, Facebook and owned websites were the most common platforms used. Sales transactions were mostly conducted using e-commerce websites. However, organizations that practiced online selling were few. Most of the organizations used Digital Marketing tools for marketing and promotions only, while their selling would happen offline. Other Digital Marketing tools that organizations were using include YouTube and Vimeo and LinkedIn. The small businesses indicated that they face almost similar challenges, the main one being that most of them do not have marketing departments and/or marketing experts in their organizations. The result is that their marketing activities may not be consistent. Neither are they professional enough. There is need for most of them to improve by making their marketing activities more consistent and professional, and the bulk of the managers acknowledged this.

Keywords: Digital Marketing, B2B, B2C, e-commerce, Digital Marketing Tools, SMEs

1. INTRODUCTION

Digital marketing refers to refers to various marketing activities that are carried out online and are associated with the five Ds which are digital devices, digital platforms, digital media, digital data and digital technology [1]. In this new marketing era, digital marketing has proved to be more popular than traditional marketing because it is data driven marketing. New and established businesses alike, are trying to make inroads into digital marketing. The increasing ubiquity of internet, social networking and online work means more and more people spend most of tier time online. As a result, businesses are beginning to realize that they need to follow their customers and to interact with them regularly online. Some of the modern businesses are not only interacting with customers online, but they are even selling and delivering products and/or services online. This is done by businesses with the objective of attaining defined marketing goals.

2. USE OF DIGITAL MARKETING TOOLS IN VARIOUS ACTIVITIES

Digital marketing is used for many purposes by business entities. Almost all the traditional goals of marketing activities can be fulfilled using either digital marketing, traditional marketing or both [2]. Because in digital marketing there are so many platforms, applications and sites, businesses chose those platforms where their customer personas are likely to be found most. That means businesses need to model their customers before they select digital marketing channels that they will then use to do their marketing. From the data that was collected during the research, small business managers who participated in the research had the following responses.

2.1 Use of Digital Marketing in Real Time Communication with Customers.

From the business perspective, most of their customers use WhatsApp more than any other app in their daily life. As a result, each time they want to make enquiries about products and/or services they would prefer communicating via WhatsApp. This is convenient to them as they will be having the app handy, and they will be having data that is ready for use each time they want to communicate. Thus for most business enquiries, customers prefer using WhatsApp. So businesses are quick to provide their WhatsApp numbers to customers if they are to make business easy for their customers.

Table 1. Businesses' platform preferences in real communication with customers in B2C businesses.

Platform	Number of businesses
WhatsApp	69
Websites/Blogs	1
Facebook	11
Twitter	8
Instagram	2
Email	9
TOTAL	100

Thus it can be seen from the table above that business managers prefer WhatsApp more than other marketing tools for real time communication with customers. Blogs and websites are least preferred while some would use Facebook Messenger as the app is quite familiar with customers that use Facebook in their daily life.

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For B2B, the situation is slightly different. This can be shown in the table below.

Table 2. Businesses' platform preferences in real communication with customers in B2B businesses.

Platform	Number of businesses
WhatsApp	20
Websites/Blogs	2
Facebook	7
Twitter	6
Instagram	3
Email	60
TOTAL	100

Comparison of platform preferences between B2C and B2B is shown in the graph below. WhatsApp is more popular in B2C than it is used in B2B, though its usage in both is quite high. On the other hand, the email is very popular with businesses when compared to its usage in B2C. The other platforms are not popular both in B2C and in B2B for real-time communication between the customers and the organizations in question.

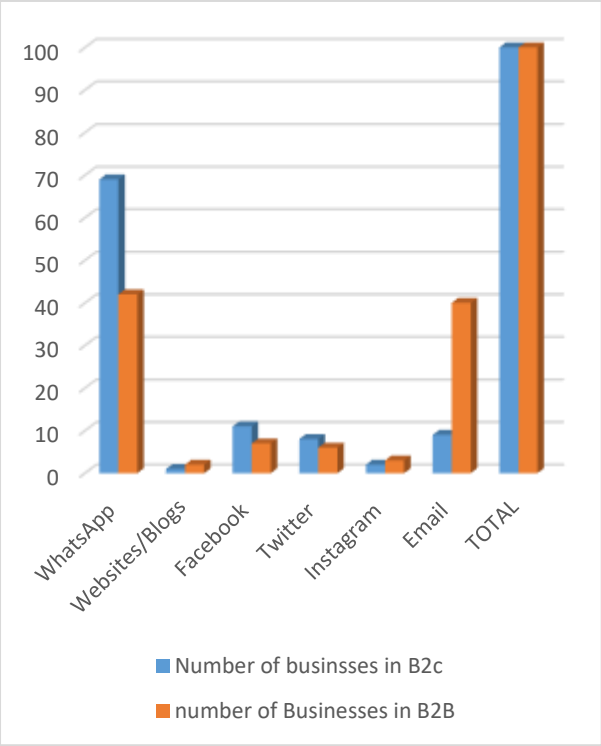

Figure 1. A comparison of platform preferences between B2C customer target and B2B customer targeting.

2.2 Use Of Digital Marketing In Developing And Implementing Marketing Campaigns And Promotions.

Most businesses indicated that their customers are mostly found on Facebook than any other platform. Thus they need to have Facebook pages, Facebook accounts and Facebook groups if they are to reach many customers online. Added to that, Facebook insights provide very pertinent information when it comes to analyzing campaign results. It is very informative and can help companies make informed decisions on their products and/or services.

Second from Facebook are blogs and/or websites. Most small businesses from which data was collected indicated that they have websites and they do most of their campaigns and promotions on their websites. Campaigns will be placed mostly on landing pages so that traffic to the site can interact with the campaigns and promotion the moment they get to the websites. Advantages sited for websites by businesses are that websites are their owned platforms and they have greater control of their multimedia campaigns and promotions when compared to that which they place on paid platforms like Facebook. Secondly, campaigns on owned websites are cheap (almost free) as they do not need to pay for publishing such campaigns. The site is already theirs.

Table 3. Businesses' platform preferences when developing and implementing marketing campaigns and promotions aimed at B2C.

Platform	Number of businesses
WhatsApp	4
Websites/Blogs	36
Facebook	41
Twitter	10
Instagram	4
Email	6
TOTAL	100

When businesses are targeting other businesses, they mostly use their websites as indicated in the table below. Their reasons where that clients in the business category are more informed and they mostly come through either search or they will type in the actual name of the site they are looking for. They seem to do more research when wanting to purchase when compared to final consumers.

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Thus making campaigns on owned sites will be more preferred for such a category of buyers.

Facebook came second there because SMEs are of the opinion that business buyers make decisions through people, and people are found on Facebook. Opinions of small businesses indicated that they find most people on Facebook, and it is those people who will make buying decisions either as individuals or in companies. So to them reaching many people is good for both business buyers and individual customers.

From the table, it can be seen that WhatsApp and email marketing is also being used by SMEs although at a smaller scale. Instagram and Twitter as unpopular for marketing and promotions, both in B2C and B2B. For Instagram, respondents proffered that their analytics is not as advanced as that of other platforms, though the number of customers found on the platform is increasing. Also, most SME owners and managers indicated that they are not yet very familiar with Instagram and they are yet to understand its marketing possibilities and merits.

SMEs opined that their clients are very few subscribers on Twitter and traffic from Twitter is almost insignificant to their businesses.

Table 4. Businesses' platform preferences when developing and implementing marketing campaigns and promotions aimed at B2B.

Platform	Number of businesses
WhatsApp	15
Websites/Blogs	41
Facebook	25
Twitter	5
Instagram	2
Email	12
TOTAL	100

In summary, a comparison of platform preferences between B2B and B2C is shown in the chart below.

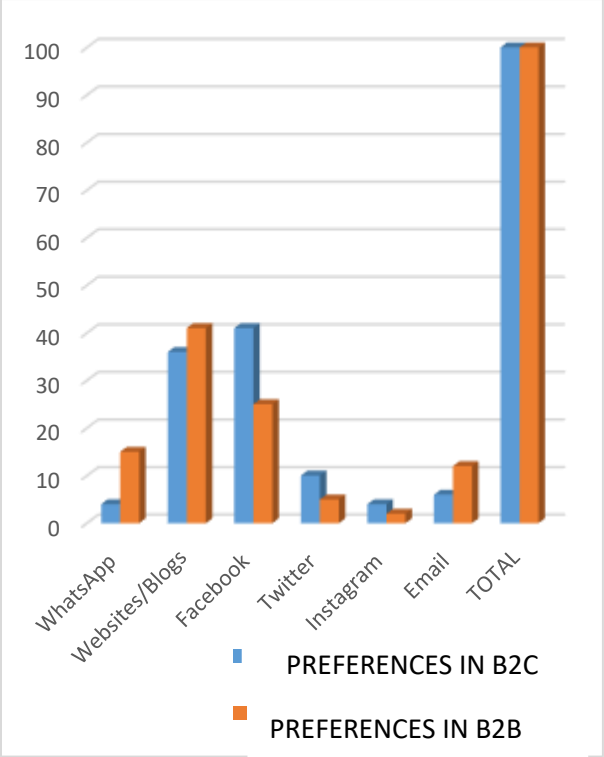

Figure 2. Businesses' platform preferences: a comparison of target platforms between B2B and B2C

2.3 Use Of Digital Marketing in Sales And CRM

Of all the respondents, only 20% of the SMEs can sell their products online. That means 80% do their selling offline. They use digital marketing tools for communication, campaigning and promotion only. Real business transactions of buying and selling is mostly done offline. Customer relationship management is also being done mostly offline as most of the businesses do not have functional e-commerce sites. They simply have basic websites that are used for blogging, marketing and promotion. Interaction that happens on the websites is very limited. They mainly do blogging, advertising and collecting of emails through online forms. The emails will then be used for targeted email marketing where necessary.

Table 5. Respondents with e-commerce sites and those without

SMEs with e-commerce sites	SMEs without e-commerce sites
20	80

3. CONCLUSION

Digital Marketing is a marketing field that is growing tremendously with the growth of internet access in our country Zimbabwe. It presents a lot of untapped on opportunities for marketers and hence the need for organizations, small and large ones alike, to adopt it. It is data-driven marketing which provides critical information for marketing managers in many and varied ways depending on the platform used. There is need for SMEs in Zimbabwe to adopt more professional and consistent ways of carrying out digital marketing activities within their organizations.

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Many thanks to all respondents who contributed data to this small research project. Their insights have great impact on the way I am going to teach digital marketing in my next coming classes.

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Project-Based Learning Interactive Multimedia: Improving Basic Electrical and Electronics Learning Outcomes

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Abstract: This study aimed to (1) determine the feasibility of PjBL-based interactive multimedia in improving learning outcomes of basic electricity and electronics. (2) Determine the effectiveness or feasibility of PjBL-based interactive multimedia in improving basic learning outcomes of electricity and electronics. This research method is R & D research with the ADDIE development model. The subjects of this study consisted of two material experts, two learning media experts, two learning design experts, and 50 grade X students of SMK Negeri 1 Bandar Masilam. The results showed that: (1) PBL-based interactive multimedia products were feasible to use in the learning process of basic electricity and electronics for vocational students from several experts and trials were carried out on students; and (2) indicated by the results of data processing on the results of the posttest obtained t count = 6.63 At a significant level ($\alpha = 0.05$) with dk 48 obtained $t_{table} = 1.648$ so that $t_{count} > t_{table}$. The average effectiveness of learning outcomes in the use of PjBL-based interactive multimedia is 73%, while the group of students who do not use media is 36%. From this data, it proves that the use of PjBL-based interactive multimedia is more effective in increasing students' knowledge and competence in basic electricity and electronics learning than without using PjBL-based interactive multimedia.

Keywords: interactive multimedia; project based learning; electric base; electronics

1. INTRODUCTION

SMK plays a very important role in preparing students to be able to work or enter the world of work according to their field of expertise. One thing that must be considered in vocational education is market needs. Firdausi and Barnawi [1] explain that vocational education must be oriented to market needs (world of work) or demand-driven, vocational education must always keep abreast of the latest technological developments, learning must be directed at improving the quality of skills (skills), and assessing students' abilities. must refer to the standards of the world of work. For SMK students, mastery of information and communication technology can support and facilitate work in their field of expertise in the future. Whether working in the world of business and industry or entrepreneurship, basic skills in information and communication technology will help them.

The use of technology has become an integral component of work, education, communication, and entertainment [2]. The integration of technology is designed to suit the needs of teachers and students as shown through experience and content in forming knowledge. The content used in learning is a reflection of the knowledge students need [3].

The fact that technology plays a much bigger role in the digital age than it did in previous generations has made the current generation have a high level of technological literacy. This increase in literacy coupled with recent technological advances has led to the expansion of technology in the field of education. From millennials to Gen-Z, this is the generation that has stepped into today's class and they share the unique characteristics that define their generation. According to Bencsik, Csikos, and Juhez [4] it shows that generation Z is the generation born between 1995 – 2010. If traced, currently generation Z is the generation aged 12 – 27 years. So it can be said that those who sit start from class VI of Elementary School up to students who study in the Undergraduate Program.

Berkup [5] describes several characteristics of Generation Z, namely in socializing in cyberspace, students use the internet very quickly, with smartphones they can use the internet efficiently and innovatively, and they like games that challenge creativity. Generation Z is very comfortable with social communication via Telegram, Whatsapp, Instagram, Twitter, and others. They are also able to use technology and the internet with all their creativity and innovation. This generation also hopes to be involved in their learning instead of just being passive learners.

Trilling & Fadel [6] explain that students are expected to have: (1) Information literacy skills, students can reach various information effectively (through the right sources) and efficiently (actual and fast information) which are developing very rapidly, can filter critically received information and process it properly, be able to utilize and process information effectively and accurately to solve various problems; (2) Media literacy skills, students can determine and even develop media for communication; (3) ICT literacy skills, students can analyze appropriate information media and are even expected to be able to create new media that are more efficient, effective and attractive for use in communication.

In this era of globalization of digital technology, the problem being faced is the lack of educators who master ICT in utilizing the use of technology as a learning medium [7]. A monotonous learning process can make students not enthusiastic about learning activities. According to Dewi, et al [8], a lesson will attract the attention of students if there is integration between the selection of learning strategies or methods and teaching materials that are appropriate to the subject matter presented.

That is, learning strategies must be packaged in such a way that the material presented is easy to accept and remember along with increasing new knowledge from the learning activities carried out.

1.1 The Nature of Basic Electrical and Electronics Learning Outcomes

Basic Electricity and Electronics (DLE) is the study of the application of basic analog and digital electronics techniques which includes material on electrical theory, introduction to various electronic components, and use of electronic components, so this material is also important as a support in practice.

This DLE subject is in the 2013 curriculum studied by SMK students with competence in Industrial Electronics Engineering. The purpose of studying this subject is to know the basic components that exist in electronic circuits, both analog electronics and digital electronics. The DLE subject matter developed in the form of interactive multimedia in this study does not cover all basic competencies but takes one basic competency.

Sudjono [9] revealed that learning outcomes are an evaluation activity that can reveal aspects of the thought process (cognitive domain) and can also reveal other psychological aspects, namely aspects of values or attitudes (affective domain) and aspects of skills (psychomotor domain) that are inherent in each individual. learners. This means ough learning outcomes can be revealed holistically depiction of student achievement after going through learning.

Meanwhile, Benjamin Bloom in (Nana Sudjana [10]) explains that learning outcomes are divided into 3 domains, namely: (1) Cognitive domain, which is related to intellectual learning outcomes which consist of 6 aspects namely knowledge, memory, understanding, application, analysis, synthesis and evaluation; (2) The affective domain, which is related to the attitude which consists of 5 aspects, namely acceptance, response or reaction, research, organization, and internalization; (3) The psychomotor domain, which is related to the results of learning skills and the ability to act. There are 6 aspects of the psychomotor domain, namely reflex movements, basic movement skills, perceptual abilities, harmony or accuracy, complex movement skills, and expressive and interpretive movements..

The three domains stated by Benjamin Bloom above are domains that can be carried out by students. These three domains can be obtained by students through teaching and learning activities. The DLE learning outcomes that will be measured and used in this study are the cognitive and psychomotor domains.

1.2 Project-Based Learning (PjBL)

Project Based Learning (PjBL) is a learning model that has been widely developed in developed countries such as the United States. Translated into Indonesian, PjBL means project-based learning. A more comprehensive definition of PjBL according to The George Lucas Educational Foundation [11] is as follows: (1). PjBL asks a question or poses a problem that each student can answer, PjBL is a learning model that requires teachers and/or students to share guiding questions. Given that each student has an asynchronous learning style, PjBL provides opportunities for students to explore content (material) in various ways that are meaningful to them, and conduct experiments collaboratively. This allows each learner, in the end, to be able to answer the guiding question; (2). PjBL asks students to investigate issues and topics addressing real-world problems while integrating subjects across the curriculum, PjBL is a learning approach that requires students to produce "bridges" that connect various subject matters. In this way, students can see knowledge as a whole. More than that, PjBL is an in-depth investigation of a real-world topic, and it will be valuable for students' attention and effort.

Global SchoolNet [12] reports on the results of the AutoDesk Foundation's research on the characteristics of PjBL. The results of this study state that PjBL is a learning approach that has the following characteristics: (1) Students make decisions about a framework; (2) There are problems or challenges posed to students; (3) Students design processes to determine solutions to problems or challenges posed; (4) Students are collaboratively responsible for accessing and managing information to solve problems; (5) The evaluation process is carried out continuously; (6) Students periodically reflect on the activities that have been carried out; (7) The final product of learning activities will be evaluated qualitatively; (8) The learning situation is very tolerant of mistakes and changes.

Based on this opinion, it can be said that PjBL-Based learning is a learning method that uses projects/activities as media. Learners explore, assess, interpret, synthesize, and information to produce various forms of learning outcomes.

Project-Based Learning is a learning method that uses problems as a first step in gathering and integrating new knowledge based on experience in real activities. Project-Based Learning is designed to be used on complex problems that students need to investigate and understand.

1.3 Interactive Multimedia

Multimedia according to experts can be seen from different perspectives, multimedia is a tool that presents information in which there is more than one media component. Mayer [13] argues that Multimedia in nouns refers to technology for conveying material in visual and verbal form, also called technology - a tool used to convey material verbally and visually. Munir [14] clarifies Mayer's opinion that Multimedia is a combination of various media (file formats) in the form of text, images (vector or bitmap), graphics, sound, animation, video, interaction, and others that have been packaged into digital files (computerized), used to convey or deliver messages to the public. The general understanding of multimedia relates to the use of more than one type of media to present information.

According to Sulilana and Riyana [15] that interactive multimedia is a tool or means of learning based on material, methods, limitations, and ways of evaluating that are designed systematically and attractively to achieve the expected subject competencies/sub-competencies according to the level of complexity. Bambang [16] argues that multimedia is a message delivery tool that combines two or more media elements, including text, images, graphics, photos, sound, films, and animations in an integrated manner.

According to Daryanto [17], multimedia is divided into two, namely linear multimedia and interactive multimedia. The definition of linear multimedia is multimedia without a controller to be used by users. Linear can be interpreted as running sequentially or sequentially, for example, TV and movies. The definition of interactive multimedia is multimedia

that has a controller to be used by the user, so it depends on the user to be able to decide or choose the process of running the multimedia.

According to Sutopo [18], multimedia consists of two kinds, namely linear multimedia and non-linear multimedia. Multimedia that runs straight or sequentially is called linear multimedia, examples of linear multimedia types are TV and movies. However, if the multimedia can be controlled by the user, it is called non-linear multimedia which is often known as interactive multimedia, an example of interactive multimedia is a learning presentation where the user can choose which topic he wants to study without having to wait for the entire presentation to be broadcast.

The research problem is formulated as follows: (1) Is the developed PjBL-based Interactive Multimedia suitable for improving learning outcomes in basic electricity and electronics?; (2) Is the PjBL-based interactive multimedia developed effectively used to improve basic electricity and electronics learning outcomes?

2. METHOD

This research is a type of development research or research and development (R&D). Research and development is a process or steps to develop a new product or improve existing products, which can be accounted for. The product in question is a simple tool as a learning medium. This type of research was chosen because the procedures contained in it are very appropriate for developing a media that has the goal of developing a product. The development research model used is the ADDIE model. The ADDIE model is a learning design model that involves the basic stages of a simple and easy-to-learn learning system. This model uses the Analysis, Design, Development, Implementation, and evaluation development stages. This model was chosen because it is a model for developing educational and learning products.

This research was conducted at SMK Negeri 1 Bandar Masilam, Simalungun Regency. The research time is carried out in the even semester of the 2022/2023 academic year. All students of class X TEI semester 2 SMK Negeri 1 Bandar Masilam T.P 2022/2023 which consists of 2 classes, namely class X TEI 1 and X TEI 2. The subjects in this study consisted of 2, namely the first validity test subjects were 2 media experts and 2 material experts. The two subjects of implementing interactive multimedia as learning media are class students who will be selected by random sampling.

The development research procedure in this study uses the ADDIE development model. The steps for developing the PjBL-based Interactive Multimedia are:

1. Analysis Phase. The analysis phase is the initial stage of development research. In the analysis stage, the researcher identifies the problems that underlie the development of instructional media. In the analysis stage, several activities were carried out, namely needs analysis, material analysis, and literature assessment studies for the products being developed. Activities at the analysis stage are described as follows: (a) Needs Analysis; and (b) Material Analysis.
2. Planning Stage. The design stage is the initial stage of development planning according to the analysis. The design stage is the planning stage in making PjBL-based Interactive Multimedia as a PjBL-based ADDIE learning medium in digital electronics material in SMKs.
3. Development Stage. The development stage is the PjBL-based interactive multimedia development stage by implementing the product framework that has been made at the design stage. The steps taken are (1) Pre-production; (2) Production; (3) Post-production & Quality inspection. At this stage, the quality inspection process will be carried out by conducting expert validation and product revision. (a) Expert validation; (b) Product Revision.
4. Implementation Stage. Product trials are carried out in three stages, namely: (1) Individual trials; (b) Small group trials; and (c) Field trials.
5. Evaluation Stage. The evaluation phase is carried out to obtain PjBL-based Interactive Multimedia assessments developed by experts and students. Assessment is done through a questionnaire or questionnaire. Experts consisting of media experts, material experts, and learning design experts provide assessments, suggestions, and input on whether the media being developed is feasible or not. Media that has been assessed by experts then goes through a revision process.

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and student responses. The respondents assessed the quality of PjBL-based Interactive Multimedia with the provisions of the research criteria in Table 1 below:

Table 1. Scoring Rules

No	Category	Score
1	Very good	5
2	Good	4
3	Pretty good	3
4	Not good	2
5	Not good	1

Table 2. Interpretation of Media

No	Interval Mean Score	Interpretation	Acceptance
1	1,00 – 2,49	Not feasible	Low acceptance
2	2,50 – 3,32	Less feasible	Acceptance is sufficient
3	3,33 – 4,16	Decent	High Acceptance
4	4,17 – 5,00	Very decent	Acceptance is very high

(Source: Sriadhi, [19])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
x_i : Score the highest answer
P : Presentation of eligibility level

The eligibility and effectiveness criteria achieved are used in the development of PjBL-based Interactive Multimedia described in Table 3 below.

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Table 3. Product Validation Criteria

Percentage %	Validity Level	Information
81,00 – 100,00	Very valid	Can be used without revision
61,00 – 80,00	Valid	Usable with minor revisions
41,00 – 60,00	Less valid	It is recommended not to be used because it is heavily revised
21,00 – 40,00	Invalid	Shouldn't be used, needs major revision
00,00 – 20,00	Totally invalid	Should not be used

The PjBL-based Interactive Multimedia that was developed received a positive response from students if the percentage obtained from the student response questionnaire reached a score of ≥ 60%, then the PjBL-based Interactive Multimedia learning media was categorized as feasible and effective.

Product Eligibility:
Ho : μ < μo; Ho = null hypothesis; μ = criterion with a value of 70.00; μo = score from a material expert, media expert, and respondent.
So it can be concluded that PjBL-based interactive multimedia in this study is said to be inappropriate if it is less than 70.00 from material experts, media experts, and respondents.
Ha : μ > μo; Ha = Alternative hypothesis ; μ = criterion with a value of 70.01; μo = score from material expert, media expert and respondent
So it can be concluded that PjBL-based interactive multimedia in this study is feasible if it is greater than 70.01 from material experts, media experts, and respondents.

Product Effectiveness:
To test the ability of interactive multimedia in improving learning outcomes, the N-Gain effectiveness formula is used. The normalized gain test (N-Gain) is calculated to see an increase in learning outcomes after being given treatment. Calculating the normalized N-Gain score is based on the formula according to Archambault [20], namely::

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score} x100$$

The obtained N-Gain calculations that have been normalized are then interpreted based on the appropriate N-gain interpretation table (Hake, [21]) can be seen in Table 4 below.

Table 4. Criteria for Grouping N-Gain

No	Percentage of N-Gain	Classification
1	100 – 71%	High
2	70 – 31%	Moderate
3	30 – 1%	Low

The mean normalized gain score (N-Gain) between the experimental class and the control class is used as data to compare students' literacy abilities. Testing the difference in the mean of the two experimental classes and the control class uses the t-test. As for the t-test requirements, the data between the experimental class and the control class must be normally distributed, and have the same (homogeneous) variance. The formula is as follows:

$$Efektivitas = \frac{N - Gain\ Experimental\ Class}{N - Gain\ Control\ Class}$$

The criteria used to determine which type of learning is more effective between learning that uses PjBL-based interactive multimedia and learning that does not use interactive multimedia are as follows:

1) if effectiveness > 1 then there is a difference in effectiveness where learning with interactive multimedia based on PjBL learning is stated to be more effective than learning without interactive multimedia
2) if effectiveness = 1 then there is no difference in effectiveness between learning with interactive multimedia based on PjBL learning and without interactive multimedia.
3) if effectiveness < 1, then there is a difference in the effectiveness of learning without PjBL-based interactive multimedia which is stated to be more effective than learning with PjBL-based interactive multimedia.

Furthermore, to test the hypothesis, the two-party test formula is used. The t test is used if the alternative hypothesis reads "bigger" or above (>). For research data that is normally distributed and homogeneous, the hypothesis testing uses the t-test with the formula:

$$t = \frac{\overline{x_1} - \overline{x_2}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where S is the root of the combined variance calculated by the formula:

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}, dimana\ S = \sqrt{S^2}$$

Where :
$\overline{x_1}$ = average score of the experimental class
$\overline{x_2}$ = average score of the control class
n_1 = the average number of experimental classes
n_2 = the average number of control classes
S_1^2 = variance of the experimental class group
S_2^2 = variance of control class group
S = combined variance
t = calculation price

The test criteria are accepted Ho if tcount > ttable is obtained from the t distribution list with dk = (n-1) with a significant level of α = 5%, then the teaching material is effectively used..

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment will then be analyzed and determined whether or not it is appropriate to develop PjBL-based Interactive Multimedia. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials and field trials is shown in table 5 below:

Table 5. Average Percentage of Assessment Results for PjBL-based Interactive Multimedia

No	Categorization	Percentage of average score%	Criteria
1.	Material Expert Validation	90,00	very feasible
2.	Media Expert Validation	89,20	very feasible
3.	Learning Design Validation	92,20	very feasible
4.	Individual Trial	91,70	very feasible
5.	Small Group Trial	92,40	very feasible
6.	Field Test	92,30	very feasible
Rata-rata		91,30	very feasible

Based on Table 5 above, it can be concluded that the PjBL-based interactive multimedia product developed includes very feasible criteria, thus it is known that the average rating (μo) from experts and field trials is 91.3% while the eligibility threshold value criteria (μ) is 70%, then μo > μ. So it can be concluded that PjBL-based interactive multimedia in this study is said to be very feasible to use and can meet the needs of implementing basic electronics learning.

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 6 below:

Table 6. Summary of Data Normality Test with Liliefors

No.	Class	L_{count}	L_{table}	Conclusion
1	Pretest student learning outcomes that do not use PjBL-based interactive multimedia (control class)	0,080	0,173	Normal
2	Posttest student learning outcomes that do not use PjBL-based interactive multimedia (control class)	0,141	0,173	Normal
3	Pretest student learning outcomes that do not use PjBL-based interactive multimedia (experimental class)	0,097	0,173	Normal
4	Posttest student learning outcomes that do not use PjBL-based interactive multimedia (experimental class)	0,131	0,173	Normal

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{Varian\ terbesar}{Varian\ terkecil} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 7 below:

Table 7. Summary of Data Homogeneity Test with Fisher's Test

Class	F_{count}	F_{table}	Conclusion
Posttest student learning outcomes that do not use PjBL-based interactive multimedia (control class)	2,94	4,24	Homogeneous
Posttest student learning outcomes using interactive multimedia based on PjBL (experimental class)			

From Table 7 above it is known that after the F test was carried out on the data on student learning outcomes in the control class and the experimental class, Fcount = 2.94, and it was known that Ftable = 4.24 at a significance level of 0.05 with n = 25 and dk = 2- 1 = 1. The results of the calculation above state that Fcount < Ftable which means that the learning outcomes of students in the control class and the experimental class have homogeneous variances, which means that the sample from each treatment group in this study has the same empirical character for the problem researched.

N-Gain Score test results To test the ability of interactive multimedia in improving learning outcomes, the N-Gain effectiveness formula is used. The normalized gain (N-Gain) test is calculated to see an increase in students' literacy skills after being given treatment. The results of calculating the n-gain score in this study are presented in Table 8 below:

Table 8. N-Gain Score Results

Class	Ideal Score (100-Pre)	N-Gain Score	N-Gain Score (%)
Posttest student learning outcomes that do not use PjBL-based interactive multimedia (control class)	36,52	0,36	36%
Posttest student learning outcomes using interactive multimedia based on PjBL (experimental class)	43,30	0,73	73%

Based on Table 8 above, it can be concluded that the use of PjBL-based interactive multimedia can improve basic electronic learning outcomes with a percentage of 73% in the high category.

Product Effectiveness Hypothesis
The results of the product effectiveness hypothesis test are known through the differences in the post-test results of control and experimental class students. The differences in learning outcomes are presented in Table 9 below.

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Table 9. Post-Test Calculation Results for Hypothesis Testing

Statistics	Class	
	Control	Experiment
N	25	25
Mean	77,23	88,37
Sd	7,26	2,81
S^2	52,73	17,88
t_{count}	6,63	
t_{table}	1,648	
Status	H_a accepted	

Based on Table 9 above, it is obtained that the value of t count = 6.63 At the significant level (α = 0.05) and dk = n1 + n2 – 2 = 48 it is known that for the level (0.05; 48) is 1.648, the price of tcount is compared with ttable turns out tcount > ttable, namely (6.63>1.468). Then Ha is accepted so that it can be concluded that PjBL-based Interactive Multimedia has a higher effectiveness compared to previous media in terms of learning outcomes.

(a) (b) (c)

Figure 1. Display of PjBL-based Interactive Multimedia; (a) Opening Page Display; (b) Display Menu Page; (c) User Guide Page Display Page 1

Figure 2. The learning process using PjBL-based Interactive Multimedia for students in Basic Electricity and Electronics subjects

3.2 DISCUSSION

The results of this study are in line with research conducted by Pramitasari, Mustaji & Harwanto [22] in their research that interactive multimedia on basic subjects of electricity and electronics, the results of this study are said to be very valid and feasible and can be used as alternative media in learning in the form of android applications, Which means that the developed learning media is very feasible to use without revision. Based on the results of the assessment by the material expert validator, the results obtained were 80.95% in the strong category. This means that the floating media is feasible to be applied in learning with a little revision. Based on the results of field trials, the results obtained were 96.87% in the very strong category.

In the process of teaching and learning several factors influence the achievement of learning objectives including educators, students, environment, methods/techniques, and learning media. Arifin [23] said that the media when understood in general is human, material, or events that build conditions that enable students to acquire knowledge, skills, or attitudes. In this sense teachers, textbooks, and the school environment are media. More specifically, the notion of media in the teaching and learning process tends to mean graphic, photographic, or electronic tools for capturing, processing, and reconstructing visual and verbal information.

Selection of the right media can certainly help to optimize the learning process carried out. Arsyad [24] suggests three characteristics of the media which are an indication of why the media is used and what media can do that the teacher may not be able to (less efficiently) do, namely: (1) fixative characteristics; (2) Manipulative traits; (3) Distributive Characteristics.

The results of Fui-Theng's research [25] on Interactive Multimedia Learning: Innovating Classroom Education In A Malaysian University. The results of the study put forward the conclusion that a significant increase was found in the test results as evidence that a good learning process had been carried out. The use of learning media brings changes in students' positive attitudes, they become more active and motivated in the learning process.

Sadiman [26] argues that media is anything that can be used to channel messages from senders to recipients so that they can stimulate thoughts, feelings, concerns, and interests as well as students' attention in such a way that the learning process occurs. The media also has related software containing educational messages which are usually presented using the equipment.

Kemp and Dayton in Kustandi [27] argue that learning media can fulfill three main functions if the media is used for individuals, groups, or large groups, namely in terms of (1)

motivating interest or action, (2) presenting information, and (3) giving instructions. To fulfill the motivational function, learning media can be realized with drama or entertainment techniques. As for information purposes, learning media can be used to present information in front of a group of students. The content and form of the presentation are very general, serving as an introduction, report summary, or background knowledge. Presentations can also take the form of entertainment, drama, or motivational techniques.

Hamalik (in Arsyad, [28]) also revealed that the use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulate learning activities, and even have a psychological influence on students. The selection of learning media must be adjusted to the material being taught and the conditions of the students. So it is hoped that the learning media can help students understand the concept of the material being taught, and can create a fun learning atmosphere.

The results of Akhtar Naz's research [29] regarding the Use of Media for Effective Instruction and its Importance: Some Consideration. The results of the study suggest that the media helps educators to transmit knowledge impressively by diversifying classroom teaching and making learning more effective. Instructional media provide teachers with powerful tools to make their teaching effective to achieve specific classroom goals.

Based on several opinions and research results stated above, it can be concluded that the role of the teacher will be very influential in helping and determining the success of their students. The teacher is the main actor as a facilitator of the implementation of the learning process. The teacher's task is to convey subject matter to students through communication in the teaching and learning process carried out at school. Therefore, the success of a teacher in conveying subject matter to students also depends on the learning media he uses.

4. CONCLUSION

After carrying out the process or stages of developing PjBL-based interactive multimedia, the following conclusions can be drawn:

1. PjBL-based interactive multimedia developed on the basic subjects of electricity and electronics is feasible to use because it has gone through the expert/expert validation stage in the fields of material, media, and instructional design and has also gone through individual, small group and field trial stages for SMK students.
2. PjBL-based interactive multimedia developed on the basic subjects of electricity and electronics is used effectively because it has gone through several requirements tests and carried out tests of basic learning outcomes in electricity and electronics by comparing it to the control class using different learning media.

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Cooperative Learning Model Type Teams Games Tournament Aided by Kokami Media: Analysis of Differences in Activities and Social Studies Learning Outcomes

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Abstract: The purpose of this study was to find out the differences in social studies learning activities in classes using the cooperative learning model of the TGT type assisted by Kokami media and classes using conventional learning models, and to find out the differences in social studies learning outcomes in classes using the cooperative learning model type TGT assisted by Kokami media with classes that using conventional learning models. This study used a Quasi-Experimental Design research design. The subjects in this study were students of class VII at SMPN 10 Vocational Junior High School. Determination of the sample was carried out by selecting two classes, namely classes VII-1 and VII-2, totaling 60 people. The results showed that: (1) the average learning activity for the control class was 62.90, and the average for the experimental class was 78.96; (2) the post-test scores of the experimental class were mostly in the range of values between 70 to 85. While the post-test scores of students in the control class were 60 to 70. The results of this study indicate that the TGT-type learning model assisted by Kokami media has an influence on increasing activity and student learning outcomes compared to conventional models.

Keywords: cooperative learning; teams games tournament; kokami media; activities; social studies learning

1. INTRODUCTION

One of the lessons that must be learned by students is social studies. Social studies education is one of the lessons that make a significant contribution to overcoming social problems. Because social studies lessons have a significant role in shaping and improving human resources. Humans who are social beings need the provision of knowledge about dignity and the procedures for interacting with other social beings. So skills and knowledge are needed regarding social procedures based on the values and norms that apply in society, or what we usually call social intelligence.

Social Studies Learning Objectives According to Widiyanto [1], students have the ability about concepts related to community life and the environment, master the basic skills to think critically and logically, solve problems, curiosity, inquiry, and social skills in social life, responsible, able to communicate, cooperate, and compete in a pluralistic society at local, national and global levels without leaving local socio-cultural values.

One learning model that aims to develop students' activeness, both in the aspects of social skills, cognitive skills, and students' attitudes is the cooperative learning model. Trianto in Darmadi [2] writes that the function of the learning model is as a guide for learning designers and teachers in carrying out learning. Hasanah, Suparman [3] states that this learning is based on the philosophy of Homo, Homini, and Socius. This philosophy emphasizes that humans are social beings, so there needs to be interdependence between one another. Interactive dialogue (social interaction) is the key to all social life.

One type of learning that uses the principle of working cooperatively is the Teams Games Tournament (TGT) learning type. The TGT type of cooperative learning model is a group learning model with elements of games and competitions. In practice, the TGT learning model consists of presenting classes, forming study groups, playing games, conducting competitions, and giving prizes to groups with the highest points.

TGT learning should be done if the questions asked are convergent or if there is only one right answer. This model also motivates students to help each other in mastering competencies that can be completed. This learning involves the activities of all students without any difference in status, involves the role of students as peer tutors, and contains elements of play and reinforcement. TGT learning provides learning opportunities that are more relaxed, responsible, cooperative, healthy competition, and learning involvement [4].

1.2 Learning Activity

Learning activities are learning activities. Learners who learn can be sure to have learning activities. Learning activities are efforts to form oneself through activities that are carried out physically, mentally, and emotionally to obtain success and benefits from an activity facilitated by educators and students themselves [5].

According to Kurniati [6], learning activities are a series of activities carried out by students in the learning process by providing opportunities for students to be able to learn on their own or carry out activities on their own to gain knowledge, understanding, and aspects of behavior. other.

Yohana [7] learning activities are all activities in the classroom during learning to form an attitude that affects learning outcomes. According to Sudjana in Sundahri [8] Indicators of student learning activities seen in the learning process are as follows: (1) Students seek and provide information; (2) Students

ask questions both to the teacher and other students; (3) Students submit opinions on information submitted by teachers or other students; (4) Students give a real response to the learning stimulus carried out by the teacher; (5) Students have the opportunity to conduct their assessment of the results of their work, as well as improve and perfect the results of work that is not yet perfect; (6) Students make conclusions about lessons in their language; and (7) Students make optimal use of learning resources or the learning environment around them.

Paul B. Diedrich in Sardiman [9], learning activities (activities) include reading, writing, arithmetic, which can be described as follows: (1) Visual Activities, namely learning activities in the form of reading, paying attention to pictures, demonstrations, experiments; (2) Oral Activities, namely learning activities in the form of stating, formulating, asking questions, giving suggestions, expressing opinions, interviews, discussions; (3) Listening Activities, namely learning activities in the form of listening to descriptions, speeches, conversations; (4) Writing Activities, namely learning activities by writing stories, composing, scientific work reports, copying lessons; (5) Drawing Activities, namely learning activities by drawing, making graphs, maps and diagrams; (6) Motor Activities, namely learning activities to do with fine and gross motor skills, including conducting experiments, making constructions, playing; (7) Mental Activities, namely learning activities involving elements of inspiration including responding, remembering, solving problems, analyzing, making decisions; (9) Emotional Activities, namely learning activities involving emotional elements such as interested, happy, enthusiastic, brave, calm; and (10) learning activities as above, if actually implemented in learning environments and situations, meaningful learning activities will be formed which are characterized by learning conditions that are dynamic, creative, active, constructive, applicable and contextual.

In this study, the learning activities that were measured included visual activities (observing and reading), oral activities (asking, answering questions, and giving suggestions), listening activities (listening to teacher explanations), motor activities (conducting group discussions and working on LKS), mental activities (remembering material and solving problems), emotional activities (having interest and enthusiasm, being brave and confident).

1.1 Social Science Learning Outcomes

Social Sciences according to Rofiq [10] is a blend of several subjects (science) whose content emphasizes the formation of good citizens rather than emphasizing the content and discipline of the subject. IPS has two main functions, namely fostering knowledge, intelligence, and skills that are beneficial for the development and continuation of student education and fostering attitudes that are in harmony with the values of Pancasila and the 1945 Constitution.

Social science is a science that studies human behavior and studies humans as members of society. All aspects of human behavior in society such as economic aspects, attitudes, mentality, culture, and social relations, Zuhroh [11] based on the opinion above, it can be concluded that social science is a science that studies human behavior to have an attitude that is in harmony with the values of Pancasila and the 1945 Constitution.

Said Hamid in Susanto [12] explains that the purpose of learning social sciences, especially social sciences, can be seen from three categories, namely having the characteristics of the category of developing students' intellectual abilities, developing abilities and a sense of responsibility as members of society and nation, as well as self-development of students as individuals. The three characteristics can be described in full as follows: (1) the purpose of developing intellectual abilities; namely aiming to develop students' ability to understand social science disciplines, think in social science disciplines, as well as professional abilities in seeking information, processing information and communicating findings; (2) the purpose of developing the ability to feel social responsibility; namely aiming for students to be able to communicate with other members of society, a sense of responsibility as a state and citizen of the world; and (3) the purpose of developing personality abilities; namely with regard to the development of attitudes, values, norms, and morals that become the role models of students, such as the willingness to continue to develop themselves through learning at further education levels and outside the school education level, the formation of positive habits for their personal lives, and a positive attitude towards themselves to spur self-development as a person, the progress of the nation's society and also science, is a goal that is included in the personality development of students.

1.3 Cooperative Learning Model

The learning model is a systematic procedure or pattern that is used as a guide to achieving learning objectives in which there is a strategy. techniques, materials methods, media, and tools [13].

According to Ishaac [14] A learning model is a pattern or plan designed to create effective and efficient classroom learning to achieve learning objectives. The learning model forms the basis of the practical implementation of learning and is based on educational psychology theories, and is designed based on various analyzes whose application is by the applicable curriculum in the education system.

The learning model according to Yoana [15] is an activity scheme that can be used to produce curriculum, design learning materials, and guide learning activities. According to Ariswan [16] One of the learning processes that promote collaboration, which makes the atmosphere fun and can make students more active is cooperative learning.

According to Putra [17] cooperative learning is learning that demands cooperation between students in teaching and learning activities to achieve learning goals. So that in the completion of the task. In the group, each member of the group must work together and help each other to understand the subject matter or give each other opinions, so that each student besides having individual responsibilities also has responsibilities in the group.

Isjoni in Parwanti [18] describes the elements of cooperative learning, including (1) Students must have the perception that they "sink or swim together"; (2) Students must have responsibility for other students or students in the group, in addition to responsibility for themselves in studying the material at hand; (3) Learners must think that they must have the same goal; (4) Students divide tasks and various responsibilities among group members; (5) Students are given an evaluation or award which will influence the group evaluation; (6) The students share leadership while they acquire cooperative skills during learning; and (7) Each student will be asked to individually account for the material handled in cooperative groups.

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1.4 Teams Games Tournament (TGT) Assisted by Media Komika

The TGT learning model is cooperative learning which aims to increase students' abilities and interests in understanding subject matter through games and competitions [19].

Slavin in Karim [20] says that in the learning process, the TGT model consists of five stages, namely the first stage is class presentation, the second stage is learning in groups, the third stage is games, the fourth stage is competition, and the final stage is the award for the winning group.

Chairani [20] states that learning activities with games designed in the TGT cooperative learning model allow students to learn more relaxed while fostering responsibility, cooperation, healthy competition, and learning involvement.

Based on some of the expert opinions above, the authors conclude that the TGT type cooperative model is a type of learning with a group learning pattern that uses a game pattern with a tournament system to get score points for each team. In the TGT-type cooperative model, there are two stages of group division, namely the heterogeneous origin group and the homogeneous tournament group. The division of this group is based on the qualification level of the academic ability of the students in the class. In its application, the cooperative model of the TGT type aims to improve the basic abilities, achievement, positive interactions between students, self-esteem, and the attitude of acceptance of each student in a heterogeneous class.

Kokami stands for mysterious rhyme card box. At first, this media was called Kokami, short for box and mystery card which was a game media consisting of a box containing question cards taken at random.

Media Kokami was first introduced by Abdul Kadir, who is a teacher at SMP Negeri 15 Mataram, West Nusa Tenggara. Abdul Kadir introduced this game media at the 2003 IPSK Field of Junior High School Level Teacher Creativity Competition organized by the Indonesian Institute of Sciences (LIPI) and won second place in this event [21].

This Kokami media can be made in a simple way that functions as a container for envelopes containing message cards. While message cards contain subject matter to be conveyed to students, formulated in the form of orders, instructions, questions, understanding pictures, bonuses, or sanctions.

Figure 1. Kokami Media (Mysterious Pantun Boxes and Cards)

The research problem is formulated as follows: (1) Are there differences in social studies learning activities in classes that use the TGT cooperative learning model assisted by Kokami media and classes that use conventional learning models for students?; and (2) Are there differences in social studies learning outcomes in classes that use the TGT cooperative learning model assisted by Kokami media and classes that use conventional learning models for students?

2. METHOD

This study uses a quantitative approach, and the data analysis technique used is statistical analysis techniques. The design used in this study is Quasi-Experimental with Nonequivalent Control Group Design, which is an experiment that has treatments, impact measurements, and experimental units, but does not use random placement. According to Sugiyono in Suwandi [22], "Quasi-experimental design has a control group, but it does not fully function to control external variables that affect the implementation of the experiment. This design can be described in Table 1 below:

Table 1. Research Design of Student Learning Outcomes

Class	Initial Conditions	Treatment	Final Condition
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

Source: Sugiyono dalam Edi Suwandi [22]

Information:
X1 : Treatment with the Kokami media-assisted TGT model
X2 : Treatment with conventional models with lecture and discussion methods
O1 : Pretest experimental group
O2 : Posttest experimental group
O3 : Pretest control group
O4 : Posttest control group

Table 2. Research Design of Student Learning Activities

Class	Initial Conditions	Treatment	Final Condition
Experiment	---	X_1	O_1
Control	---	X_2	O_2

Source: Fatchan, Soekamto, Utaya, & others [23]

Information:
X1 : Treatment with the Kokami media-assisted TGT model
X2 : Treatment with conventional models with lecture and discussion methods
O1 : Experimental group learning activities
O2 : Control group learning activities

Based on this design, this Quasi-Experimental study involved two groups of students, namely the experimental group and the control group. The experimental class was given the Kokami-assisted TGT learning model, while the control class was not given the Kokami-assisted TGT learning model but studied using the conventional model that is usually used by teachers, namely the lecture and group discussion methods.

This research was conducted at SMPN 10 Vocational Junior High School, Aceh Tamiang. The population in this study were all class VII students of SMPN 10 Vocational Junior High School, totaling 185 students. The sample in this study was students in classes VII-5 and VII-6, totaling 60 students. Sampling was done randomly.

Table 3. Descriptive Analysis Qualification Criteria Conversion Guidelines

Criteria	Qualification
> (Mi + 1,5 SDi)	Very High
(Mi + 0,5 SDi) s/d (Mi + 1,5 SDi)	Tall
(Mi – 0,5 SDi) s/d (Mi + 0,5 SDi)	Currently
(Mi – 1,5 SDi) s/d (Mi – 0,5 SDi)	Low
< (Mi – 1,5 SDi)	Very low

Source: Hopkins & Antes [24] in (Gunawan [25])

Information:
Mi = average (mean) ideal
= ½ (ideal maximum score + ideal minimum score)
SDi = ideal standard deviation
= 1/6 (ideal maximum score – ideal minimum score)

To determine the qualifying scores for student learning activities in the control and experimental classes in social studies subjects, the qualifying score for activity scores is calculated according to the predetermined univariate analysis conversion guidelines. The ideal mean (Mi) = ½ x (100 + 0) = 50, and the ideal standard deviation (SDi) = 1/6 x (100 – 0) = 16.67.

Based on the results of these calculations, the score qualifications as a reference for the level of student learning activity profiles are as follows:

Table 4. Classification of Student Learning Activity Scores

Criteria	Qualification
> 75	Very High
58,33 – 75	Tall
41,67 – 58,33	Currently
25 – 41,67	Low
< 25	Very low

Source: Muhajirin[26]

In conducting data analysis to test the hypothesis, a statistical data processing application was used, namely SPSS for Windows version 20. The data used in testing this hypothesis must be tested for analysis requirements first which include the normality test, and homogeneity test before analyzing the mean difference test (t-tests). If the results of the prerequisite test analysis are met, then proceed with testing the hypothesis using the Independent Sample T-test. However, if the results of the two prerequisite tests show that the data are not normally distributed and homogeneous, then hypothesis testing is carried out with the Mann-Whitney U-test.

Test the Student Learning Activity Hypothesis
The main aspect that forms the basis for testing the hypothesis in this learning activity research is the average score of learning activities obtained from the implementation of learning in the control and experimental classes. Hypothesis testing is carried out using the Independent Sample T-test, with the assumption that the results of the analysis prerequisite test are normal and homogeneous. However, if the prerequisite test results are not normally distributed, then the test is carried out using the Mann-Whitney test.

Interpretation of the results was tested at the significance level (p) 0.05. The hypothesis in this study of learning activity data is as follows:

Ho_1: there is no difference in social studies learning activities in the experimental class using the TGT learning model assisted by Kokami media and the control class using conventional learning models.

Ha_1: There are differences in social studies learning activities in the experimental class using the TGT learning model assisted by Kokami media and the control class using conventional learning models.

Student Learning Outcomes Hypothesis Test
The main aspects that form the basis for testing the hypothesis in this study of learning outcomes data are the pretest and posttest results obtained from the implementation of learning in the control and experimental classes. According to Sugiyono in Supriadi [27] to get real test results, it is necessary to do two analyzes. The first analysis is to examine the difference in pretest results between the control and experimental classes (O1 : O2). The expected result is that there is no significant difference between the pretest results in the control class and the experimental class.

The second analysis is to test the proposed hypothesis, namely "there are differences in social studies learning outcomes in the experimental class using the TGT learning model assisted by Kokami media and the control class using conventional learning models. The data tested is the average gain score obtained from the pretest and posttest results. The gain score of learning outcomes is calculated using the Hake formula, the Average Normalized Gain Score (N-Gain), or the average normalized gain score [28].

Furthermore, Hake in Nur and Sari [29] classify this increase in gain into several levels of interpretation. The normalized gain index can be seen in Table 5 below.

Table 5. Index of Normalized Gain Value (N-Gain)

Gain Value	Interpretation
$g \geq 0.70$	High
$0,70 > g \geq 0,30$	Currently
$g < 0,30$	Low

Source: Adaptation from Hake (Nur & Sari, [29])

The average gain score obtained is then analyzed using the Independent Sample T-test or the statistical formula used to compare data from two different sample groups (Independent). The interpretation of the t-test values was tested at a significance level (p) of 0.05. The hypothesis in this study of learning outcomes data is as follows:

Ho2: There is no difference in social studies learning outcomes in the experimental class using the Kokami media-assisted TGT learning model and the control class using conventional learning models

Ha2: There are differences in social studies learning outcomes in the experimental class using the TGT learning model assisted by Kokami media and the control class using conventional learning models

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the analysis of learning activity data in the control class and the experimental class can be seen in Table 6 below.

Table 6. Data Description of Learning Activity Scores of Control and Experiment Class Students

Class	Ideal Score	Minimum Score	Maximum Score	Range	Mean
Control	100	54,86	77,08	22,22	62,90
Experiment	100	72,22	86,11	13,89	78,96

Source: Calculation Results, 2023

Based on the data in Table 6, the learning activities of students in the control class showed that the highest score obtained by students was 77.08 while the lowest score obtained by students was 54.86. Based on the maximum and minimum acquisition scores, it shows a score range of 22.22. The average score of learning activities for the control class is 62.90.

The results of the normality test of learning outcomes data in the experimental and control classes can be seen in Table 7 below

Table 7. Results of Normality Test of Learning Activity Data for Experiment Class and Control Class

Class	Statistics	Df	Sig.
Eksperimen	0,104	31	0,200
Kontrol	0,196	29	0,006

Source: Calculation Results, 2023

Based on the data in Table 4.7 above, testing the normality of learning activity data in the experimental class, a significance value of p = 0.200 was obtained, so that p> 0.05 and the significance of the control class was p = 0.006, so that p <0.05. Thus, it can be concluded that the learning activity score data in the experimental class is normally distributed, but the learning activity scores in the control class are not normally distributed. These results indicate that the Independent Sample T-test cannot be tested on the hypothesis testing of student learning activity data. Further hypothesis testing was carried out using the Mann-Whitney U-test.

Table 8. Significance Test of Learning Activity Scores of Experiment Class and Control Class Students

Description	Score
Mann-Whitney U	15,500
Wilcoxon W	450,500
Z	-6,425
Asymp. Sig. (2-tailed)	,000

Source: Calculation Results, 2023

Based on Table 8 above, shows a U value of 15.50 and a W value of 450.50. When converted to a Z value, the magnitude is -6.425. From these results, it is known that the Asymp.sig (2-tailed) value is 0.000, so Asymp. sig. 0.000 < 0.05. So according to the decision-making in the Mann-Whitney test it can be concluded that Ho1 is rejected and Ha1 is accepted. This means that there are differences in social studies learning activities in the experimental class using the TGT cooperative learning model assisted by Kokami media and the control class using conventional learning models.

The pretest results of students in the experimental class and control class can be seen in Table 9 below.

Table 9. Data on Pretest Results of Experiment Class and Control Class Students

	Number of Samples	Minimum Score	Maximum Score	Range	Mean
Experiment	31	25	70	45	48,54
Control	29	25	70	45	44,22

Source: Calculation Results, 2023

Based on the data in Table 9 above, it can be seen that the average pretest score in the experimental class was 48.54 and the average pretest score in the control class was 44.22. The highest pretest score obtained by students in the experimental class was 70 and the highest pretest score in the control class was 70. Meanwhile, the lowest pretest score obtained by students in the experimental class and control class was the same, which was 25.

The results of the normality test of learning outcomes data in the experimental and control classes can be seen in Table 10 below

Table 10. Results of the Normality Test for Social Studies Learning Outcomes in Experiment Class and Control Class

Class	Statistics	Df	Sig.
Experiment			
Pretest	0,153	31	0,231
Postest	0,134	31	0,123
Kontrol			
Pretest	0,95	29	0,531
Postest	0,129	29	0,298

Source: Calculation Results, 2023

Based on the data in Table 10 above, the normality test in the experimental class, a significance value was obtained for the pretest p = 0.231, so that p > 0.05 and posttest p = 0.123, so that p > 0.05. Thus, it can be concluded that the data on learning outcomes in the experimental class are normally distributed. The normality test in the control class obtained a significant value for the pretest p = 0.531 so that p > 0.05 and posttest p = 0.298 so that p > 0.05. Thus, it can be concluded that the data on learning outcomes in the control class is normally distributed.

Table 11. Results of Homogeneity Test Data on IPS Learning Outcomes in Experiment Class and Control Class

Description	Lavene Statistics	df1	Df2	Sig.
Pretest	0,161	1	58	0,690
Postest	0,212	1	51	0,647

Source: Calculation Results, 2023

Based on the data in Table 11 above, the pretest significance results obtained were 0.690 > 0.05 and the posttest significance was 0.647 > 0.05. Thus, it can be concluded that the two learning outcomes above are homogeneous.

Table 12. Test of Significance of Pretest Results of Experiment Class and Control Class Students

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Description		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2 tailed)
Pre test	Equal variances assumed	0,157	0,693	5,470	58	0,00
	Equal variances not assumed			5.484	59,96	0,00

Source: Calculation Results, 2023

Based on the results in Table 12, it is known that the sig. (p) is 0.102. Thus, it means p> 0.05, meaning that there is no difference in the pretest results in the experimental class and the control class.

Then an analysis was carried out on the average gain score of the two classes to test the proposed hypothesis. The average gain score of students in the experimental class and control class can be seen in Table 13 below..

Table 13. Gain Score Social Studies Learning Outcomes Experiment Class and Control Class

	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	31	0,19	0,78	0,58	0,12
Control	29	0,22	0,72	0,40	0,11
Valid N (listwise)	29				

Source: Calculation Results, 2023

The average gain score in Table 13 above shows that the experimental class obtained an average gain score of 0.58. And the control class gets an average gain score of 0.40. These results show that both the experimental class and the control class are at the moderate gain index level. The average gain score data obtained were then analyzed using the Independent Sample T-test to test the research hypothesis. The results of the hypothesis significance test of student learning outcomes data can be seen in Table 14 below.

Table 14. Significance Test of Social Studies Learning Outcomes Hypothesis

Description		t-test for Equality of Means						
		t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Gain_ Score	Equal variances assumed	5,470	58	0,000	,1733	,0316	,1098	,2367
	Equal variances not assumed	3,584	57,9	0,000	,1733	,0316	,1110	,2365

Source: Calculation Results, 2023

Based on the results in Table 14, it is known that the sig. (p) value is 0.000, which means p <0.05. Thus the alternative Ho2 is rejected and Ha2 is accepted. This means that there are differences in social studies learning outcomes in the experimental class using the TGT cooperative learning model assisted by Kokami media and the control class using conventional learning models.

3.2 DISCUSSION

Research shows that the control class, which is only taught by conventional models, has high learning activity qualifications. This high learning activity is caused by the teacher's ability to master the class and the very good material. So the learning activities of students in the class also tend to be high. However, when compared to the experimental class, the qualifications for learning activities with the conventional model are still lower than the Cooperative learning model of the TGT type assisted by Kokami media. The results showed that learning activities in the experimental class had very high qualifications for learning activities.

These results are to the conclusions of Syilvi's [30] research; Rastika and Ariswoyo [31]); and Laksana [32] who said that the learning activities of students in classes using the TGT model and also Kokami media were high and very active. The results of this study also provide a clear picture that classes using the Cooperative learning model type TGT assisted by Kokami media have higher learning activity qualifications when compared to classes using conventional learning models. So it can be concluded that the Cooperative learning model of the TGT type assisted by Kokami media is very effectively used to increase student learning activities, especially in social studies subjects.

The very active learning activity in the experimental class was caused by several factors, namely: first, the tournament activities carried out in the TGT model proved to encourage students in the experimental class to study more actively when compared to the control class. This is what was concluded by Rusyanto's [33] research which states that the TGT model encourages the learning success of each student, where the success of a group lies in the success of each member of the group. So that by themselves students learn harder and are more responsible for understanding the material so that they can contribute to the success of the team. Second, the discussion group in the experimental class was considered more interactive than the control class. Even though each student in the original group in the experimental class had different individual abilities, they were seen helping each other and cooperating in learning the material provided by the teacher. This is in line with Chairani's [34] research which concluded that cooperative learning using the TGT model is very effectively applied in class to increase the positive attitude of students in the class, which consists of students with different characters and individuals. The three uses of Kokami media during the tournament turned out to have a pretty good influence on the activities of students in the experimental class, where students seemed to be more enthusiastic and motivated when carrying out tournaments with this Kokami media.

The higher learning outcomes in the experimental class are caused by the application of the TGT learning model which has more interesting learning variations than the control class, namely in the form of games and tournaments. Because there is an element of fun games and the emergence of a desire to compete openly and fairly, this ultimately motivates students to be more actively involved in participating in the learning process. Sumarmi (Syilvi [35]) said the TGT model makes students more positive, tolerant, enthusiastic, and very actively involved in learning, where the demands of contributing to their home group encourage students to learn more independently and not just stick to the knowledge taught by a teacher only. However, it cannot be denied that there are also some conspicuous weaknesses in the use of the Kokami media-assisted TGT cooperative learning model. This weakness lies in the variation in the level of difficulty of the questions each student gets when choosing a question card. The difference in the level of difficulty of the questions is a lucky factor for adding student scores, where students who get questions with a low level of difficulty will very easily answer the questions on the question cards. While students who get question cards with a high level of difficulty will have more difficulty answering. So, with findings like this, more attention should be paid to the technique of making question cards with a more equal level of difficulty.

In addition, the use of Kokami media turns out to provide challenges for each student. They are motivated to be able to solve every question on the card they choose. This kind of learning atmosphere ultimately has a positive impact on students' understanding of the material being studied. Questions originating from Kokami media automatically make students trained in solving problems better. Which in turn has a positive effect on improving student learning outcomes in the experimental class.

The results of this study are in line with some of the results of previous studies which are used as references in this study. As mentioned by Rani [36] and Kahar [37] in their research concluded that the learning outcomes of the experimental group increased significantly compared to the control class after being given treatment with the TGT model. It was also stated that the post-test results in classes using the TGT model showed higher results than conventionally taught classes. In addition, Syilvi [38] also said in his research that student learning outcomes increased after being given the application of learning by utilizing Kokami media. So it can be concluded that the TGT learning model combined with Kokami media in this study proved to have a positive and significant impact on improving social studies learning outcomes compared to conventional learning models.

4. CONCLUSION

1. The average score of students' learning activities using conventional learning models can be said to be high. The average score of students' learning activities in the experimental class showed a total score of 78.96. These results indicate that the learning activities of students in classes using the TGT cooperative learning model assisted by Kokami media are said to be very high.
2. There are differences in social studies learning activities in classes that use the Cooperative type TGT model assisted by Kokami media and classes that use conventional learning models. The results showed that the Cooperative model of the TGT type assisted by Kokami media had a better effect on increasing social studies learning activities than the conventional model.
3. There are differences in social studies learning outcomes in classes that use the Cooperative learning model of the TGT type assisted by Kokami media and classes that use conventional learning models. The results showed that the Cooperative Learning model of the TGT type assisted by Kokami media had a better effect on improving social studies learning outcomes than the conventional model.

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Development of a Compact, Interactive Online Video Lesson for Learn Adlib College Lower Six Students Using Adobe Animate and Adobe Premiere 2022

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Abstract: This research is a development and experimental research premised on the 4D model. A compact video lesson was developed for Lower Six students at LearnAdlib College in Bulawayo, Zimbabwe. An introductory video was developed in Adobe Premiere 2022 using presets and background sounds obtained from the internet. Main content of the lesson was recorded using Zoom. Adobe Animate was then used to develop the user interface and to integrate all parts of the lesson. Interactivity was enabled through the use of ActionScript programming language in Adobe Animate 2022. Buttons were developed to enable the student to navigate the lesson from the introduction till the end. The main aim of the lesson was to introduce Visual Basic programming through both theory and a practical activity. Videos to explain the basic concepts and to demonstrate the practical activity were developed and deployed to student machines so that they run the lesson in the browser. A Lower Six class of 28 students was split into two, the experimental class and the control class. Ten (10) multiple choice questions and one practical exercise were used to test student understanding for both the experimental group and the control group. Three Computer Science teachers evaluated the compact lesson's suitability to the level of learning of the students. They also commented on validity of lesson content in relation to the requirements of the Zimbabwean Advanced Level Computer Science Syllabus 6023. The outcome of the experimental research showed that students who used the online compact lesson managed to answer questions and to produce scores as high as those of the control group. The compact online lesson was therefore as effective as the physical lesson. It had the merit that students could replay some of the areas when doing the practical, each replaying as many times as he or she wants until he or she gets the steps correctly. Thus in an interactive video lesson the student can control the pace of learning while in a face to face lesson the teacher will have to determine pace. That was very convenient for the students and that made them enjoy the lesson. However, they could not ask questions on the go in times when they would have needed to: the advantage which was enjoyed by those in the control group. Students in the face to face class can ask the teacher some questions any time during the course of the lesson.

Keywords: computer programming, 4D model, interactive online video lesson, Adobe Animate, Adobe Premiere Pro

1. INTRODUCTION

Computer programming is a very important component both for high school Computer Science students in Zimbabwe and for the real world of computing in general [5]. Programming as a process of software development involves a lot of problem solving skills. Students also need to understand how the computer works for them to be able to design solutions that will be automated by the use of the computer [6]. High school Computer Science students in Zimbabwean schools will need to understand both the theory and practice of programming for them to be ready for the examinations and the world of work after school. However, there is shortage of skilled Computer Science teachers in the country and students at times spend a lot of time looking for online alternatives to learning especially during the holidays or weekends [4]. Also, currently there is still need to cover learning gaps that were created by learning stoppage during the COVID-19 era [3].

One of the ways to close learning gaps is to enable independent learning on the part of the student during the time they will not be in the usual physical class [3]. This is where online learning comes in and hence the need the develop multimedia lessons that are interactive to motivate the student to go an extra mile. Thus the student needs to do both face to face classes and online classes. This is called blended learning and is a means of making the student cover up for time lost because of any problem [3].

Adobe Premiere Pro 2022 is a video authoring tool (software) developed by a software company called Adobe Systems [1]. Adobe Animate 2022 is an animation development tool (software) that was also developed by Adobe Systems [2]. Thus both these tools are products of the same company and when using them one can easily export files from one tool into another. In Adobe Animate 2022, one can do programming using the programming language called ActionScript. It is also possible to develop applications that can run in the browser using HTML and CSS [2]. Thus HTML and CSS is used to develop the user interface for applications (in this case the lesson) that runs in the browser. To control and navigate the video, ActionScript programming language comes into play.

2. THE RESEARCH METHOD

This research is a research a mix of development and experimental research which begins with the 4D model for designing instructional media and then goes further into testing of the video lesson in teaching the experimental class. Performance of the experimental class is going to be compared with the performance of the control class.

The instructional media to be developed is a compact video lesson to introduce Visual Basic programming to Lower Six students. It will introduce the IDE (Integrated Development Environment) called Visual Studio Community from Microsoft. Students will watch a theory video lesson on variables, constants and data types in Visual Basic programming language. They will then watch a demonstration

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on how to create a project in Visual Studio and then to declare, initialize, manipulate and print results onto the screen. A theory and a practical exercise will then be done and results will be tabled. Finally, both the Computer Science students and their teachers will complete some questionnaires on product usability and effectiveness.

3. RESULTS AND DISCUSSION

3.1 Define

The aim of this research is to develop a compact and interactive online video lesson for Lower Six Computer Science students at LearnAdlib College. The objectives of the lesson to developed were as follows:

By the end of the lesson students should be able to:

-define what a variable is and to explain at least three associated variable data types found in Visual Basic programming language.

-create a new Visual Basic project in Visual Studio IDE.

-declare and initialize variables using Visual Basic programming language.

-manipulate variables and print output on the console window.

During the definition stage related articles were read to gain understanding of the nature of the problem at hand. The researcher also visited LearnAdlib College to do preliminary interviews with the teachers and the students. The following documents were downloaded from Zimbabwe's Ministry of Primary and Secondary Education website (http://mopse.co.zw/).

1. Education policy 5.0
2. Advanced Level Computer Science Syllabus
3. Sample examination papers

The main reason for reading these documents was to check on the competencies and skills required by the ministry so that the media was to be developed aligning to such requirements. Introduction to Programming was chosen as a suitable topic to teach the students considering what they had covered with their teachers. That introduction was to focus mainly on variables and data types in Visual Basic programming language.

3.2 Designing

User interface was designed using HTML and CSS in Adobe Animate canvas. A simple lesson home page was developed which only had important information and the college logo. Other lesson stages were developed using ActionScript buttons and video components. A student would click a button to go to any lesson stage. The illustration of the lesson home page is shown below.

Figure 1. Lesson home page

On the home page above, lesson stages are seen as buttons that would allow the student to navigate to any part of the lesson. Each button is linked to a video component which holds the suitable video for that stage of the lesson. When the dutton is clicked, the correct video gets onto the timeline for the student to watch that part of the lesson. So the lesson stages are

- Lesson introduction
- Lesson objectives
- Basic terms
- Lesson content
- Lesson activities
- Lesson exercise
- Conclusion

Examples of video components with videos for lesson introduction and lesson objectives are as follows.

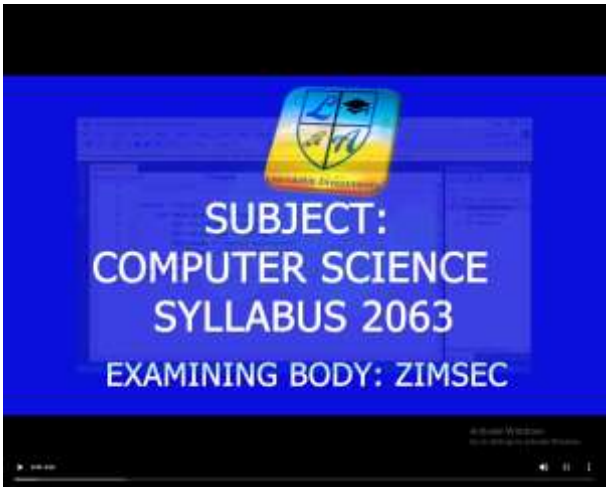


Figure 2. Video for the lesson introduction

Figure 3. Video for the lesson objectives

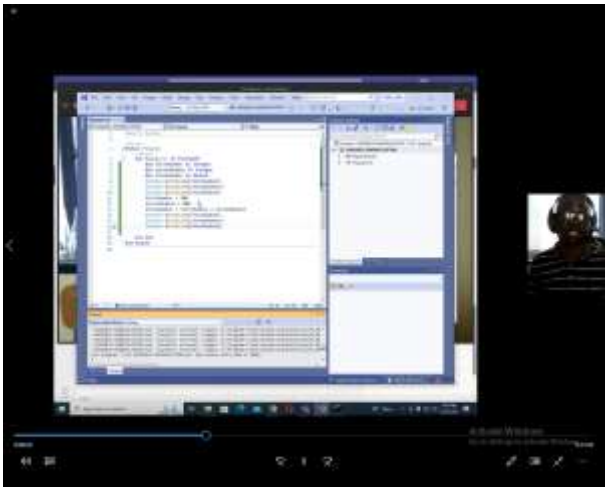


Figure 3. Video for the lesson practical programming

3.3 Developing functionality and interactivity

As can be seen on two sample videos above, navigation from one stage of the lesson has been laid from top to bottom, but the student can click at any button at random and will be taken to the lesson stage clicked. Sample ActionScript code for the navigation buttons was as follows:

```
/* Stop at This Frame

The  timeline will stop/pause at the frame where you insert this code.

Can also be used to stop/pause the timeline of movieclips.

*/

this.stop();

/* Click to Go to Frame and Stop

Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.

Can be used on the main timeline or on movie clip timelines.

Instructions:

1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.

2.Frame numbers in EaselJS start at 0 instead of 1

*/

this.btnIntro.addEventListener("click", fl_ClickToGoToAndStopAtFrame.bind(this));

function fl_ClickToGoToAndStopAtFrame()

{

        this.gotoAndStop(5);

}

/* Click to Go to Frame and Stop

Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.

Can be used on the main timeline or on movie clip timelines.

Instructions:

1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.

2.Frame numbers in EaselJS start at 0 instead of 1*/

this.btnObjs.addEventListener("click", fl_ClickToGoToAndStopAtFrame_2.bind(this));

function fl_ClickToGoToAndStopAtFrame_2()

{

        this.gotoAndStop(10);

}

/* Click to Go to Frame and Stop

Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.

Can be used on the main timeline or on movie clip timelines.

Instructions:

1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.

2.Frame numbers in EaselJS start at 0 instead of 1

*/

this.btnBasics.addEventListener("click", fl_ClickToGoToAndStopAtFrame_3.bind(this));

function fl_ClickToGoToAndStopAtFrame_3()

{

        this.gotoAndStop(15);

}

/* Click to Go to Frame and Stop

Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.

Can be used on the main timeline or on movie clip timelines.

Instructions:

1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.

2.Frame numbers in EaselJS start at 0 instead of 1

*/

this.btnContent.addEventListener("click", fl_ClickToGoToAndStopAtFrame_4.bind(this));

function fl_ClickToGoToAndStopAtFrame_4()

{
```

```
        this.gotoAndStop(20);
}
/* Click to Go to Frame and Stop
Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.
Can be used on the main timeline or on movie clip timelines.
Instructions:
1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.
2.Frame numbers in EaselJS start at 0 instead of 1
*/
this.btnActivities.addEventListener("click", fl_ClickToGoToAndStopAtFrame_5.bind(this));
function fl_ClickToGoToAndStopAtFrame_5()
{
        this.gotoAndStop(25);
}
/* Click to Go to Frame and Stop
Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.
Can be used on the main timeline or on movie clip timelines.
Instructions:
1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.
2.Frame numbers in EaselJS start at 0 instead of 1
*/
this.btnExercise.addEventListener("click", fl_ClickToGoToAndStopAtFrame_6.bind(this));
function fl_ClickToGoToAndStopAtFrame_6()
{
        this.gotoAndStop(30);
}
/* Click to Go to Frame and Stop
Clicking on the specified symbol instance moves the playhead to the specified frame in the timeline and stops the movie.
Can be used on the main timeline or on movie clip timelines.
Instructions:
1. Replace the number 5 in the code below with the frame number you would like the playhead to move to when the symbol instance is clicked.
2.Frame numbers in EaselJS start at 0 instead of 1
*/
this.btnExit.addEventListener("click", fl_ClickToGoToAndStopAtFrame_7.bind(this));
function fl_ClickToGoToAndStopAtFrame_7()
{
        this.gotoAndStop(34);
}
```

The code shows that if a student clicks a certain button, ActionScript will automatically jump to a defined point in the timeline. When it arrives at a defined point in the timeline, it will load a video at that point and wait for the user to click the play button. The user will also be availed with other control buttons at that point. Thus he can pause the video, increase or decrease the volume, increase or decrease playback speed, view on full screen mode or in picture by picture mode or even download the video for offline play.

3.4 Student Scores for the Theory Exercise out of 10

From the table below, it can be noted that marks ranged from 6 to 10 out of 10 for all the two classes, the experimental class and the control class. Average mark for the experimental class was slightly greater than that of the control class. Average for experimental class was 8.3 out of 10 while that of the control class was 8.1 out of 10.

Table 1. Student scores for the theory exercise out of 10

Experimental class	8	6	7	10	9	8	9	10	9	9	7	8	7	10
Control class	8	8	8	6	6	10	8	8	8	7	10	10	9	8

The student scores in the above table have been plotted on the graph below.

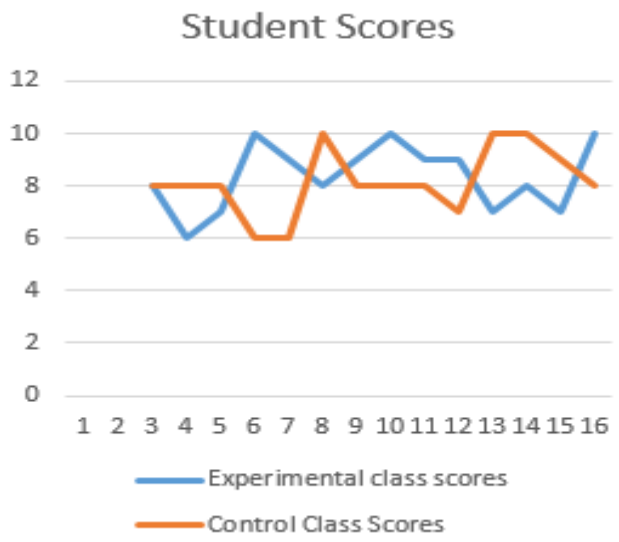


Figure 3. Student scores for the theory exercise out of 10

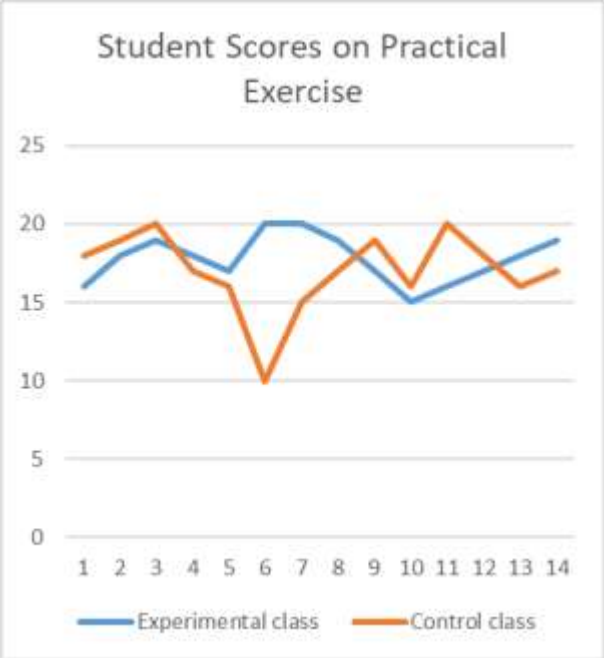
3.5 Student Scores for the Practical Exercise out of 20

From data in the table below, the difference between scores of the experimental class and those of the control class was also small. The average mark for experimental class was 17.8 while that of the control class was 17.4 out of 20.

Table 2. Student scores for the practical exercise out of 20

Experimental class	16	18	19	18	17	20	20	19	17	15	16	17	18	19
Control class	18	19	20	17	16	10	15	17	19	16	20	18	16	17

Student scores in the above table have been plotted on the graph below.



3.6 Media Evaluation by Students

Students were generally thrilled the video lesson. They cited that they had control on the lesson because they could navigate to any stage of the lesson as they learned independently. They could also revisit some of the stages if they did not understand. Or at times they could decrease playback speed so that they follow the practical session to the end.

Their problem, however, was that they could not ask questions in a video lesson the way they would do if they were in a real lesson. They had to remain with unanswered questions and would wait with such questions until they meet the teacher some other time. That was unlike those who were in the control class who would ask questions as and when they so wish.

3.7 Media Evaluation by Computer Science Teachers

All the three Computer Science teachers felt that the media was quite suitable for the age level and it managed to achieve the objectives for which it was developed. Two of them however, noted that there is need for videos to be perfected more so that they draw more attention from the students.

One of them suggested that there is need for thorough preparation when developing an online video lesson than when preparing for a live lesson because in a video lesson no one will be available to answer student questions if some of the information becomes unclear to the student watching the lesson. That means a video lesson should try as much as possible to exhaust details associated with a concept it is trying to convey.

4. CONCLUSION

The development of an online video lesson using Adobe Animate and Adobe Premiere Pro 2022 and the testing of the video lesson was done and completed. Performance of the students in the experimental class was slightly above that of the students in the control class. This proved that students can do well if such material is developed and provided for them so that they do blended learning instead of waiting for physical face to face lessons with a teacher. Online video lessons will make them learn outside the classroom. However, there is need for video lessons to be prepared more thoroughly as they will be used by the in the absence of the teacher and hence such lessons should not leave students with many unanswered questions.

5. ACKNOWLEDGMENTS

I want to thank all the teachers and students I worked with at LearnAdlib for their support and cooperation.

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Virtual Laboratory Management Model: Improving the Competence of Hair Beauty LKP Instructors In Sumatera Utara

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Abstract: This study aims to determine the process of research product development, and hair beauty virtual laboratory management model to improve the competency of LKP hair beauty instructors. The research approach applied in product development is research and development (R&D). This development model is carried out in 8 stages, namely: Research and Information Collecting, Planning, Develop Preliminary Form of Product, Preliminary Field Testing, Operation Field Testing, Operational Product Revision, Main Field Testing, and Main Product Revision. The subject of the trial was a level II hairstyling instructor in the city of Pematangsiantar. The instrument used to collect data in this development research is a questionnaire or questionnaire. The results showed that the hair beauty virtual laboratory management model that was developed effectively could increase the creativity of instructors which was supported by the acquisition of validation scores by material experts of 86.4% and media experts obtained a percentage of 80.7% with a very good category and effectiveness experts obtained results 97.50%. In addition, the results of the respondents from the acquisition of scores for the small group trial of 5 students were 78.3% in the good category, the medium group trial with 15 learning residents was 81.3% in the very good category, and the large group trial with 30 learning residents was 93. .6% with a very good category. This means that this virtual laboratory is feasible to use.

Keywords: e-module; biomedicine; learning media

1. INTRODUCTION

Learning media is involved in the process of learning and teaching is something that cannot be separated from the unity of the world of education. Learning media are all things that can be used to convey the message of the sender to the recipient so that it can stimulate the thoughts, feelings, attention, and interests of students for learning [1]. Learning media plays an important role in the learning process so that it can improve the quality of education. In addition, the use of learning media in the mathematics learning process can increase the motivation and interest in learning among students who learn independently.

Life skills education is broader than work skills, let alone manual skills. Life skills education is an educational concept whose aim is to intuitively prepare learning citizens to have the courage and willingness to face life and life problems naturally without feeling distracted and then creatively come up with solutions as well as be able to remember them. The indicators included in life skills are conceptually grouped: (1) self-awareness or, concurrently, personal skills, (2) thinking skills or academic skills, (3) Social skills, and (4) Vocational skills are also associated with technical skills or technical skills.

Problems that have been encountered in the world of non-formal education, namely the way of teaching instructors which are valued in a way that results in a lack of knowledge of students studying in the field of material, especially in hair beauty subjects, namely negative responses to practical exams during competency tests with practical results in DUDI. Residents learn to think that practice while in DUDI is not the same as during the competency test. Instructors think that the learning community must be aware of practical learning so that many instructors only discuss practical results without being reinforced by theoretical studies so that when teaching the instructor makes less use of learning media. Indirectly, the opinion causes the learning community to become lazy to intuitively try to understand concepts and theories both materially and clearly practice their lessons in SKKNI.

This problem of proficiency also becomes a problem as well as training students because of course achieving good skills for all student's learning becomes a difficult thing, because in their learning it is certain that there are students who experience difficulties in the learning process and this difficulty can be overcome by students pa similar thing, infrastructure, teacher competency, instructor competency, and learning process. Like the presentation of Manik and Panjaitan [2] in his research results showed that "Discipline, passion and teaching methods of instructors are necessary things, but this is not a sufficient requirement possessed by an instructor to be able to increase the value of the PLPG participant competency test" in From the results of this research, it can be seen that the instructor is not only with discipline, enthusiasm and teaching methods that can affect the learning outcomes of many other things that affect the instructor, of course, this instructor competence should be owned by every instructor who will carry out the training. The instructor is one of the important elements that must exist in a series of learning activities in training.

1.1 Hair Beauty Instructor Competency Level II

In the training process, a competent teacher or instructor is needed so that students can learn effectively and efficiently, to achieve the expected goals. This is emphasized again by Hamalik [3] who defines the educator or instructor as follows: The educator or instructor is a person who works as an educator in an educational and training institution and has a certain

amount of competence to teach students, as well as so that it can achieve the intended goals, namely so that the teachers of the students can improve their skills in work.

Being able to plan the presentation of learning materials based on appropriate reference standards is an absolute requirement of competence that instructors must master. The instructor can stimulate learning media to intuitively process the learning process according to existing competencies. The instructor can master the class when teaching. Instructors are also expected to be able to motivate the learning community.

Instructor Skills Competition Goals Instructor Skills Competition is Intuitive: Providing encouragement and opportunity for instructors to compete positively and constructively, to increase pride in their profession and unit of work. Inquiry and monitor the competency map of BLK UPTP/UPTD instructors by their field of expertise. Give input in planning the instructor development program in the future. Motivating instructors to increase their competence both individually and in terms of officialdom in their respective agencies. Fostering and enhancing cooperation between fellow instructors and trainers at Work Training Centers, both at the regional and central levels.

Adding insight and competitive experience to instructors and managers of the Work Training Center and Competition Development, so that BLK is preparing potential Asian Skills Competition (ASC) competitors and can prepare themselves for trainer competitions at the Southeast Asian level or a wider level. As a medium for exchanging experiences and information related to science, technology, and the world of training. Meimpeireirat is related to cooperation between the government, industry, and education and training institutes. Increase national insight and love for the motherland. Regional-level Instructor Skills Competitions are Work Training Institute Instructors in designated regional areas, and National-level Skills Competitions are Work Training Institute Instructors at regional level competitions.

Hair beautification is a program that creates a pool of reliable human resources in the field of hair cosmetology. The increasing population of people has resulted in more job opportunities for quiz graduates as well as hairdressing training to increase the skills needed for hairdressers. The most important goal of the program is to gain expertise, both theoretically and practically in aspects of hair beauty design. The learning activity program for the Hair Beauty Management Quiz is packaged in the form of levels, namely Basic, Skilled and Advanced levels with separate qualification levels and independent positions. Each level has a program structure consisting of 1 (general), 2 (Core), and 3 (special)

Figure 1. Hair beauty skills

1.2 Virtual Laboratory Management

Laboratory infrastructure is a part that together becomes the main obstacle. The maintenance of infrastructure is not only a matter of cost and time but also the continuity of management which is quite complex, especially for LPK with limited resources (land, workers, funds,d time). Several other things that are considered to be a problem in laboratory management include the role of (1) Laboratory Resources: including practical equipment, laboratory workers/technicians, supervising instructors, practical assistants, and practical places, (2) Laboratory Management: How is the management of practice time becomes easy, both from the management side and the laboratories supervisor). How can students maximize the use of practical hours, (3) Practical Costs: How to reduce practical costs to a minimum, considering that the price of practical materials that have changed has increased, certainly without reducing the quality of the results of the internship, as well as (4) Increasing the quality/competence of students with good limited power supply in the laboratory [4].

For teachers/teachers balancing the system will have several academic skills such as time and a more flexible practice location, without reducing practical competence in the competencies students acquire. Some of the research on virtual laboratories that existed previously as virtual laboratory balancing studies can be seen from several circuit implications. Virtual laboratories or what can be called virtual labs are a series of laboratory tools that are in the form of interactive multimedia-based computer software, which are operated with a computer and can simulate activities in the laboratory as if the machine is in the laboratory. as true. The intuitive virtual potential laboratory provides a significant improvement and a more effective learning experience.

It is hoped that this virtual laboratory balance can solve the learning problems experienced by students and overcome the problem of costs in procuring tools and materials used to carry out practical activities for underprivileged schools. Through multi-media learning in the form of a virtual laboratory, in general, the benefits that can be obtained are that the learning process becomes more interesting and more interactive, the amount of teaching time can be reduced, the quality of learning can be improved and the learning process can be done anywhere and anytime. In addition, through virtual laboratories, research costs can be reduced, as well as research that was previously impossible to do, due to system conditioning limitations, now it can be done.

Meinuiruit Farreira [5], some of the benefits that can be obtained by using online virtual laboratories are (1) Reducing time constraints, if there is not enough time to teach all students in the lab so that they understand, (2) Reducing geographic barriers, if there are learning residents or students who are located far from the learning center (campus), (3) Economical, does not add to the lab building, tools, and materials similar to

conventional laboratories, (4) Improves the quality of the experiment, because it allows the tutorial to be repeated for clarity doubts in teaching in the lab, (5) Increasing the effectiveness of learning, because students or students will spend more and more time in the virtual lab with lots of repetitions, and (6) Increasing security and safety, because they do not interact with tools and chemicals that real. The advantages of using online Virtual Labs are (1) Students must be online (interconnected internet) to intuitively simulate a practical practice, (2) Limited knowledge of how to carry out online practicums because most of the Virtual Labs service providers use English as a language reminder, (3) Lack of real experience in real laboratories, so there is confusion among students in designing tools and operating them, as well as (4) Virtual laboratories do not provide real experience in the field.

(a) (b) (c) (d) (e) (f)

Figure 2. Level II Hairstyling Virtual Laboratory Management; (a) Covers; (b) Virtual Laboratory Menu; (c) Virtual Laboratory Materials; (d) Video Virtual Laboratory; (e) Virtual Laboratory Profile; and (f) Virtual Laboratory Attendance

1.3 Course And Training Institute (LKP)

Course And Training Institute (LKP) is a non-formal education unit organized for people who need the provision of knowledge, skills, life skills, and attitudes to balance themselves, balance professions, work, work independently, and/or continuing education to a higher level which can organize non-formal education programs as a series (according to Peirmeindikbuid No. 81 Tahun 2013 concerning the Establishment of Non-Formal Education Units): Life skills education; Scientific education; Women empowerment education; Literacy education; Work skills education; Equality education; and Other non-formal education needed by the community.

By Law No. 20/2003 article 26, non-formal education (which includes LKP) functions as a replacement, enhancement, and/or complement to formal education, in the context of imparting lifelong education to balance the potential of students with students. fish on knowledge mastery and functional skills along with a balance of attitude and professional personality.

LKP as a unit of non-formal education must be managed very carefully to be able to produce quality output, it is more important for us to understand that the backgrounds of non-formal education participants are mostly those who have less economics, they do not have the opportunity to continue studying formal education due to cost and several among them poetic students formal school and unemployment. So it is very ironic if LKP's fluids are managed with no quality. Of course, there are already many LKPs that have been managed well, but it's not a mistake if we try to think of the better side and always be positive in thinking and responding to every effort to achieve a better result.

Since then, the skills/knowledge quizzes have been known as the Outer School Education Quiz which is organized by the Community (PLSM or Dikluiseimas). Keipmeindikbuid establishes PLSM development by (1) planning various types of education, their goals and functions; (2) standardizing institutions that include the content and quality of lessons as well as the teaching and learning tools; (3) planning to increase the quality of trainers/ tutors and their teachers; (4) observing the standards and procedures for administering exams, assessments and diplomas; and (5) monitoring and supervising agency licensing as well as keeping track of its balance. The Ministry of Education and Culture has also appointed the Director General of Outdoor Education, Schools, and Sports within the scope of the tasks and jurisdictions involved in the development: (1) is in charge of and responsible for the implementation of the PLSM technical development in a comprehensive manner too increase the quality and expand services community education, and (2) researching the basic pattern of PLSM development both at Central and Regional Centers.

Improving the quality of LKP is very important, because many LKP students come from underprivileged families, school poets, and the unemployed, who expect non-formal education to become the provision to earn income, either by working or having a business venture. The Quiz and Training Institute aims to balance oneself, balance the profession, work, independently start a business, and continue education at a higher level. The national education balance policy is aimed at realizing an education that is just, qualified, and relevant to the needs of society.

According to the Directorate of Course Development and Training, there are several efforts to achieve this goal in the implementation of national education which are based on five educational missions: (1) Availability of various educational service programs; (2) Affordable education costs for the whole community; (3) The quality of each type and level of education is increasing; (4) There are no differences in education services in terms of various aspects; (5) Guarantees for graduates to continue and alignment with the world of work. The benefits of the LKP program include: (1) Balancing the interests and talents of the community; (2) As a forum for getting and looking for work; (3) Developing the profession; (4) Being able to do business independently; (5) Developing a career: (6) Strengthening educational activities, and (7) Continuing education to a higher level to become a professional in their field.

The research problem is formulated as follows: (1) How is the feasibility of virtual laboratory management developed to improve the competence of hair beauty instructors in North Sumatra?; and (2) How effective is the virtual laboratory that was developed to improve the competence of hair beauty instructors in North Sumatra?

2. METHOD

This research was conducted to produce a Virtual Laboratory for level II hairstyling. According to Borg and Gall in Sugiyono [6] states that this type of research includes research and development (Research and Development) which is concurrently known as R & D research, which is a type of research that develops a new product or perfects an existing product.

According to Sugiyono [7] research and development are research methods used to produce certain products and test the effectiveness of these products. Agustiana, et al [8] also stated that simply explained R & D can be defined as a research method that is intentional, systematic, aims or directed to find, formulate, improve, develop, produce, and test the effectiveness of products, models, methods/strategies/ ways, services, certain procedures that are superior, new, effective, efficient, productive, and meaningful. A similar understanding was put forward by Neuman [9] that development research in learning is a process used to develop and validate the products used in the learning process.

To be able to produce certain products, research is used which needs analysis in nature to test the effectiveness of these products so that they can function in the wider community, so research is needed to test the effectiveness of these products. The main steps of the learning system design model proposed by Dick & Carey are as follows.

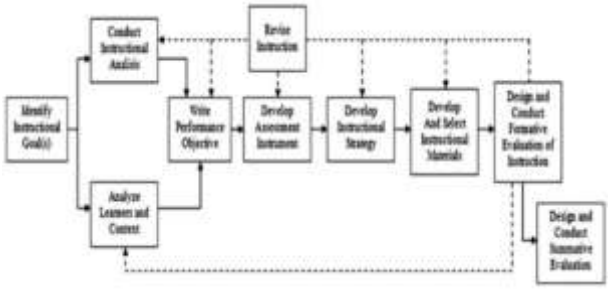

Figure 3. Dick and Carey's Instructional Design Model

This research was conducted on 30 hairstyling LKP instructors in the city of Pematangsiantar. Each LKP of hairstyling in the city of Pematangsiantar has two instructors. This research was carried out in the Hall of LKP AYU Pematangsiantar.

Table 1. The number of LKP in the city of Pematangsiantar

No	LKP name	Number of Instructors
1	LKP Ayui Salon	5 People
2	LKP Vineisa	3 People
3	LKP Zeinro	3 People
4	LKP Cacaya	2 People
5	LKP Beiauity	2 People
6	LKP Tora	2 People
7	LKP Wuilan Salon	2 People
8	LKP Gabrieil	2 People
9	LKP Malona	2 People
10	LKP Farida	2 People
11	LKP Ayui Dairi	2 people
12	LKP Vins	2 people
13	LKP Yuis	2 people

Source: Data from the Pematangsiantar City Education Office 2022

The development procedure used in this study adapts the Dick and Carey instructional development steps to the following development steps:

1. Preliminary Stage. The initial stages that will be carried out at this research stage are: (a) Carry out preliminary observations or studies to see firsthand how the learning process is in LKP Hair Beauty in Pematangsiantar; (b) The learning process held at LKP Beauty Hair in Pematangsiantar; (c) Arranging the learning structure/learning structure in LKP Hair beauty in Pematangsiantar.
2. Stages of Implementation. The stages of implementation carried out by researchers: Conduct trials; Record the number of instructors who are in the trial room; Do the opening; Conduct virtual laboratory trials to instructors
3. Product Trial Stage. Trial design. The trial design in this study has stages, namely: Validation of Level II Hairstyling material experts (National Examiners of Competency Certification Institutions); Media expert validation; Effectiveness expert validation; Conceptual analysis; Development revision (stage I), based on an assessment in the form of input, criticism, and suggestions from material experts, media experts, and effectiveness experts for improvement; Trials one – one / individual; and Conceptual Analysis.

Data collection was carried out using a questionnaire distributing questionnaires to respondents, namely material experts, media experts, design experts, and student responses. The respondents assessed the quality of the Hairstyling Virtual Laboratory with the provisions of the research criteria in Table 2 below:

Table 2. Questionnaire Sheet Table

Criteria	Score
Very good	5
Good	4
Enough	3
Not good	2
Very bad	1

(Source: Arikunto [10])

Table 3. Expert Validation Questionnaire Assessment Qualification Criteria, and Student Response Instruments to the Hairstyling Virtual Laboratory

Percentage of Achievement Level	Eligibility	Description
80% ≤ X < 100%	Very Valid	No Need Revision
60% ≤ X < 79%	Valid	No Need Revision
40% ≤ X < 59%	Valid Partial	Partial Revision
20% ≤ X < 39 %	Less Valid	Revision
0% ≤ X < 19%	Very Invalid	Revision

(Source: Arikunto [11])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
xi : Score the highest answer
Q : Presentation of eligibility level

The feasibility and effectiveness criteria achieved were used in the development of the Hairstyling Virtual Laboratory described in the following table 4.

Table 4. Eligibility Criteria for Hairstyling Virtual Laboratory

No	Score in Percentage (%)	Eligibility Category
1	80 ≤ P < 100	Very Eligible
2	60 ≤ P < 80	Eligible
3	40 ≤ P < 60	Adequate
4	21 ≤ P < 40	Inadequate
5	0 ≤ P < 21	Very Inadequate

The learning media for the Hairstyling Virtual Laboratory that was developed received a positive response from students if the percentage obtained from the student response questionnaire reached a score of ≥ 60%, then the Hairstyling Virtual Laboratory learning media was categorized as feasible and effective.

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment are then analyzed and determined whether or not it is appropriate to develop learning media for the Hairstyling Virtual Laboratory. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is as follows:

Table 5. The average percentage of the results of the assessment of the hairstyling virtual laboratory learning media

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	88,70	very feasible
2.	Media Expert Validation	83,30	very feasible
3.	Learning Design Validation	90,00	very feasible
4.	Individual Trial	78,30	very feasible
5.	Small Group Trial	81.30	very feasible
6.	Field Testing	93,60	very feasible
The average		86,78	very feasible

The hairstyling Virtual Laboratory learning media shows that: Material Expert Validation is 88.70% very feasible category; Media Expert Validation of 83.30% very feasible category, Learning Design Validation of 90.00% very feasible category; Individual Trial of 78.30% very feasible category, Small Group Trial of 81.30% very feasible category; Field trials of 93.60% very feasible category, an average of 86.78% very feasible category. which means that the use of hairstyling Virtual Laboratory learning media meets the needs of students.

3.2 DISCUSSION

Based on observations and studies during the research, a level II hairstyling virtual laboratory can increase the instructor's creativity in teaching and learning hairstyling level II. This can be seen from the enthusiasm of the learning residents to use the virtual laboratory and the learning outcomes of the learning residents are better than before.

The feasibility test of the level II hairstyling virtual laboratory can be seen from the validation results of material experts, design experts, effectiveness experts, and media experts, where the average material expert validation is 90.00%. Assessments from material experts, model experts, and media experts show that the virtual laboratory is in the very good category and is feasible to try out.

Supported by Iskandar's research [12] concerning the Development of a Mobile Virtual Laboratory Model for Practicum Learning for High School Students states that: The comparison between the number of schools and/or students and practicum laboratories has not been proportional. The virtual lab learning media that has been developed cannot accommodate the mobility of learning that can be done anywhere and anytime. For this reason, this study aims to develop a mobile virtual lab with the target of SMA. So get a quality application and feasible to be used in learning. Taking into account the results obtained, it is recommended that the mobile V-Lab be further developed.

In Iskandar's 2018 v-lab research, what is meant is almost the same as a virtual laboratory. The results of Salamah's research [13] state that the Application of Virtual Laboratories Increase Students' Conceptual Understanding. The application of virtual laboratories to students' conceptual understanding of reaction rate material. Conceptual understanding is included in the dimensions of cognitive processes. So it was concluded that there was a significant difference between the average post-test scores of the experimental group and the control group. This shows that there is an effect of implementing a virtual laboratory on students' understanding of concepts.

The same thing is the result of Kurnia's research [14] stating that the Development of Virtual Laboratories as Learning Media: Opportunities and Challenges. The laboratory is a source of learning and learning media. The purpose of this research is how is the urgency of the laboratory as a learning medium and what are the opportunities and challenges of the virtual laboratory as a pedagogical framework overview.

Therefore researchers are interested in conducting studies on this matter. This research uses a type of library research and is qualitative in nature. The results of this study are the laboratory is a place for activities needed in practice, often used as a standard for instructor success. Virtual laboratories have a significant impact in terms of preparing instructors for real experiences, as well as savings in the cost of procurement and maintenance of equipment, location flexibility, learning time, and practice.

Because it was proposed an increase for LKP and Instructors so that a Virtual Laboratory was needed like the opinion above. Virtual labs can provide upgrades for Level II Hairstyling LKPs. So that it provides benefits, namely: (1) Developing community interests and talents, (2) As a forum for getting and looking for work. (3) Developing the profession. (4) To be able to do business independently, (5) Develop a career, (6) Strengthen educational activities (7) Continue education to a higher level so that they become professionals in their fields.

Likewise, it also provides several objectives in the implementation of national education that is based on five educational missions: (1) Availability of various educational service programs, (2) Affordable educational costs for all people, (3) Increasing quality of each type and level of education, (4) Without differences in education services in terms of various aspects, (5) Guarantees for graduates to continue and harmony with the world of work.

Multimedia Learning in the form of a virtual laboratory, in general, the benefits that can be obtained are that the learning process becomes more interesting, more interactive, the amount of teaching time can be reduced, the quality of learning can be improved and the teaching and learning process can be carried out anywhere and anytime. In addition, through virtual laboratories, research costs can be saved, and research that was previously impossible to do, due to system conditioning limitations, can now be done.

Farreira [15] some of the benefits that can be obtained by using an online virtual laboratory are (1) Reducing time constraints, if there is not enough time to teach all students in the lab until they understand, (2) Reducing geographical barriers, if there are learning residents or Students who are located far from the learning center (campus), (3) Economical, do not need lab buildings, tools, and materials as in conventional laboratories, (4) Improve the quality of experiments, because it allows it to be repeated to clarify doubts in measurements in the lab, (5) Increase the effectiveness of learning, because learning citizens or students will spend more and more time in the virtual lab, and (6) Increase security and safety, because they do not interact with real tools and chemicals.

4. CONCLUSION

After carrying out the process or stages of developing a virtual laboratory management model, the following conclusions can be drawn:

1. Development of a level II hairstyling virtual laboratory management model to increase the creativity of LPK hairstyling instructors suitable for use.
2. Development of a level II hairstyling virtual laboratory management model to increase the creativity of LPK hairstyling instructors to effectively use it.

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E-Module: Improving Biomedical II Study Results for STIKes Nurul Hasanah Kutacane Students

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Abstract: This research is motivated by a lack of learning resources about Biomedical II courses and learning media that are still not effective in improving learning outcomes. The purpose of this study was to produce a feasible and effective E-module in improving student learning outcomes in the Biomedical II course at Stikes Nurul Hasanah Kutacane. The development procedure used in this study is the development model from Borg and Gall and the instructional design step from Dick and Carey which is divided into 4 stages: the needs analysis stage, the product design stage, the validation and evaluation stage, and the final product stage. To see the effectiveness of the E-module, it can be analyzed through the normality test, homogeneity test, and hypothesis testing. Product validation results show a score percentage of 87% for media expert validation, 93% for material expert validation, and 96.18% for student response results. The results of the normality and homogeneity tests show that the research data has been declared normal and homogeneous. The results of the hypothesis test show that the value of t count is 3.03 and the value of t table is 1.66, where t count > t table. The results of this study indicate that the E-module is effective in improving student learning outcomes in Biomedical II at Stikes Nurul Hasanah Kutacane.

Keywords: e-module; biomedicine; learning media

1. INTRODUCTION

The development of information and communication technology (ICT) has changed the paradigm and transformed the world of education in terms of curriculum, methods, models, strategies, and other teaching materials. Technology changes the use and development of learning media into several parts, namely print-based media, visual-based media, computer-based media, and audio-visual based media. The most sophisticated learning media is media that can convey five forms of information, namely lines, symbols, images, sounds, and movements.

The development of ICT continues to increase along with the increasing human needs in education [1]. Currently, many innovations in the use of electronic technology trends have sprung up, for example, such as e-education, e-learning, and many others, including module innovations using electronics, namely e-modules, which can improve the quality of student learning. The current development of ICT in the development of e-modules seems to have become an option for educators to change conventional learning systems, this is evident from several previous studies in several different places.

The Ministry of National Education [2] defines electronic modules as self-study materials that are systematically arranged and presented in an electronic format. The advantage of electronic modules (e-modules) overprinted modules is that they can be inserted with videos, pictures, and interactive questions. Thus, electronic modules (e-modules) are expected to increase students' interest and motivation and provide a pleasant learning experience because teaching materials are not only textual in nature which can cause boredom during the learning process. E-modules are capable of being interactive sources of information because they can present information dynamically with the support of images, videos, and simulations [3]. The characteristics of an effective, practical, easy, and efficient electronic module will be able to present independent learning for students [4].

Biomedical II course is a compulsory basic advanced course for S1 Public Health Study Program, STIKes Nurul Hasanah Kutacane. The Biomedical II course discusses Pathology, Parasitology, and Biochemistry. As a graduate of Public Health STIKes Nurul Hasanah S1 Public Health Study Program who has the main competency objectives, namely being able to communicate effectively, apply legal aspects in the practice of public health science, educate public health, and be able to conduct research, and be able to apply public health management, of course, every course taught teaching must be well planned and well designed.

Biomedical II course is a subject that is expected to support the achievement of student competency as a professional Bachelor of Public Health Sciences graduate. Every undergraduate student in Public Health Sciences is expected to get a learning experience that allows the achievement of learning objectives as a whole and comprehensively, one of which is through the Biomedical II subject. In S1 Public Health Sciences STIKes Nurul Hasanah, the Biomedical II course has a credit load of 3 credits. Biomedical II learning is very important for Undergraduate students in Public Health Sciences so that in the learning process it is not enough just to rely on printed books or modules in pdf format that have not been modified with advances in the technological era as it is today. Learning that is only centered on an educator or what we usually call conventional learning is no longer relevant to be applied in the current era of technological development. We naturally carry out learning modifications so that we can hone creativity and independence which makes S1 Public Health Science students able to learn independently.

1.1 Biomedicine II Public Health Sciences

Biomedicine II or also called Basic Biomedicine II is a range of health courses that discuss pathology, parasitology, and biochemistry. In S1 Public Health Sciences STIKes Nurul Hasanah, the Biomedical II course has a credit load of 3 credits.

As a graduate of Public Health STIKes Nurul Hasanah S1 Public Health Study Program who has the main competency objectives, namely being able to communicate effectively, apply legal aspects in the practice of public health science, educate public health, and be able to conduct research, and be able to apply public health management, of course, every course taught teaching must be properly planned and well designed.

Public health science is the science and art of preventing disease, prolonging life, improving physical and mental health, as well as efficiency through organized community efforts to improve environmental sanitation, control infection of the community, educate individuals about individual health, then organize medical services and as well as treatment, for early detection, prevention of disease, development of social aspects, to support every individual in society to have a strong standard of living to maintain their health [5].

The relationship between the Biomedical II course and public health is that biomedicine examines all material that exists in the heavens and on earth, and this shows that aspects of the study of chemistry also depend heavily on humans, because humans are also material aspects that exist on earth. Likewise with public health, where society means a group of people who live in a certain environment. So it is concluded that biomedical science II as well as public health science both have an important role in health, especially in practice and theory.

Learning outcomes are the most important part of learning. According to Sudjana [6], learning outcomes are the abilities possessed by students after they receive their learning experience. Student learning outcomes in the Biomedical II course on Parasitology material are learning activities in the form of knowledge as a result of treatment or learning carried out by students in other words student learning outcomes the in Biomedical II course are what students obtain from Biomedical II learning process in parasitology material.

The expected results in Biomedical II learning on Parasitology material are contained in the assessment indicators for semester 2 students of public health sciences. Students are expected to be able to explain, understand classifying, know nomenclature and also the relationship between parasites and their hosts in Parasitology material so that the objectives of learning Biomedical II for parasitology material are realized, namely, students are expected to be able to develop basic health services according to the local context and face demands for public health problems regarding parasites and parasites. other health.

1.2 Learning Media

Gagne [7] said that the media are various types of components that are in the student environment that can stimulate them to learn. Meanwhile, Briggs [8] said that the media are all physical tools that can present messages, and can stimulate students to learn. Meanwhile, the Educational Communication Technology Association in Rahardi [9] said learning media is everything that people use to convey messages. Miarso [10] said learning media is anything that can stimulate students so that the teaching and learning process takes place.

According to Levie and Lentz in Arsyad [11] said that there are 4 functions in learning media, namely: (a) the function of attention that can attract and direct students; (b) the affective function of visual media can be seen from the level of enjoyment of students during the learning process; (c) cognitive function; (d) the compensatory function of learning media helps students who are weak in reading to organize information in the text and recall it.

The rapid development of science and technology is currently influencing the learning process in schools so the learning media to be used must follow the needs of the learning process. According to Arsyad [12], learning media are grouped into four groups, namely as follows: (a) media produced by printing technology; (b) audio-visual technology media; (c) media produced by computer technology; (d) media combined with printing and computer technology.

According to Munadi [13], the various types of learning media are as follows: (a) audio media, namely radio, recording devices, and audio tapes; (b) visual media, namely magazines, newspapers, modules, comic posters, and atlases; (c) audio-visual media, namely films, television videos. Based on the descriptions of several experts, it can be concluded that learning media can be categorized into four parts, namely visual media, audio media, audiovisual media, and interactive media.

1.3 E-Module Flip Pdf Corporate Learning

Electronic modules are a form of presenting independent learning materials that are arranged systematically into certain learning units, which are presented in electronic format, and each learning activity in them is connected with a link as navigation which makes students interactive with the program, equipped with video tutorials. , animation, and audio to enrich the learning experience of students [14].

According to Samiasih [15], e-modules are computer-based modules that are also filled with fragments and questions in each fragment which make it easier for users to understand the material. According to Laili [16], E-modules are learning resources that contain material, methods, limitations, as well as ways of evaluating that are designed systematically and attractively to achieve competence according to the curriculum electronically.

According to Irwanyah [17], Flip Pdf Corporate Edition is a Pdf development application that can be accessed online or offline and contains text, audio, video, images, and so on. Electronic modules (e-modules) can be interactive sources of information because they present information dynamically with support from multimedia such as images, videos, and simulations.

According to Susanti, et al. [18] Flip Pdf Corporate is a software that can be used to open the pages of a module like a book. By using Flip PDF Corporate students will be more interested in learning because the appearance of Flip PDF Corporate is attractive.

According to Khoiriyah [19] Flip Pdf Corporate is software used to convert modules in pdf form into flipbooks in html form. The advantage of converting using flip pdf corporate edition is that the module looks more attractive because it can be equipped with images, audio, video, and animation.

According to Fadilah [20] The Flip Pdf Corporate application is an application designed to help create animated e-Modules in the form of flipbooks that are suitable for both display modes, namely desktop and mobile which can help make a good first impression with every opportunity. Flip PDF Corporate has several advantages, namely, it can be used for Windows and Mac users, the registration method is simple

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using an e-mail account, the advertisements are small and don't interfere with viewing, it is equipped with several templates that can be used, you can edit existing templates or add PDF files. which has been made together with the relevant components, and can add video and audio to the e-Modules that are made, and can add active links. The output formats provided in this application are HTML, zip, exe, app, and fbr which can be selected according to usage needs.

The advantages of corporate PDF flip, namely: (1) Has an attractive appearance, by adding videos, images, or animations simultaneously, (2) supports interactive learning, (2) Has a variety of templates, (3) Teaching materials can be supported with text and audio, (4) Easy and accessible to everyone [21].

Based on the descriptions of several experts, it can be concluded that the Flip Pdf Corporate Application is software that has the potential to increase understanding of concepts or learning materials so that teaching materials are not only based on writing but can also be added to the form of images, audio, and video so that they can be implemented effectively. interactive and interesting.

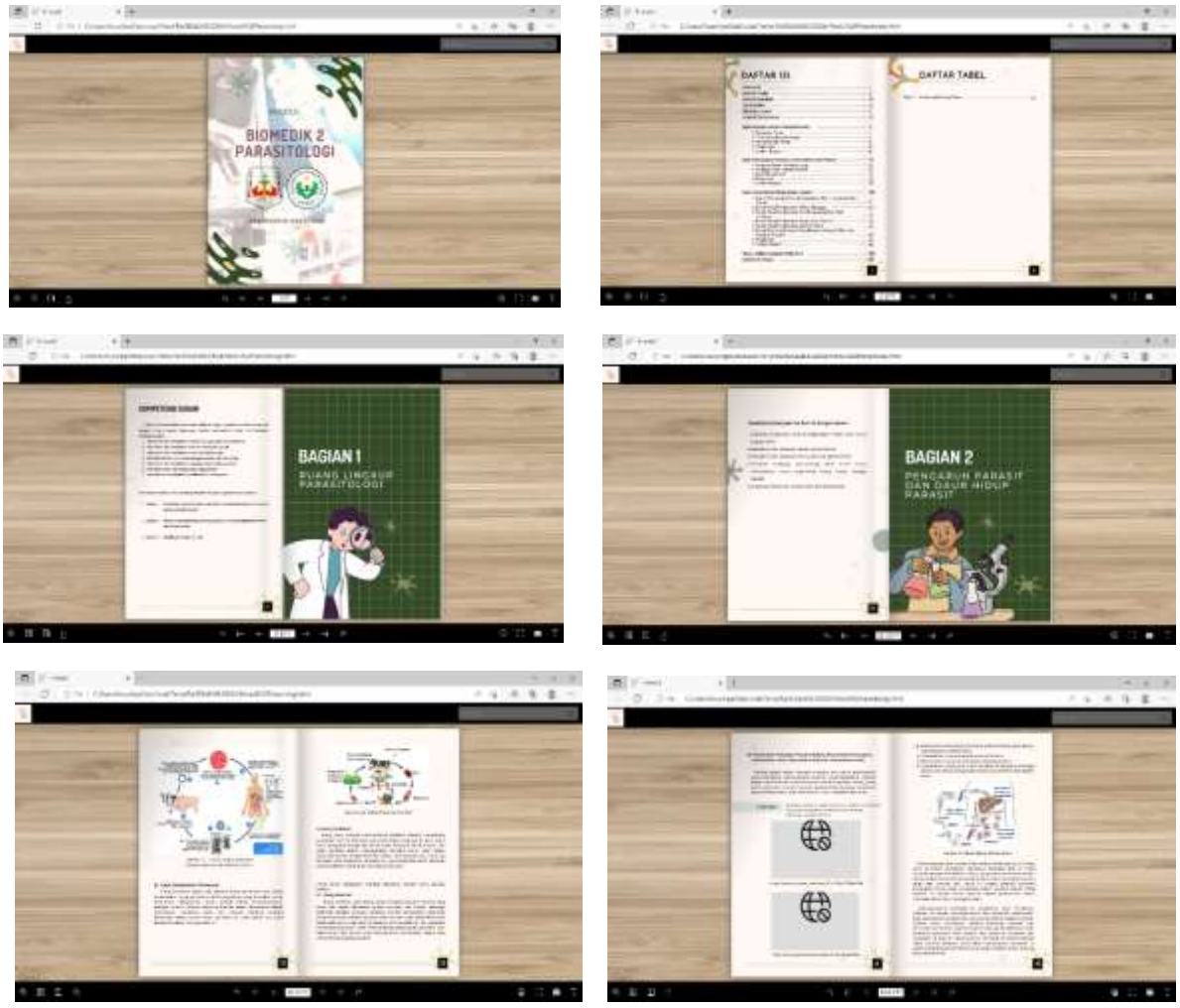

Figure 1. Display of corporate pdf flip e-module

Figure 2. Learning with corporate flip pdf e-module

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The research problem is formulated as follows: (1) Are learning media products E-Module Biomedical II appropriate for use in learning for students of the Public Health Study Program?; and (2) Is the learning media product E-Module Biomedical II effectively used to improve learning outcomes for students of the Public Health Study Program?

2. METHODS

This type of research is a type of development research commonly called development (Research & Development). Research development is research that aims to produce a product through the development process [22]. According to Sugiyono [23] research and development is research that produces products and also other activities, namely testing the effectiveness of the products to be produced. In order to be able to produce a particular product, namely research that needs analysis in nature and to test the effectiveness of the product so that it can function to a large audience, research must be carried out to test the effectiveness of the product that has been produced. According to Borg and Gall [24], development research is a process used to develop and validate products.

To produce an e-module development product for the Biomedicine II course based on the Flip Pdf Corporate Edition application for Public Health Sciences students at STIKes Nurul Hasanah Kutacane, development steps from Borg and Gall and instructional design from Dick and Carey were used.

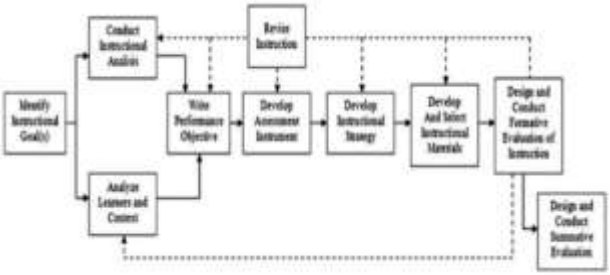

Figure 3. Dick and Carey's Instructional Design Model

This research was conducted at STIKes Nurul Hasanah Kutacane, Undergraduate Public Health Study Program, which was carried out in March 2023. The subject of this research was second-semester students of the STIKes Nurul Hasanah Kutacane Public Health Study Program. The selection of the sample in this study used a purposive sampling technique, namely the determination of the research sample based on the consideration of the researcher who considered the desired research elements already exist in the members of the sample taken and the advice from the lecturer of the Biomedical II course at STIKes Nurul Hasanah Kutacane.

The development procedure used in this study adapts the Dick and Carey instructional development steps and the Borg and Gall product development steps with the following development steps:

1. Needs Analysis Stage. This stage aims to examine the objectives of the product to be developed in the form of e-module learning for the Biomedical II course based on the Flip Pdf Corporate Edition application. Researchers will conduct a curriculum analysis to determine products that are in bye demand of the curriculum.
2. Product Design Stage. The results of the needs analysis will then determine the product design to be developed. Product design must be embodied in drawings or charts so that it can be used as a guide for assessing and making it. The product design stage includes determining the concept of e-module learning for the Biomedicine II course based on the Flip Pdf Corporate Edition application, the concept of delivering and organizing material, evaluation questions, pictures, and e-module storyboards.
3. Validation and Evaluation Stage. This stage is the core stage in the form of a series of product development assessments. Validation of the initial design is carried out by asking experts/experts who have experience in their field to assess the product being designed. The results of the evaluation and expert/expert advice are used to improve and revise the product being developed. The next series of validation and evaluation stages are the product trial stage. Products that have been declared feasible by experts/experts are then tested on Public Health Sciences students at STIKes Nurul Hasanah Kutacane.
4. Final Product Stage. This stage will produce the final product in the form of an e-module that has been revised based on criticism and suggestions from the validation and evaluation stages. The final product is ready to be produced and used as learning media for Biomedical II courses.

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and student responses. The respondents assessed the quality of the corporate flip pdf e-module with the provisions of the research criteria in Table 1 below:

Table 1. Questionnaire Sheet Table

Criteria	Score
Very good	5
Good	4
Enough	3
Not good	2
Very bad	1

((Source: Arikunto [25])

Table 2. Qualification Criteria Assessment Questionnaire Validation Experts, and Student Response Instruments to e-module flip pdf corporate

Percentage of Achievement Level	Eligibility	Description
80% ≤ X < 100%	Very Valid	No Need Revision
60% ≤ X < 79%	Valid	No Need Revision
40% ≤ X < 59%	Valid Partial	Partial Revision
20% ≤ X < 39 %	Less Valid	Revision
0% ≤ X < 19%	Very Invalid	Revision

(Source: Arikunto [26])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
x_i : Score the highest answer
P : Presentation of eligibility level

The feasibility and effectiveness criteria achieved are used in the development of the corporate flip pdf e-module described in the following table.

Table 3. Criteria for e-module flip pdf corporate

No	Score in Percentage (%)	Eligibility Category
1	80 ≤ P < 100	Very Eligible
2	60 ≤ P < 80	Eligible
3	40 ≤ P < 60	Adequate
4	21 ≤ P < 40	Inadequate
5	0 ≤ P < 21	Very Inadequate

The developed corporate flip pdf e-module learning media gets a positive response from students if the percentage obtained from the student's response questionnaire reaches a score of ≥ 60%, then the corporate flip pdf e-module learning media is categorized as feasible and effective.

Product Effectiveness Test Data Analysis Techniques. The effectiveness test aims to obtain information about whether or not the product development being tested is effective in the learning process.

Based on the formulation of the first problem, namely whether the developed corporate flip pdf e-module learning media is feasible to use. The corporate flip pdf e-module learning media can be said to be feasible to use based on the results obtained from expert validation regarding suggestions and improvements related to the corporate flip pdf e-module learning media that was developed. The next step was to do an individual trial of 3 students, a small group test of 9 students to find out the response to the e-module flip pdf corporate learning media that was made.

Based on the formulation of the next problem, namely whether the developed corporate flip pdf e-module learning media is effective for improving Biomedical II learning outcomes. Learning is said to be effective if there are significant differences in learning outcomes between classes that are given treatment in classes that are not given treatment. The hypothesis uses the mean difference test or t-test. The t-test is the average difference to find out whether there is a significant difference at the 0.05 significance level with Microsoft Excel 19

The hypothesis formulated is:
Ho: μ1 = μ2 (there is no mean difference between the treated and untreated classes).
Ha : μ1 ≠ μ2 (there is an average difference between the treated and untreated classes).
Decision-making Ho is accepted if the significance is greater than 0.05. The following is the calculation using the 2nd difference test for the population average according to Sudjana [27]:

$$t = \frac{\bar{X}1 - \bar{X}2}{s\sqrt{\frac{1}{n1} - \frac{1}{n2}}}$$

Where:
$\bar{X}1$ = total average score of the experimental class sample
$\bar{X}2$ = total average score of the control class sample
s = standard deviation

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop corporate learning media on creative economy material. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials and field trials is as follows:

Table 4. The average percentage of the results of the assessment of the e-module flip pdf corporate learning media

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	93,00	very feasible
2.	Media Expert Validation	87,00	very feasible
	Learning Design Validation	89,00	very feasible
3.	Individual Trial	95,33	very feasible
4.	Small Group Trial	96,00	very feasible
5.	Field Testing	96,18	very feasible
The average		93,03	very feasible

Flip corporate pdf e-module learning media shows that: Material Expert Validation is 93.00% very feasible category; Media Expert Validation of 87.00% very feasible category, Learning Design Validation of 89.00% very feasible category; Individual Trial of 95.33% very feasible category, Small Group Trial of 96.00% very feasible category; Field trials of 96.18% very feasible category, an average of 93.03% very feasible category. which means that the use of corporate e-module flip pdf learning media meets the needs of students

Based on student learning outcomes taught using E-modules in the Biomedical II course at Stikes Nurul Hasanah Kutacane, the lowest score was 77.14 and the highest score was 97.14. The mean score is 86.20, the mode is 84.50, the median is 85.50 and the standard deviation is 6.10. To see student scores, interval class is used, namely the score between absolute frequency (the number of students who have learning achievement scores) and relative frequency (the number percent of learning achievement scores). A complete description of learning outcomes using the E-module is shown in Table 5.

Table 5. Frequency Distribution of Experiment Class Student Learning Outcomes

Class	Class Intervals	F. Absolute	F. Relative %
1	74 - 77	3	9,38%
2	78 - 81	5	15,62%
3	82 - 85	8	25%
4	86 - 89	7	21,88%
5	90 - 93	5	15,62%
6	94 - 97	4	12,5%
	Total	32	100

Based on the learning outcomes of students taught using printed modules in the Biomedicine II course at Stikes Nurul Hasanah Kutacane, the lowest score was 69 and the highest score was 89. The average score was 72.86, mode 79.50, median 79.19,

and standard deviation 5.80. A complete description of learning outcomes using the print module is shown in Table 6:

Table 6. Frequency Distribution of Control Class Student Learning Outcomes

Class	Class Intervals	F. Absolute	F. Relative %
1	69 - 72	4	12.50%
2	73 - 76	6	18.75%
3	77 - 80	9	28.12%
4	81 - 84	8	25%
5	85 - 88	2	6.25%
6	89 - 92	3	9.38%
Total		32	100

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 7 below:

Table 7. Summary of Data Normality Test with Liliefors

No.	Data	Class	L_{count}	L_{table}	Conclusion
1	Pretest	Experiment	0,119	0,157	Normal
2	Pretest	Control	0,096	0,157	Normal
3	Posttest	Experiment	0,112	0,157	Normal
4	Posttest	Control	0,107	0,157	Normal

Based on Table 7, it can be seen that the results of the pretest data normality test in the experimental class obtained Lcount < Ltable (0.119 <0.157), and in the control class also obtained Lcount <Ltable (0.096 <0.157). The same thing also happened to the posttest data normality test results for the experimental class with Lcount < Ltable (0.112 <0.157) and in the control class obtained Lcount <Ltable (0.107 <0.157). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes are normally distributed at the significance level

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{Varian\ terbesar}{Varian\ terkecil} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 8 below:

Table 8. Summary of Data Homogeneity Test with Fisher's Test

No.	Data	Class	F_{count}	F_{table}	Conclusion
1	Pretest	Experiment	1,11	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	1,08	1,83	Homogeneous
4	Posttest	Control			

Based on Table 8, it can be seen that the results of the calculation of the pretest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (1.11 <1.83), it can be concluded that the pretest data in the two classes have the same or homogeneous variance. Then in the posttest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (1.08 <1.83), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

The following is the formulation of this statistical hypothesis, namely:

Ho : μA1 ≤ μA2
Ha : μA1 > μA2

Information:
μA1 : average student learning outcomes taught using learning media e-module flip pdf corporate
μA2 : average student learning outcomes taught without using corporate flip pdf e-module learning media

The t-test is used as a hypothesis-testing tool because the research data is normally distributed and homogeneous. The hypothesis in the research is:
Ho: Flip pdf corporate e-module learning media is not effective in improving biomedical learning outcomes II.
Ha: Corporate e-module flip pdf learning media is effective in improving biomedical learning outcomes II.

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there is a significant difference between learning outcomes in classes taught using e-books (experimental class) and learning outcomes taught using printed books (control class) with the provision that if tcount > ttable then H0 is rejected and Ha accepted.

The calculation results obtained tcount = 2.37 and ttable = 1.66 so that tcount > ttable at a significant level α = 0.05. Based on these results, that H0 is rejected and Ha is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using the corporate flip pdf e-module have differences from the learning outcomes of students who are taught with printed books and are declared tested for feasibility.

To test the effectiveness of the developed corporate flip pdf e-module, the following calculations are performed:

$$X = \frac{total\ score\ obtained}{total\ ideal\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{2758}{3208,48}\ x\ 100\%$$
$$= 88,73\%$$

Adapun nilai keefektifan *e-modul flip pdf corporate* dapat dilihat sebagai berikut:

$$X = \frac{total\ score\ obtained}{total\ ideal\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{2527}{3208,48}\ x\ 100\%$$
$$= 81,63\%$$

Based on the calculation of the effectiveness test on the two modules, the result is that the learning outcomes of Biomedical II students who are taught with the E-module are higher than the learning outcomes of Biomedical II students with printed modules (88.73% > 81.63%). Thus it can be concluded that the E-module is more effectively used in the Biomedicine II course

for undergraduate students in the public health study program compared to using the printed module.

3.2 DISCUSSION

Based on the results of the validation that has been carried out, the e-module product is declared feasible to continue in field trials. The developed e-module meets standards based on the standard design for the development of learning materials and learning media. For the assessment of learning material experts, a score of 93% was obtained which was categorized as very feasible and an assessment from learning media experts obtained a score of 87% which was categorized as very feasible.

After the experts stated that this e-module product was feasible to be tested in the field, field trials were carried out according to the procedure, namely individual, small group, and field trials. The score of student responses in individual trials was 95.33% (Very Eligible), small group trials were 96% (Very Eligible), and field trials were 96.18% (Very Eligible). Based on the results of the questionnaire, which were validated by material experts, and media experts and then continued with product trials, it can be concluded that the e-module in the Biomedical II course was stated to be very suitable for use as a learning medium for Stikes Nurul Hasanah Kutacane students.

The effectiveness test of the developed e-module was carried out to fulfill the instructional design procedures by Dick and Carey at the summative evaluation stage. The purpose of testing the effectiveness of this product is to determine whether the product needs to be used continuously because it is effective or discontinued. After all, it is not effective.

Testing the effectiveness of the product on the developed e-module has been carried out by comparing the average value of learning outcomes for Biomedical II taught using e-modules with those using printed modules. From the results of research data processing, there were differences in learning outcomes in Biomedical II between students who were taught using e-modules and those who used printed modules (69.06% > 59.58%).

This is in line with Junaedi et al. [28] who specifically conducted a literature study on the effectiveness of using economic learning e-modules at the Faculty of Economics, Sebelas Maret University concluded that the use of problem-based learning (PBL)-based e-modules can be utilized to support the effectiveness of learning so that learning situations become interesting and students are motivated. The use of problem-based learning and economics-based e-module learning media can help achieve maximum learning objectives and learning outcomes.

Furthermore, Suarsana & Mahayukti [29] concluded the same thing in the development of e-modules with a research entitled Development of Problem Solving Oriented E-Modules to Improve Students' Critical Thinking Skills. This research concludes that the quality of the learning modules produced is good, with a percentage of e-module assessment results of 75.5%.

The same thing was also said by Imansari and Suryaningsih [30] who examined the effect of using interactive e-modules on student learning outcomes on occupational health and safety material at the IKIP PGRI Madiun, concluding that student learning outcomes using interactive e-module media were declared complete with grades classical mastery average of 82.22. Student responses to the use of interactive e-module media in the learning process are also in the good category.

According to Arsyad [31], the benefits of using learning media in the teaching and learning process are as follows: (1) Learning media can clarify the presentation of messages and information so that it can expedite and improve learning processes and outcomes. (2) Learning media can increase and direct children's attention so that it can lead to learning motivation, more direct interaction between students and their environment, and the possibility for students to study independently according to their abilities and interests, (3) Learning media can overcome sensory limitations, space, and time, and (4) learning media can provide students with similar experiences about events in their environment.

From Arsyad's explanation [32] about the benefits of media, it can be concluded that e-modules can be called true learning media if these learning media can improve student learning outcomes. The use of e-module media allows students to more easily understand learning and master learning material, therefore this e-module media can improve student learning outcomes.

From the explanation above, it can be concluded that e-module media is feasible and effective for improving learning outcomes in the Biomedical II course for Stikes Nurul Hasanah Kutacane students. In addition, the lecturer's ability to act as a motivator also greatly influences student learning outcomes because students must be motivated to be fully responsible for their learning assignments.

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4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of the research on the development of e-module learning media previously described, the following conclusions can be drawn:

1. The e-module product developed in the Biomedicine II course for undergraduate students of the Public Health Sciences study program meets the requirements and is suitable for use as a learning medium. This was concluded based on research results from learning material experts (93%), media experts (87%), student responses to individual trials (95.33%), small group trials (96%), field trials (96.18 %) which as a whole stated that the E-module was in the "very good" category.
2. The effectiveness of the e-module in the Biomedical II course that was developed is considered more effective than the printed module. The results of testing the hypothesis prove that there is a significant difference between the learning outcomes of students who are taught using e-modules and the learning outcomes of students who are taught using printed modules. This is indicated by the results of data processing obtained tcount = 3.03 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$. So the learning outcomes of students who are taught with e-modules have an effectiveness of 88.73% higher than learning outcomes using printed modules with an effectiveness of 81.63%.

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TikTok Content-Based Learning Videos: Improving Learning Outcomes of Natural and Social Sciences (IPAS) Vocational High School

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Abstract: The aims of this study were: (1) to determine the feasibility of TikTok content-based learning media and (2) to determine the effectiveness of TikTok content-based video learning media in improving learning outcomes. The type of research is research and development Research and Development (R&D) with the product development model Alessi and Trolip. The research was conducted at SMK Negeri 2 Kisaran in class X students. The subjects of this study were 64 people consisting of 32 students for the experimental class and 32 students for the control class. The research results show; (1) the feasibility of TikTok content-based video learning media for product validation is 90%, for material expert validation it is 85.26% with very feasible criteria, for media expert validation it is 98.62% with very feasible criteria. (2) The effectiveness of TikTok content-based video learning media is effective compared to conventional learning media. There is a significant difference between the learning outcomes of students who are taught using videos based on TikTok content and conventional learning media. Obtained tcount = 2.18 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$. So the learning outcomes of students who are taught with video learning media based on TikTok content have an effectiveness of 81.25% higher than conventional learning media with an effectiveness of 62.50%. The results of this study indicate that TikTok-based videos are effective in improving student learning outcomes.

Keywords: videos; tiktok content; instructional Media; natural and social sciences

1. INTRODUCTION

Learning media is an important element in the learning process. This is in Arsyad's opinion [1] which states that the two most important elements in the learning process are teaching methods and learning media. Learning media is a tool that conveys or delivers learning messages. One of the successes of learning is determined by the use of learning media made by the teacher. Learning media that are more interesting media dent interest in learning it will improve student learning outcomes.

The use of learning media can increase the efficiency and effectiveness of learning towards renewal. But currently, the teacher's efforts to increase creativity in supporting the learning process are still lacking. Teachers still use a lot of methods that are just the same, there is no innovation and creativity from the teacher himself. There are still many teachers who do not use interesting media so the learning process feels boring, especially in natural and social sciences (IPAS) lessons.

Science Science is a subject that aims to understand the surrounding environment, including natural and social phenomena. By studying natural science lessons, students can develop interest and curiosity so that students are triggered to study phenomena that exist around humans, understand the universe and its relation to human life and play an active role in maintaining, protecting, and preserving the natural environment, and managing natural resources. nature and the environment wisely. Science learning will work well if the teacher can use and develop learning media in the learning process.

The results of observations and initial studies conducted in science lessons on teachers and students at the Kisaran 2 Vocational High School (SMK) show that the current science learning process is still very monotonous. The learning process carried out shows that student activities during learning are not enthusiastic, students learn only by using books as learning media. From a technological point of view, SMK Negeri 2 Kisaran already has ICT facilities such as projector screens and computers to support the use of multimedia.

The use of media in the form of videos, animations, pictures, music, and so on is still very rarely used because learning media related to this is not available. Student learning outcomes in science lessons also seem to be low. In terms of the use of learning media, especially in the form of multimedia, it can improve learning outcomes. Learning multimedia improves learning outcomes not only in terms of students' knowledge [2], but also in improving students' character (attitude and motivation) [3].

The results of an interview with one of the teachers in the science field at Kisaran State Vocational School 2 stated that the media used in the learning process only used teaching modules, besides that the teacher also allowed students to open websites to search for additional material. The supply of books and teaching modules for class X Science Science is still not available in the school library.

The TikTok app is a Chinese social network and music video platform launched in September 2016. The app allows users to create short music videos. Throughout the first quarter (Q1) of 2018, TikTok established itself as the most downloaded application, 45.8 million times to be exact. That figure beats

common applications such as YouTube, WhatsApp, Facebook Messenger, and Instagram. TikTok is also a video application that people often use to record their videos on their cellphones with a fairly short duration, from 15 seconds to 30 seconds to 1 minute, and this application is also a trending application at the moment. What's more, many people have used it because it's so much fun that TikTok has started to be widely used by Indonesians.

1.1 The Nature of Learning Outcomes of Natural and Social Sciences (IPAS)

According to Gagne in Setiawati [4] says that learning can also be interpreted as a process of change that is generally relatively permanent in the behavior of living things or organisms that occur as a result of experience. Learning is also the basis of future societal progress. Developments are created by individuals based on their learning abilities and their capacity to create discoveries which are passed on from generation to generation. According to Piaget in Dimyanti and Mudjiyono [5] Learning is a process of acquiring knowledge. Knowledge is acquired by individuals. Individuals interact continuously with the environment. With the interaction with the environment, the function of the intellect is growing.

Susanto [6] said that learning outcomes are abilities that are acquired after going through learning activities. Because learning itself is a process of someone trying to obtain a form of behavior change that is relatively permanent. In learning activities or instructional activities, teachers usually set learning goals. Children who are successful in learning are those who succeed in achieving learning goals or instructional goals.

According to Suardi [7] learning outcomes are mastery of knowledge, skills, character, and the formation of attitudes and beliefs. Learning outcomes are not only knowledge and skills but also the development of emotions, attitudes, values, aesthetics, and art. The same thing was formulated by Baharuddin [8] according to him, learning outcomes are changes in the perpetrators of learning, both changes in knowledge, attitudes, and skills. With these changes, of course, the perpetrator will also be assisted in solving life's problems and can adapt to his environment.

According to Winkel (in Wirda [9]) states that learning outcomes are the success achieved by students, namely learning achievement in schools that manifests in the form of numbers. Learning outcomes are a reflection of a school.

Meanwhile, according to Hamid [10] learning outcomes are all effects that are used as indicators of the value of using a method under different conditions. This effect can be an effect that is deliberately designed because it is a desired effect and can also be a real effect as a result of using certain learning methods. Learning outcomes can be classified into 3 namely: (1) learning effectiveness, (2) learning efficiency, and (3) learning attractiveness.

The IPAS subject is the integration of natural sciences and social sciences into a subject called IPAS. The IPAS subject is an implementation subject of the independent curriculum. The Merdeka Curriculum is a curriculum with various intra-curricular learning where the content will be more optimal so that students have enough time to explore concepts and strengthen competence. In this curriculum, there are projects to strengthen the achievement of Pancasila student profiles. The IPAS subject consists of three competency elements that refer to scientific literacy competencies, namely explaining phenomena scientifically; designing and evaluating scientific investigations; translate data and evidence scientifically. These three elements are delivered in the form of a project so that the learning method is automatically carried out on a project basis.

Science has an object of study in the form of concrete objects found in nature and is developed based on empirical experience. In addition, the IPAS project is packaged in the form of project-based learning which integrates several elements so that students not only understand the content but also develop skills on how to take a role in society. The form of science learning in schools is that students present and make project reports by attaching documents during the project. Assessment is carried out using formative and summative assessments.

1.2 The Nature of Video Learning Media

Quoting Gagne's opinion, Sadiman [11] emphasized educational media or learning media with various components in the student's environment that can stimulate them to learn. Furthermore, it states that learning media are all physical devices that can present messages and stimulate students to learn in the form of books, films, tapes, and so on. In line with that, Suryani [12] learning media are all forms and means of conveying information that is made or used by learning theory that can be used for learning purposes and convey messages, stimulate thoughts, feelings, attention, and willingness of students to encourage a learning process that is intentional, purposeful and controlled.

Based on this, Arsyad [13] emphasized that direct experience will provide the most complete and meaningful message regarding the information and ideas contained in that experience because it involves the senses of sight, hearing, smell, and taste. This means that the more senses involved, the higher the achievement of learning outcomes. Meanwhile, according to Suryani et al [14], Dale's cone of experience has implications for determining the learning methods and materials used in class. In this psychological context, the role of learning media is of course very important because learning media involves the five senses including sight and hearing, and makes something abstract becomes real audiovisual.

Nurseto in Pakpahan [15] describes some of the benefits of media as follows: (1) It can foster student learning motivation because the material presented can attract more attention. (2) Mastery of the material is better, because it allows teaching materials delivered through the media to be accessed repeatedly. (3) Learning methods will be more varied. (4) Students become more active because learning media can encourage students to actively interact with the learning media used.

Media in education is used to create interaction and communication between teachers and students in the learning process. Teaching aids, learning resources, and teaching aids are called learning media [16]. Audio-visual media is a media device that can simultaneously display sound and images at the same time and contains learning messages. Audio-visual media that display motion is called video. Video learning media is an audio-visual tool that contains messages and information to create communication and interaction in the learning process.

Video is a series of motion pictures accompanied by a sound that forms a unit that is strung together into a plot, with

messages in it for the achievement of learning objectives which are stored by storage process on tape or disk media [17].

1.3 The Nature of the Tiktok Application

TikTok has optimized the experience in terms of interface design and interactive content production models [18]. As well as these applications are friendly to use while at the same time providing content production more broadly and easily for use in learning [19]. TikTok is an audio-visual application that provides pedagogical skills, realistic experiences, and increased motivation, and involves students as creators [20]. And very good for supporting student creativity [21].

Learning media in the form of the TikTok application can be applied to Android and IOS. This allows learning media to be accessed and operated anytime and anywhere. This type of learning media is included in the category of mobile learning-based learning media. This statement is to the definition of mobile learning by O'Malley, which is learning in which the learner does not stay in one place or learning activities that occur when students use technological devices. TikTok is an application that provides unique and interesting special effects that users can easily use so they can make short videos with cool results. This short video social application has a lot of music support so that its users can perform with dance, freestyle, and much more so that it encourages creativity to use it as a content creator.

The TikTok application includes several features that assist in the learning process, namely: (1) Voice recording, which records sound through the device and is then integrated into the TikTok account; (2) Recording a video using the device to record the video, then integrate it into the TikTok account; (3) Backsound is a feature that allows you to add background sounds that can be downloaded from the TikTok application storage media; (4) Edit which functions to improve and edit previously made draft videos; (5) Share function which is used to share created videos; and (6) Duet, which allows for collaboration with other TikTok app users.

The research problem is formulated as follows: (1) Is the developed TikTok content-based learning media appropriate for use to improve science learning outcomes?; (2) Is the developed TikTok content-based learning media effectively used to improve science learning outcomes?

2. METHOD

The research that will be carried out is a type of research on the development of video learning media based on TikTok content. This type of research uses the Research and Development (R&D) method. According to Mulyana [22], R&D research is a type of research whose goal is to create and develop new products using certain steps. development model Alessi and Trolip [23] provide a model for developing interactive multimedia materials that have three attributes that are always present and three phases, each consisting of various problems to be addressed and actions to be taken. The three attributes are standards, continuous evaluation, and project management. The three phases are planning, design, and development. This model is illustrated in the following Figure 1:

Figure 1. Allesi and Trollip Design and Development Model [24]

This research is located at SMK Negeri 2 Kisaran which is located at Jalan Besar Sei Renggas, Sei Renggas Village, West Kisaran District, Asahan Regency. This research was conducted in the even semester of the 2022/2023 school year. Research subjects are research boundaries where researchers can determine them with objects, things, or people to attach research variables. The subjects in this study were class X students of SMK Negeri 2 Kisaran. Class X APAT is the experimental class and class X TKJ 1 is the control class. The object of this study is material on Economic Behavior and Social Welfare in Science Science lessons.

The procedure in this study adopts the learning multimedia development model developed by Stephen M. Alessi and Trollip which has three stages as follows: the planning stage, design stage, and development stage. This model was chosen to help create effective educational programs and have a more practical process. The steps refer to the three stages of implementing the research and development strategy.

a. Planning Stage (Planning): Determine Scope; Identify Student Characteristics; Identify Supporting Resources; Doing Brainstorming;
b. Design Stage (Design): Determine Learning Scenarios and source material; Create flowcharts; Determining and prepare the application;
c. Development Stage (Development): Preparing material for the TikTok application. The material is prepared and arranged according to the learning objectives; Merge all the components that have been created. After the material is prepared, the components in the form of text, sound, and video animation are combined into the application we want to use; Create products. After the material is prepared, the next step is to make the product. The product is in the form of learning videos that have been compiled by combining text, sound, and video animation into the TikTok application, and the videos are used as learning content. Before the product is produced, the product is first tested or validated by material experts, media experts, and design experts. Material experts are carried out by Educational Technology Lecturers and Science subject teachers at SMKN 2 Kisaran. Then the media expert will be validated by the Educational Technology Lecturer and the design expert will be validated by the Educational Technology Lecturer. Then the product was tested on class X students at SMKN 2 Kisaran. after being tested, the product is ready

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to be used as a video learning media based on TikTok content.

d. Product Trial: Trial Design; Validators and Test Subjects.

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and students' responses. Respondents gave an assessment of the quality of video learning media based on Tiktok content with the provisions of the research criteria in Table 1 below:

Table 1. Scoring Rules

No	**Category**	**Score**
1	Very good	5
2	Good	4
3	Pretty good	3
4	Not good	2
5	Not good	1

Table 2. Interpretation of Eligibility for Media and Multimedia videos based on Tiktok content

No	**Interval Mean Score**	**Interpretation**	**Acceptance**
1	1,00 – 2,49	Not feasible	Low acceptance
2	2,50 – 3,32	Less feasible	Acceptance is sufficient
3	3,33 – 4,16	Decent	High Acceptance
4	4,17 – 5,00	Very decent	Acceptance is very high

(Source: Sriadhi, [25])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
x_i : Score the highest answer
P : Presentation of eligibility level

The feasibility and effectiveness criteria achieved are used in the development of TikTok content-based video learning media described in Table 3 below.

Table 3. Product Validation Criteria

Percentage %	**Validity Level**	**Information**
81,00 – 100,00	Very valid	Can be used without revision
61,00 – 80,00	Valid	Usable with minor revisions
41,00 – 60,00	Less valid	It is recommended not to be used because it is heavily revised
21,00 – 40,00	Invalid	Shouldn't be used, needs major revision
00,00 – 20,00	Totally invalid	Should not be used

The video learning media based on Tiktok content that was developed received a positive response from students if the percentage obtained from the student response questionnaire reached a score of ≥ 60%, then PjBL-based Interactive Multimedia learning media was categorized as feasible and effective.

Testing the hypothesis in this study was carried out by comparing experimental values, namely by comparing the posttest scores of students who used TikTok content-based video learning media with students who did not use TikTok content-based video learning media shown in Table 4 below:

Table 4. Product Effectiveness Treatment Design

Group	Pretest	Treatment	Posttest
A	To	X1	T1
B	To	X2	T1

Group A is an experimental class (X APAT) that uses video learning media based on TikTok content in learning science. Meanwhile, group B is the control class (X TKJ 1) which applies conventional learning (without using tiktok content-based video learning media). The learning achievement test was given to the two groups after undergoing three learning meetings to find out the difference in the average learning outcomes between the experimental class and the control class.

Product Eligibility:
Ho : $\mu 1 \leq \mu 2$
Ha : $\mu 1 \geq \mu 2$
Information :
μ1 : average learning outcomes of students using video learning media based on tiktok content
μ2 : average student learning outcomes by not using video learning media based on tiktok content.

Furthermore, to test the hypothesis, the two-party test formula is used. The t test is used if the alternative hypothesis reads "bigger" or above (>). For research data that is normally distributed and homogeneous, the hypothesis testing uses the t-test with the formula:

$$t = \frac{\overline{x_1} - \overline{x_2}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where S is the root of the combined variance calculated by the formula:

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}, dimana\ S = \sqrt{S^2}$$

Where :
$\overline{x_1}$ = average score of the experimental class
$\overline{x_2}$ = average score of the control class
n_1 = the average number of experimental classes
n_2 = the average number of control classes
S_1^2 = variance of the experimental class group
S_2^2 = variance of control class group
S = combined variance
t = calculation price

The test criteria are accepted Ho if tcount > ttable is obtained from the t distribution list with dk = (n-1) with a significant level of α = 5%, then the teaching material is effectively used.

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials and limited field

trials for all aspects of the assessment are determined by the average score. The results of the assessment are then analyzed and determined whether or not it is appropriate to develop TikTok content-based learning media. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials and field trials is shown in table 5 below:

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Table 5. Average Percentage of Assessment Results for TikTok content-based learning media

No	Categorization	Percentage of average score%	Criteria
1.	Material Expert Validation	90,00	very feasible
2.	Media Expert Validation	85,26	very feasible
3.	Learning Design Validation	91,35	very feasible
4.	Individual Trial	92,66	very feasible
5.	Small Group Trial	95,40	very feasible
6.	Field Test	98,62	very feasible
Rata-rata		92,22	very feasible

TikTok content-based learning media shows that: Material Expert Validation is 92.94% very feasible category; Media Expert Validation of 91.76% very feasible category, Learning Design Validation of 95.55% very feasible category; Individual Trial of 94.00% very feasible category, Small Group Trial of 95.66% very feasible category; Field trials of 98.26% very feasible category, an average of 94.70% very feasible category. which means the use of TikTok content-based learning media meets the needs of students.

Based on the learning outcomes of students who were taught using video learning media based on Tiktok content at SMK Negeri 2 Kisaran, the lowest score was 70 and the highest score was 95. The average score was 84,593, mode 83.25, median 82.5 and standard deviation 7.404. To see student scores, interval class is used, namely the score between absolute frequency (the number of students who have learning achievement scores) and relative frequency (the number of percent of learning achievement scores). A complete description of learning outcomes using TikTok content-based videos is shown in table 6.

Table 6. Frequency Distribution of Experiment Class Student Learning Outcomes

Kelas	Interval Kelas	F. Absolut	F. Relatif %
1	70 – 74	3	9,375%
2	75 - 79	6	18,75%
3	80 - 84	8	25%
4	85 - 89	6	18,75%
5	90 - 94	6	18,75%
6	95 - 99	3	9,375%
	Jumlah	32	100

Berdasarkan hasil belajar siswa yang diajarkan dengan menggunakan pembelajaran konvensional di SMK Negeri 2 Kisaran diperoleh skor terendah 70 dan skor tertinggi 95. Nilai rata-rata skor 80.718, modus 81,25, median 80.5, dan simpangan baku 6,744. Secara lengkap gambaran tentang hasil belajar dengan menggunakan media pembelajaran konvensional ditunjukkan pada tabel 7.

Table 7. Frequency Distribution of Control Class Student Learning Outcomes

Class	Interval Class	F. Absolute	F. Relative %
1	70 - 74	3	9,375%
2	75 - 79	7	21,875%
3	80 - 84	9	28,125%
4	85 - 89	6	18,75%
5	90 - 94	5	15,625%
6	95 - 99	2	6,25%
Total		32	100

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 8 below:

Table 8. Summary of Data Normality Test with Liliefors

No.	Data	Class	L_{count}	L_{table}	Conclusion
1	Pretest	Experiment	0,097	0,16	Normal
2	Pretest	Control	0,060	0,16	Normal
3	Posttest	Experiment	0,124	0,16	Normal
4	Posttest	Control	0,118	0,16	Normal

Based on Table 7, it can be seen that the results of the pretest data normality test in the experimental class obtained Lcount < Ltable (0.097 <0.157) and in the control class also obtained Lcount <Ltable (0.060 <0.157). The same thing also happened to the posttest data normality test results for the experimental class with Lcount < Ltable (0.124 <0.157) and in the control class obtained Lcount <Ltable (0.105 <0.157). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes are normally distributed at the significance level $\alpha = 0{,}05$

A summary of the homogeneity of the two samples is seen in Table 9 below:

Table 9. Summary of Data Homogeneity Test with Fisher's Test

No.	Data	Class	F_{count}	F_{table}	Conclusion
1	Pretest	Experiment	1,02	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	1,61	1,83	Homogeneous
4	Posttest	Control			

Based on Table 8, it can be seen that the results of the calculation of the pretest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (1.02 <1.83), it can be concluded that the pretest data in the two classes have the same or homogeneous variance. Then in the posttest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount <Ftable (1.61 <1.83), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

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Hypothesis testing uses the t-test with the formula, namely:

$$t = \frac{\bar{x}1 - \bar{x}2}{s\sqrt{\frac{1}{n1} + \frac{1}{n2}}}$$

The following is the formulation of this statistical hypothesis, namely:
Ho : μA1 ≤ μA2
Ha : μA1 > μA2

Information:
μA1 : average student learning outcomes taught using TikTok content-based learning media on the subject of IPAS
μA2 : average student learning outcomes taught without using TikTok content-based learning media on the subject of IPAS

The t-test is used as a hypothesis-testing tool because the research data is normally distributed and homogeneous. The hypothesis in the research is:
Ho: TikTok content-based learning media is not effective in improving science learning outcomes.
Ha : TikTok content-based learning media is effective in improving science learning outcomes

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there were significant differences between learning outcomes in classes taught using video-based TikTok content (experimental class) and learning outcomes taught using conventional learning media (control class). The calculation results obtained tcount = 2.18 and ttable = 1.66 so that tcount > ttable at a significant level α = 0.05. Based on these results, that H0 is rejected and Ha is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using video learning media based on TikTok content have differences from the learning outcomes of students who are taught with conventional learning media and are declared feasibility tested.

To test the effectiveness of videos based on TikTok content being developed, the following calculations are carried out:

$$X = \frac{otal\ score\ obtained}{ideal\ total\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{26}{32}\ x\ 100\%$$
$$= 81{,}25\%$$

The value of the effectiveness of the Print Module can be seen as follows:

$$X = \frac{total\ score\ obtained}{ideal\ total\ score\ of\ all\ items}\ x\ 100\%$$
$$= \frac{20}{32}\ x\ 100\%$$
$$= 62{,}5\%$$

Based on the calculation of the effectiveness test on both, the results were obtained that the learning outcomes of students who were taught with videos based on TikTok content were higher than those of students with conventional learning media (81.25% > 62.50%). Thus it can be concluded that videos based on TikTok content are more effectively used in science learning at SMK Negeri 2 Kisaran compared to using conventional learning media.

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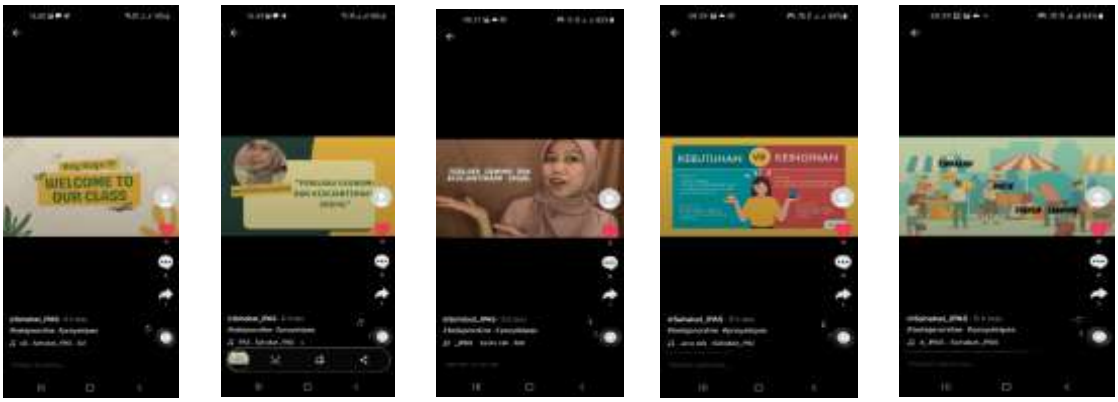

Figure 1. Video display based on science-learning TikTok content

3.2 DISCUSSION

Based on the results of the validation that has been carried out, the TikTok content-based video product is declared feasible to continue in field trials. The TikTok content-based videos that have been developed meet standards based on the design of the development of learning materials and learning media. For the assessment of learning material experts, a score of 90% was obtained which was categorized as very feasible and an assessment from learning media experts obtained a score of 85.26% which was categorized as very feasible. The score of student responses in individual trials was 92.66% (Very Eligible), small group trials were 95.40% (Very Eligible), and field trials were 98.62% (Very Eligible). Based on the results of the questionnaire, which were validated by material experts, and media experts and then continued with product trials, it can be concluded that videos based on TikTok content in science learning are stated to be very suitable for use as learning media for SMK Negeri 2 Kisaran students.

The effectiveness test for videos based on TikTok content that has been developed is carried out to fulfill the procedures of the Alessi and Trolip models. The purpose of testing the effectiveness of this product is to determine whether the product needs to be used continuously because it is effective or discontinued. After all, it is not effective. Testing the effectiveness of the product on the developed TikTok content-based videos has been carried out by comparing the average value of student learning outcomes taught using TikTok content-based videos with those using conventional learning media. From the results of research data processing conducted, there were differences in learning outcomes between students

who were taught using videos based on TikTok content and those who used conventional learning media (81.25% > 62.50%).

This is in line with Santyasa [26] which states that the learning process should contain five communication components, namely the teacher (communicator), learning materials, learning media, students (communicants), and learning objectives. While learning media are all physical devices that can present messages and stimulate students to learn in the form of books, films, tapes, and so on [27].

Furthermore, Suryani [28] states that learning media are all forms and means of conveying information that is created or used by learning theory that can be used for learning purposes and convey messages, stimulate thoughts, feelings, attention, and willingness of students to encourage a learning process that is intentional, purposeful and controlled.

Media in education is used to create interaction and communication between teachers and students in the learning process. Teaching aids, learning resources, and teaching aids are called learning media [29]. Audio visual media is a media device that can simultaneously display sound and images at the same time and contain learning messages. Audio-visual media that display motion is called video [30].

The TikTok application learning media can be run on Android and iOS-based mobile devices. So that learning media can operate anytime and anywhere. This learning media is included in the category of mobile learning-based learning media. This is by the definition of mobile learning stated by O'Malley in Purbasari [31], which is learning in which the learner does not stay in one place or learning activities that occur when students use mobile technology devices.

This is to Miarso's statement in Mahnun [32] which states that the first thing a teacher must do in using media effectively is to find, find, and choose media that meet children's learning needs, attracts children's interest, according to their developmental maturity and experience and special characteristics that exist in the study group. These characteristics include the maturity of the child and his experience and background as well as mental conditions related to the age of his development. In addition to the problem of student interest in media, the representation of messages conveyed by teachers should also be considered in selecting media.

In terms of user experience, TikTok has optimized the experience in terms of interface design and interactive content production models [33]. As well as these applications are friendly to use while at the same time providing content production more broadly and easily for use in learning [34]. TikTok is an audio-visual application that provides pedagogical abilities, realistic experiences, increases motivation, and involves students as creators [35] and is very good for supporting student creativity [36].

This is in line with Aji [37] who stated that the use of the Tik Tok application as an interactive learning medium helps students understand and accept the learning process carried out by the teacher. Interactive learning media can represent what the teacher cannot convey, making the learning process more effective and efficient. Through the TikTok application, a teacher can easily create interactive learning to adapt to the environment, situation, and conditions of students.

Then according to Mufidah [38], the TikTok application can be used as an effective learning medium. The TikTok application meets the learning needs of students, can attract students' interest because of its novelty, and has many features that can be implemented in learning, and finally, the TikTok application is equivalent to the development of maturity and the characteristics of students who are millennials, who are attached and close to the world digital.

Based on some of the explanations above, it can be concluded that video learning media based on TikTok content can be called good learning media if the learning media can improve student learning outcomes. The use of TikTok content-based video media allows students to easily understand learning and master learning material. This is also to the results of the development of TikTok content-based video learning media at SMK Negeri 2 Kisaran which obtained decent results in terms of product development and was effective in improving student learning outcomes in the Sciences subject. In addition to the use of this media, the ability of the teacher also plays an important role as a motivator which greatly influences student learning outcomes because students must be motivated to be fully responsible for their learning assignments.

4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of research on the development of TikTok content-based video learning media previously described, the following conclusions can be drawn:

1. Video learning media products based on TikTok content that has been developed meet the requirements and are suitable for use as learning media. This was concluded based on research results from learning material experts (90%), media experts (85.26%), student responses to individual trials (92.66%), small group trials (95.40%), field trials (98.62%) who overall stated that TikTok's content-based video learning media was in the "very feasible" category.
2. The effectiveness of the developed TikTok content-based video learning media is considered more effective than conventional learning media. The results of hypothesis testing prove that there is a significant difference between the learning outcomes of students who are taught using videos based on TikTok content and the learning outcomes of students who are taught using conventional learning media. This is indicated by the results of data processing obtained tcount = 2.18 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$. So the learning outcomes of students taught with TikTok content-based video learning media have a higher effectiveness of 81.25% compared to learning outcomes using conventional learning media with effectiveness of 62.50%.

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Project-Based Learning Digital Teaching Materials: Improving Student History Learning Outcomes

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Abstract: This study aims to determine the feasibility of PjBL-based digital teaching materials used in history learning, and to determine the effectiveness of PjBL-based digital teaching materials used in history learning. This research includes development research (R&D). The development procedure refers to the Borg and Gall development model namely: Potential Problems, Data Collection, Product Design, Design Validation, Design Revision, Product Trial, Product Revision, and Usage Trial. The test subjects were students of class XI. MAN 2 Medan Model. With a total of 31 students, data collection methods are interviews and instruments. The results of the development research show that: PjBL-based digital teaching materials developed in history subjects are appropriate to use, because they have gone through the expert/expert validation stage in the fields of material and media, and PjBL-based digital teaching materials developed in history subjects are effective in use because it has gone through several requirements tests and carried out a history learning achievement test by comparing it to the control class using different learning media. The results of the study show that: PjBL-based digital teaching materials used in history learning are appropriate for use in the learning process, and PjBL-based digital teaching materials that are used effectively can improve history learning outcomes.

Keywords: digital teaching materials; project-based learning; history

1. INTRODUCTION

Studying history allows us to develop a better understanding of the world we live in. Building knowledge and understanding of historical events and trends, especially over the past century, allows us to develop a much greater appreciation for current events today. And if we heed Santayana's warning, then remembering history – and taking important lessons from it – will help us avoid previous mistakes and prevent them from happening again.

Gischa [1] writing history is often seen as mere rote knowledge. There is a story behind a past event. Through the story of the event, we come to know the background or origin of an event that occurred. Able to see the changing times and culture from the past to the present. A historical story always contains values. Through history, we come to know the value of unity, tolerance amid differences, nationalism, and other noble values. One must learn history to emulate the values of heroic stories and historical stories in the form of tragedies. This is to create a better life in the future. These experiences provide new knowledge about what has happened. If bad things that have happened in the past happen again in the future, we can avoid them and overcome them. Learning history will also cultivate the habit of thinking contextually by the space and time in which events occur without leaving behind the nature of changes in socio-cultural processes. By studying history, we are easily trapped in opinions, because we are used to thinking critically, analytically, and rationally and are supported by facts.

The development and progress of learning theories and current curricula make the role of educational technology even more real. Negara et.al [2] state that modules are teaching materials written with the aim that students can study independently without or with teacher guidance. The application of the use of modules causes students to be more active in the learning process (student center). The Ministry of Education, Culture, Research, and Technology said that teaching modules are a type of teaching device that contains a learning implementation plan, to help direct the learning process to achieve Learning Outcomes (CP).

Supriadi et. al [3] expressed in their research that learning history is learning that discusses the past and sometimes tends to be teacher center learning, besides that material that is less concrete will make students feel more abstract in learning history. so, that is the function of the history teacher to be able to overcome this problem, namely, learning must be designed according to the conditions of students and analysis of student needs.

The role of history education itself is as the main foundation for social studies education in internalizing values such as self-identity, empathy, and tolerance in fostering a sense of belonging and a sense of solidarity to form a national identity. Often learning History at school is not given enough attention. The learning media used in class is only based on student textbooks. Student worksheets stacked with knowledge questions were also found. Lack of creativity from teachers in developing student learning in history subjects such as conducting simple research or research around their homes or schools, visits to museums that are only for recreation rather than deepening the material, not doing book reviews related to all history learning content.

1.1 The Nature of Learning History

Suprijono [4] defines learning as a change in behavior as a result of experience. Suprijono [5] defines learning as a permanent change in behavior as a result of experience. Learning according to Gage and Berliner as cited by Dimyati and Mudjiono [6] is a process that makes a person experience a change in behavior as a result of the experience he has gained.

Sturtevant [6] argues that the study of history is a window into the past that provides an understanding of the present, and how individuals, nations, and global communities might develop in the future. The study of history also instructs us about how societies emerged and examine cultural, political, social, and economic influences across space and time. It can also build a personal understanding of how we as individuals are the sum of various past experiences and actors ourselves in the process of historical change. In short, studying the past helps us to gain greater personal insight and understanding of each person's place in the great sweep of the human story.

Divine [8] explained that a learning process, it is an attempt to make students learn so that the situation is an event of learning, namely an effort to change the behavior of students. Changes in behavior can occur because of the interaction between students and their environment. According to Sardiman [9] that history is a branch of science that examines systematically the entire development process of change and the dynamics of people's lives with all aspects of life that occurred in the past. History is not only a reconstruction of the past that is retold but history is a science that can solve social problems. The understanding of history according to Syafi'i [10] history is the result of the recorded interaction and dialogue of the soul and mind of the historian with the reality of human life which takes place dynamically and creatively in a certain time and space.

Zahro et. al [11] explained that History Learning has a very important role in character education because history lessons have strategic meaning in the formation of dignified national character and civilization and in the formation of people who have a sense of nationality and love for the country. Strengthening history lessons as character education can be applied to start from the objectives of implementing learning, materials, sources, and media up to the assessment. Learning History plays an important role in the formation of character, attitude, and development of the nation which is meaningful in the formation of an Indonesian nation that has a sense of nationality, is intellectual, respects the struggle of the nation, and a sense of nationalism.

According to Sapriya [12] learning History has the following material coverage: (1) Contains the values of heroism, exemplary, pioneering, patriotism, nationalism, and an unyielding spirit that underlies the process of forming the character and personality of students; (2) Contains a repertoire of civilizations of nations including the civilization of the Indonesian nation; (3) Instill awareness of unity and brotherhood and solidarity to become a unifying nation in facing the threat of disintegration; (4) Contains moral teachings and wisdom that are useful in overcoming multidimensional crises faced in everyday life; (5) Instilling and developing a responsible attitude in maintaining environmental balance and sustainability.

The objectives of learning History according to the Regulation of the Minister of Education and Culture Number 20 of 2016, namely class X, and the IPS program (XI and XII) are divided into two historical contents in the first high school for specialization groups, namely: ways of thinking history, basic principles of history, early human civilization, the development of traditional countries in Indonesia, the great world revolution and the influence of Indonesian tourism and nationality. The world during the cold war and global political changes, the struggle to defend Indonesia's independence, Indonesia during the New Order and Reform era, and Indonesia and the world during the Information and Communication Technology Revolution. Second, Indonesian history for compulsory groups in high school, namely analyzing the basic principles of history, ancient times, medieval times, the era of regional movements, modern times, historical figures, liberal democracy, guided democracy, New Order, Reformation, Indonesia in the context of world association.

1.2 The Nature of Digital Teaching Materials

Majid [13] wrote down the meaning of teaching materials are all forms of materials used to assist lecturers/teachers/instructors in carrying out teaching and learning activities. The teaching materials in question can be written or unwritten materials. Teaching materials enable students to learn competency coherently and systematically so that cumulatively they can master all competencies as a whole and in an integrated manner.

Jazuli [14] writes that teaching materials are a set of materials that are arranged systematically that can be used by students to create a condition that allows students to learn well. Teaching materials are all forms of written and unwritten materials that are used to assist educators (teachers, lecturers, or constructors) in carrying out the learning process in class. Explains that teaching materials have an orderly design and sequence, explain the instructions to be achieved, motivate students to learn, and generally tend to be individual students which students can work on independently because they are systematic and complete. Teachers must have teaching materials that are by the curriculum, target characteristics, and demands for solving learning problems. For teachers, the development of teaching materials is used as a learning requirement to be carried out.

According to Pannen (in Prastowo [15]), teaching materials are materials or subject matter that are arranged systematically and used by teachers and students in the learning process. In this study, the teaching materials developed were in the form of Indonesian history modules.

According to Wena [16] a module is a form of print media that contains a learning unit equipped with various components so that students who use it can achieve their goals independently.

So, it can be concluded that teaching materials are all forms of materials or a set of learning materials/substances (teaching material) which are compiled as a whole and systematically, in the form of print and digital, which can also be used by educators and students for learning activities and have learning planning objectives that outline large part contains the knowledge, skills, and attitudes that must be mastered by students to achieve specific learning objectives and competencies that have been determined during learning activities.

Learning modules can also be called digital scripts. Digital manuscripts are scripts that can be read, heard, and displayed on digital devices, both desktops and smartphones. Manuscripts can be in the form of books, modules, teaching materials in the form of text, or a combination of writing, audio, or video which are displayed as a single whole as a script. Often we hear the terms e-module, e-book, and e-learning, all of which are presented as digital text using various applications.

The presentation of digital/electronic teaching materials is different from printed teaching materials. Presentation of

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teaching materials in digital/electronic form can provide a lot of convenience and interest, including: Displayed using a gadget or computer screen; More practical to carry everywhere and not burdensome to carry; Using a flash drive, hard disk, or memory card to store data; Production costs are cheaper, do not require additional costs to reproduce, and delivery of teaching materials can be done using WhatsUp, telegram, email and so on; Durable and timeless; Using a screen or monitor for too long will cause your eyes to feel sore; The script can be arranged linearly or non-linearly; Can be equipped with audio and video in the presentation; In each learning activity a password can be given which is useful for locking and providing security; and Using electricity and computers to operate it.

1.3 The Nature of Project-Based Learning (PjBL)

Sani [17] explained that project-based learning or PjBL is carried out to deepen the knowledge and skills obtained by creating works or projects related to teaching materials and competencies that students are expected to possess. Wena [18] argued that project-based learning is an innovative learning model, and places more emphasis on contextual learning through complex activities.

Cervantes [19] suggested that an effective PJBL environment consists of five components: (a) authentic and engaging driving questions, (b) student-generated artifacts, (c) student collaboration research, (d) community audience, and (e) use of technology-based cognitive, and communication tools. In PjBL principles, students pursue solutions to problems by asking and correcting questions, debating ideas, making predictions, devising plans, collecting and analyzing data, drawing conclusions, communicating ideas, asking new questions, and creating artifacts.

Ergül [20] also explained that the project-based learning method is one of the student-centered teaching methods that have been used. This is one way to provide opportunities for students to take part in a learning environment, make them take responsibility for their learning, develop students, and have them understand and structure information. In a project-based learning approach, students build and direct their learning, develop their creativity, prefer solving problems they face in collaboration, and bring the classroom to life. In short, project-based learning is an approach based on students working alone or in small groups to produce concrete products.

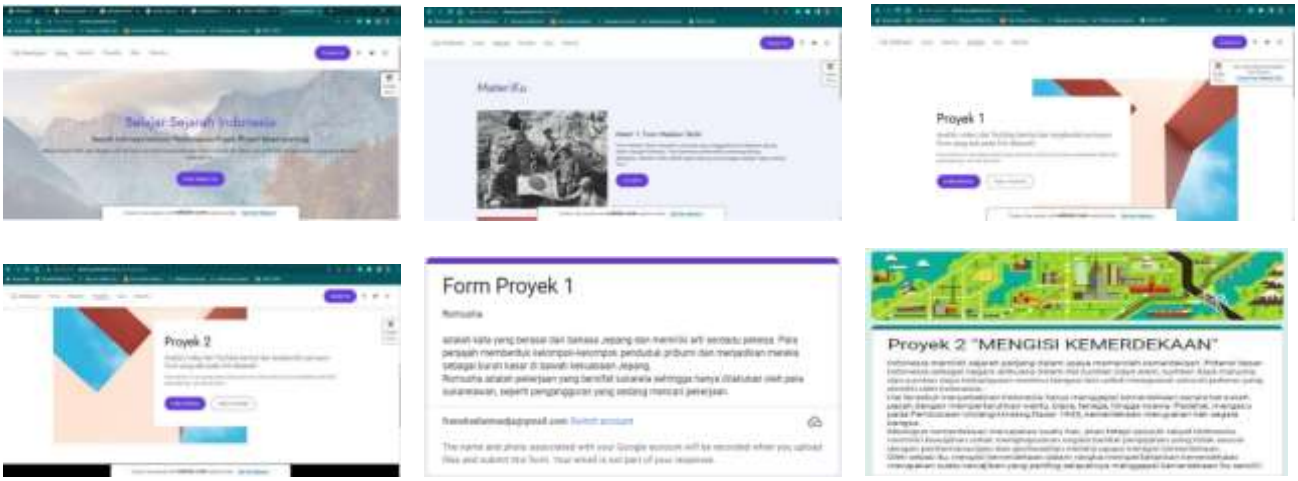

Figure 1. Display of PjBL-Based Digital Teaching Materials

The research problems are formulated as follows: (1) are PjBL-based digital teaching materials used in history learning appropriate for use in the learning process, and (2) are PjBL-based digital teaching materials used effectively to improve history learning outcomes?

2. METHOD

This type of research is a type of development research commonly called development (R&D). Development research is research that aims to produce a product through the development process [21]. According to Sugiyono [22] research and development is research that produces products and also other activities, namely testing the effectiveness of the products to be produced. To be able to produce a particular product, namely research that needs analysis in nature and to test the effectiveness of the product so that it can function to a large audience, research must be carried out to test the effectiveness of the product that has been produced. According to Borg and Gall [23], development research is a process used to develop and validate products.

Sukmadinata [24] explains research and development is a research approach that produces a new product or refinement of an existing product. R&D is a method for producing certain products or improving existing products and testing the effectiveness of these products. Researchers conducted research and development of digital teaching materials, the feasibility level of digital teaching materials in History subjects was known through validation by material experts, validation by media experts, validation by teachers, and trials of use by students. Research and development oriented to research, design, produce, validate, and test the resulting product.

The implementation of this research was carried out at MAN 2 Model Medan. The implementation time for the development of digital teaching modules and research will be carried out in March 2023 in the Even Semester of the 2022/2023 Academic Year. Research subjects are individuals who participate in research. The subjects of this study were students of MAN 2 MODEL MEDAN class XI IPS. The object of this study was

students of class XI IPS MAN 2 Medan Model in the subject of Indonesian History using PjBL to increase student interest and learning outcomes.

Procedure and Development This research uses the R&D model. Borg & Gall [25] stated that research and development (R&D) is an industry-based development model in which research findings are used to design new products and procedures which are then systematically conducted field trials are evaluated and refined until the research findings meet the effectiveness criteria. , a certain quality or a certain standard.

Borg & Gall states that R&D is an industry-based development model in which research findings are used to design new products and procedures which are then systematically conducted field trials are evaluated and refined until the research findings meet certain criteria of effectiveness, quality or certain standards: (1) Potential Problems Teaching materials function as materials that can help and complement educators in carrying out the learning process in class and helping potential students to become independent learners; (2) Data Collection Before determining the choice of product planning to be developed, it is better to collect data on needs that can be used to overcome the problems faced by the school where the research is carried out; (3) Product Design Based on the results of the needs analysis, the next step is for the researcher to design the developed product; (4) Design Validation The next step is to validate the design. Design validation is an activation process to evaluate product design rationally; (5) Design Improvements are carried out after obtaining an assessment from experts. All input, criticism, suggestions, and recommendations from experienced experts and teachers are recorded and used as a basis for improving the product designs developed [26]; (6) Product Trial After revision and improvement by the validator, the next step is product trial. This trial aims to see the feasibility and effectiveness of the product being developed. Product development can be directly tested, after being validated and revised by the validator (Sugiyono, 2014: 302); (7) Product Revision is carried out based on the results of the initial trial. The results of the field trials obtained qualitative information about the program or product being developed; (8) Use Trial After testing the product is successful and there may still be a few weaknesses that need to be corrected, then the product in the form of a teaching material supplement is applied within a wider scope of educational institutions or in a wider group [28].

Based on the formulation of the next problem, namely whether the PjBL-based digital teaching materials developed are effective in improving history learning outcomes. Learning is said to be effective if there are significant differences in learning outcomes between classes that are given treatment in classes that are not given treatment. The hypothesis uses the mean difference test or t-test. The t-test is the average difference to find out whether there is a significant difference at the 0.05 significance level with Microsoft Excel 19.

The hypothesis formulated is:
Ho: μ1 = μ2 (there is no mean difference between the treated and untreated classes).
Ha: μ1 ≠ μ2 (there is an average difference between the treated and untreated classes).
Decision-making Ho is accepted if the significance is greater than 0.05. The following is the calculation using the 2nd difference test for the population average according to Sudjana [27]:

$$t = \frac{\bar{X}1 - \bar{X}2}{s\sqrt{\frac{1}{n1} - \frac{1}{n2}}}$$

Where:
$\bar{X}1$ = total average score of the experimental class sample.
$\bar{X}2$ = total average score of the control class sample.
s = standard deviation

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts and material experts, for all aspects of the assessment are determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop PjBL-based digital teaching materials in history learning. The average percentage of the results of the assessment of media experts and material experts is in Table 1 below:

Table 1. Average Percentage of Assessment Results for PjBL-based digital teaching materials

No	Categorization	Percentage of average%	Criteria
1.	Material Expert Validation	88	very feasible
2.	Media Expert Validation	82,3	feasible
The average		85,15	very decent

PjBL-based digital teaching materials in history learning show that: Material Expert Validation is 88.00% very feasible category; Media Expert validation is 82.3% in the appropriate category so that the average is 85.15% in the very feasible category. which means that the use of PjBL-based digital teaching materials in history learning meets the needs of students

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 2 below:

Table 2. Summary of Data Normality Test with Liliefors

No.	Data	Class	L_{count}	L_{table}	Conclusion
1	Posttest	Experiment	0,214	0,161	Normal
2	Posttest	Control	0,211	0,161	Normal

Based on Table 2, it can be seen that the results of the posttest data normality test in the experimental class obtained $L_{count} < L_{table}$ (0.214 < 0.161) and in the control class also obtained $L_{count} < L_{table}$ (0.211 < 0.161). Thus, it can be concluded that the post-test data and the experimental and control classes are normally distributed at the significance level $\alpha = 0{,}05$

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{Varian\ terbesar}{Varian\ terkecil} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 3 below:

Table 3. Summary of Data Homogeneity Test with Fisher's Test

No.	Data	Class	F_{count}	F_{table}	Conclusion
1	Post-test	Experiment	1,42	1,84	Homogeneous
2	Post-test	Control			

Based on Table 3, it can be seen that the results of the posttest data homogeneity test calculations in the experimental class and control class at a significant level $\alpha = 0.05$ obtained $F_{count} < F_{table}$ (1.42 < 1.84), it can be concluded that the Posttest data in the two classes have the same or homogeneous variance.

The following is the formulation of this statistical hypothesis, namely:
Ho : $\mu A1 \leq \mu A2$
Ha : $\mu A1 > \mu A2$

Information:
μA1: average student learning outcomes taught using PjBL-based digital teaching materials
μA2: average student learning outcomes taught without using PjBL-based digital teaching materials

The t-test is used as a hypothesis-testing tool because the research data is normally distributed and homogeneous. The hypothesis in the research is:
Ho: PjBL-based digital teaching materials are not effective in improving history learning outcomes
Ha: PjBL-based digital teaching materials are effective in improving history learning outcomes

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there is a significant difference between learning outcomes in classes taught using PjBL-based digital teaching materials (experimental class) and learning outcomes taught using printed books (control class) with the provision that if tcount > ttable then H0 is rejected and Ha accepted.

The calculation results obtained tcount = 5.85 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$. Based on these results, that H0 is rejected and Ha is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using PjBL-based digital teaching materials differ from those of students who are taught with printed books, namely a higher average score of 8.5 and the control class an average score of 7.3 and has been tested for its effectiveness.

3.2 DISCUSSION

The learning that was carried out by students of class XI IPS 1 MAN 2 Model Medan while using digital history teaching materials with the material The Tyranny of the Rising Sun and Independent Indonesia was very memorable for them. So far, the use of digital learning in schools has been developed, but not comprehensively to all subjects, especially History. Class XI IPS students feel interested in learning both at school and at home with their devices or via laptops and wherever they can access the History learning material.

Sari [29] that digital teaching materials based on Project Based Learning get very good qualifications. It can be concluded that digital teaching materials based on Project Based Learning are appropriate for use in the learning process. Project Based Learning-based digital teaching materials can help students understand social studies learning.

Farhana, F., Suryadi, A., and Wicaksono, D. 2021. In the same research writing digital-based teaching materials in English lessons can experience an increase in mastering competency achievement targets in English subject class XII at SMK Atlantis, especially the Multimedia major and Nursing. The results of the post-test field trials, based on the KKM score in English lessons, showed that the learning outcomes of students who achieved mastery in learning totaled 37 people or 94.59%. The average rating of the post-test questions at the field trial stage was 87.56. This means that digital-based teaching materials in English lessons have been used effectively. This is shown that the learning outcomes of students reach the KKM target of 90%.

Digital teaching materials get very good qualifications because there are several interesting things to read in digital teaching materials on cultural diversity materials, namely material presented with pictures, interesting videos, and interactive quizzes that motivate students to learn using digital teaching materials that are developed and make learning not boring. Digital teaching materials can be designed in an attractive way containing videos and interactive quizzes.

4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of the research on the development of e-module learning media previously described, the following conclusions can be drawn:

1. PjBL-based digital teaching material products developed in history subjects meet the requirements and are suitable for use as learning media. PjBL-based digital teaching materials in history learning show that: Material Expert Validation is 88.00% very feasible category; Media Expert validation is 82.3% in the appropriate category so the average is 85.15% in the very feasible category. which means that the use of PjBL-based digital teaching materials in history learning meets the needs of students.
2. The effectiveness of PjBL-based digital teaching materials in history subjects that have been developed is considered more effective than printed modules. the learning outcomes of students who are taught using PjBL-based digital teaching materials differ from those of students who are taught with printed books, namely that the average score is 8.5 and the control class has an average score of 7.3 and has been tested for its effectiveness.

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Interactive Media Tutorial Model Based on Concept Hierarchy: Improving Chemistry Learning Outcomes in Salt Hydrolysis Material

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Abstract: The purpose of this study was to produce valid, practical, and effective interactive media in improving students' learning abilities on salt hydrolysis material. The development procedure used in this study is the development model from Borg and Gall and the instructional design step from Dick and Carey which is divided into 4 stages including the needs analysis stage, the product design stage, the validation and evaluation stage, and the final product stage. The media validity test was carried out by expert validators which included chemical material experts, media experts, and instructional design experts. While the practicality test and effectiveness test were carried out in class XI MIA 2 SMA N 1 Karang Baru Aceh Tamiang. The results of the interactive media validation of the tutorial model based on the concept hierarchy on the developed salt hydrolysis material were declared very valid with a percentage gain of 80.42% for material experts, 81.94% for media experts, and 83.61% for learning design experts. As for the percentage score of the practicality of the media, it was 89.57%, which was included in the very practical category. While the effectiveness of the media on students' learning abilities can be seen through the results of the N-gain test where the average N-gain score obtained is 0.5 (moderate category) or 56.34% which is quite effective.

Keywords: interactive media; salt hydrolysis; tutorials; concept hierarchy

1. INTRODUCTION

The reality that occurs in learning chemistry at school is that learning chemistry is considered difficult by students so most students are not successful in achieving the minimum completeness criteria (KKM) [1]. Chemistry learning is quite difficult because there are abstract chemical concepts and chemistry has a special vocabulary which is a new language for students [2]. In addition, chemistry is continuous, that is, the concepts are interconnected with one another. Therefore, chemistry must be studied coherently and continuously so that the concepts received by students can be properly assimilated and accommodated [3]. Besides that, chemical concepts need to be represented in a representation that is easier to understand, including the concepts of salt hydrolysis.

Hydrolysis of salt is a material with concrete and abstract characteristics, so understanding it requires a good ability to combine three chemical representations, namely macroscopic, submicroscopic, and symbolic. The concrete nature of this material lies in the macroscopic representations that are often encountered in everyday life. The abstractness of this material is related to the microscopic representations associated with salt solutions. In addition, the characteristics of salt hydrolysis are also the same as chemicals in general, namely having complexity in it, which means there is a connection with previously studied materials as prerequisites [4]. For example, Bronsted-Lowry acid-base material acts as a prerequisite material for understanding salt hydrolysis material so students who have not mastered Bronsted-Lowry acid-base material well will most likely experience difficulties in understanding salt hydrolysis material. In addition, the concept of hydrolysis must also be understood correctly because it will be used to study the next chemical concept, namely acid-base titration [5].

To understand the concepts of salt hydrolysis, students must understand the concepts of acid-base, acid-base equilibrium, dissociation of salt constituent ions, and the properties of reactants and products related to salt hydrolysis [6]. In addition, the salt hydrolysis material is one of the materials that combine concepts and calculations [7], so students often experience difficulties in solving questions whose completion requires high levels of metacognition and mathematical chemistry strategies.

In connection with the complexity of salt hydrolysis material, problems often occur when students are faced with questions related to the calculation or the use of other formulas, many students have difficulty determining which formula to use, so one step that can be taken to overcome this problem is to represent the concept of salt hydrolysis in a simpler form with the help of media based on concept hierarchies. Concept hierarchies are levels from the most general concepts to the most specific concepts [8] or from simple concepts to complex concepts [9] so that students' constructive stages can be monitored in the correct order [10]. The concept hierarchy applied to learning media can reinforce students to deal with problems with systematic completion steps [11].

Smartphone-based learning media in this study the Android system only requires a memory space which is not too burdensome for students' devices but the use of this application must be downloaded first [12]. In addition, the use of Android-based learning media allows students to access learning materials without being bound by time and place [13]. Several

literature studies state that the use of Android-based learning media (mobile learning) has many advantages that can replace computer-based learning media [14][15].

1.1 The Nature of Chemistry Learning Outcomes and Outcomes

According to Hamalik [16] Learning is a modification or strengthening of behavior through experience. One sign that someone has learned something is a change in behavior in him. Changes in behavior involve changes in knowledge (cognitive) and skills (psychomotor) as well as those involving values and attitudes (affective).

Meaningful learning is a process of linking new information to relevant concepts contained in one's cognitive structure, whereas rote learning will occur if one's cognitive structure does not contain relevant concepts to link newly learned concepts. In a series of lessons, students should be introduced first to the most general or inclusive concepts, then gradually become more specific concepts, in other words from general to specific [17].

According to Sudjana [18] learning outcomes are the abilities possessed by students after they receive their learning experience. Students who do the learning will get the results of the learning process. According to Suardi and Syofrianisda [19] learning outcomes are mastery of knowledge, skills, character, and the formation of attitudes and beliefs. Learning outcomes are not only knowledge and skills but also the development of emotions, attitudes, values, aesthetics, and art. The same thing was formulated by Baharuddin and Wahyuni [20], namely, learning outcomes are changes in the learner, both changes in knowledge, attitudes, and skills. With these changes, of course, the perpetrator will also be assisted in solving life's problems and can adapt to his environment. In addition, learning outcomes are also results achieved in the form of numbers or scores by someone after being given a learning achievement test at a certain time [21].

Chemistry is a branch of science that studies the composition and properties of a material, as well as the energy changes that accompany the material [22]. Chemistry broadly includes two parts, namely chemistry as a process and chemistry as a product. Chemistry as a product includes a body of knowledge consisting of facts, concepts, and principles of chemistry. While chemistry as a process includes the skills and attitudes possessed by scientists to obtain and develop chemical products [23].

The reaction of acids and bases to form salt and water is called a neutralization reaction [24]. However, a neutralization reaction does not mean that the salt solution is always neutral. Salt solutions can be formed from a strong acid with a strong base, a strong acid with a weak base, a weak acid with a strong base, and a weak acid with a weak base. The resulting salt solution can be acidic, basic, or neutral. The nature of the salt solution can be explained through the concept of salt hydrolysis.

According to Chang [25], Salt is an ionic compound formed by the reaction between an acid and a base. Salt is a strong electrolyte that dissociates completely in water and in some cases reacts with water. The term salt hydrolysis describes the reaction of the anion or cation of salt, or both, with water. Salt hydrolysis usually affects the pH of the solution.

1.2 Learning Media

Gagne [26] said that media are various types of components that are in a student's environment that can stimulate him to learn. Meanwhile, Briggs [27] said that the media are all physical tools that can present messages and can stimulate students to learn. Miarso [28] said learning media is anything that can stimulate students so that the teaching and learning process takes place.

Learning media functions as a carrier of information from information sources (teachers) to recipients (students). The function of the media can be identified based on the advantages and disadvantages of the media that may arise in the learning process. According to Sadiman, et al [29] the functions of the media in general are as follows: (a) Clarify the presentation of messages so that they are not too verbalistic; (b) able to overcome the limitations of space, time, and senses; (c) appropriate and varied media can overcome the passive nature of students; (d) able to help students and educators in learning and teaching activities.

According to Arsyad [30] said that there are 4 functions in learning media, namely: (a) the function of attention that can attract and direct students; (b) the affective function of visual media can be seen from the level of enjoyment of students during the learning process; (c) cognitive function; (d) the compensatory function of learning media helps students who are weak in reading to organize information in the text and recall it. The rapid development of science and technology is currently influencing the learning process in schools so the learning media to be used must follow the needs of the learning process. Learning media are grouped into four groups, namely as follows: (a) media produced by printing technology; (b) audio-visual technology media; (c) media produced by computer technology; (d) media combined with printing and computer technology.

According to Munadi [31], the types of learning media are as follows: (a) audio media, namely radio, recording devices, and audio tapes; (b) visual media, namely magazines, newspapers, modules, comic posters, and atlases; (c) audio-visual media, namely films, television videos.

1.3 Interactive Media Tutorial Model Based on Concept Hierarchy

According to Prastowo [32] when you hear the word "interactive" one thing that might immediately come to mind is something related to interactions or relationships. According to the Big Indonesian Dictionary, the word "interactive" implies mutual action or inter-relationship, or mutual activity.

According to Daryanto [33] Interactive multimedia is multimedia that is equipped with a controller that can be operated by the user so that the user can choose what he wants for the next process. Examples of interactive multimedia are interactive learning multimedia, game applications, and animated videos.

Jubaeruddin et al. [34] stated that learning media whose elements contain media including text, audio, video, animation, and graphics and allow students, as users to interact through the available features, are called interactive media. Meanwhile, according to Suyitno [35], interactive learning media in the form of text, visuals, and simulations can help students gain more knowledge, deeper understanding of concepts, and know the application of the knowledge being learned.

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According to Susilana and Riyana [36], tutorials in learning media are intended as a substitute for tutors (humans) whose learning process is given through text, graphics, sound, video, or animation where students are conditioned to follow a programmed learning path by presenting material and practicing questions. In addition, Roestiyah [37] stated that the tutorial program requires the computer to act as a tutor who leads students through the sequence of material they expect to be the subject which is equipped with appropriate examples and exercises and tests students at each step to check whether students have understood it properly. Good.

This type of tutorial program follows a branching learning pattern where the material will be presented in small units and after each material unit is finished, it ends with a program evaluation which is completed by giving responses to students answers to determine the learning steps for the next material unit [38].

The purpose of the tutorial model is to provide "satisfaction" or complete understanding to students regarding the subject matter being studied [39]. The tutorial program introduces new subject matter to students and is then followed up with practice and practice. This program generally provides pre-tests and post-tests regarding the material (content) presented. The tutorial program is also used as a review of previously delivered lessons to check understanding and increase retention of concepts [40].

The research problem is formulated as follows: Is this interactive media tutorial model based on a hierarchy of concepts valid to be used as a chemistry learning medium on salt hydrolysis material?; Is this interactive media tutorial model based on a hierarchy of concepts practically used as a chemistry learning medium on salt hydrolysis material?; and Is this interactive media tutorial model based on a hierarchy of concepts effectively used to increase students' understanding in chemistry lessons on salt hydrolysis material?

2. METHOD

This type of research is a type of development research commonly called development (Research & Development). Research development is research that aims to produce a product through the development process [41]. According to Borg and Gall [42], the purpose of development research is not only to develop products but more than that to find new knowledge or to answer specific questions about practical problems (through applied research).

This research was conducted at SMA Negeri 1 Karang Baru which is located in the village of Medang Ara, Karang Baru sub-district, Aceh Tamiang district. The implementation time is in the even semester of the 2022-2023 school year. The population in this study were students of class XI MIA which consisted of 4 classes with a total of 110 students. Meanwhile, the sample to be taken was 28 students (1 class). The sample selection in this study used a purposive sampling technique, namely the determination of the research sample based on the consideration of the researcher who considered the desired research elements already exist in the members of the sample taken and based on suggestions from the chemistry study teacher at school.

According to Borg and Gall, there are 10 research and development steps, namely: (1) Potential and problems, (2) Data collection, (3) Product design, (4) Design validation, (5) Design revision, (6) Trial product, (7) product revision, (8) trial use, (9) product revision, and (10) mass production.

Figure 1. The Borg and Gall Development Model

Meanwhile, the instructional design uses the Dick & Carey model, the steps of which can be seen in the following diagram.

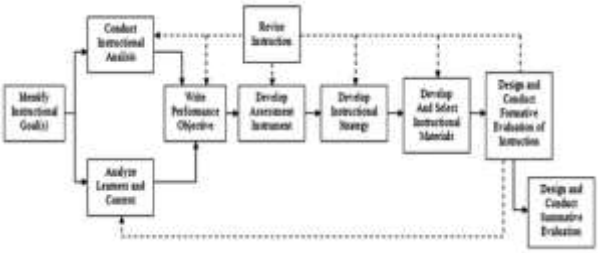

Figure 2. Dick and Carey's Instructional Design Model

Media Validity Data Analysis. Media validity analysis includes analysis of data validation results from Material Experts, Media Experts, and Learning Design Experts. Data collection was carried out using a questionnaire in the form of a Likert scale by distributing questionnaires to respondents, namely the material expert validator, media expert validator, and Learning Design Expert validator. The respondents gave an assessment of the quality of the interactive learning media based on the Concept Hierarchy Tutorial model with the following research criteria:

Table 1. Questionnaire assessment criteria

Criteria	Score
Very good	5
good	4
Enough	3
Not good	2
Very bad	1

(Source: Arikunto [43])

The results of the assessment of each respondent calculated the average score obtained. The average score obtained is then converted into a qualitative value using the formula and basic guidelines to determine the level of validity as follows:

$$P = \frac{\sum x}{\sum x^1} \text{ x } 100\%$$

Information:
P = Large Percentage
$\sum x$ = Number of Validator Answer Scores
$\sum x^1$ = Total Highest Answer Score

Table 2. Media validity classification

No	Percentage (%)	Validity Level	Qualitative Category
1.	80 -100	Very Valid	Not Revised
2.	60 -79	Valid	Not Revised
3.	40 -59	Valid Partly	Partly Revision
4.	20 -39	Invalid	Revision
5.	0 -19	Very Invalid	Revision

(Source: Arikunto [43])

Based on the classification table above, the media is declared valid and suitable for use if the average percentage of media validation given by all validators is ≥ 60%.

Media Practicality Data Analysis. The data obtained from the student response questionnaire were analyzed by determining the percentage of students who gave positive responses for each category asked in the questionnaire. According to Riduwan [44], analyzing student response questionnaires using the following formula:

$$\%Practicality = \frac{\sum value\ obtained}{maximum\ value}\ x\ 100\%$$

Furthermore, the Student Response Value obtained is represented in the following Practicality table:

Table 3. Practicality classification of the media

Interval (%)	Category
81 – 100	Very Practical
61 – 80	Practical
41 – 60	Quite Practical
21 – 40	Less Practical
0 – 20	Not practical

Based on Table 3 of the classification above, the media is stated to be practical and feasible to use if the average value of the percentage of students' positive responses to the media developed is at least 61%.

Media Effectiveness Data Analysis. The effectiveness of learning media is measured through data on the increase in the extent to which targets are achieved from the start before treatment (initial ability test/pre-test) to the target learning outcomes after being given treatment (post-test). The target to be achieved is of course 100% of the material mastered by students, and at least they have reached KKM (Minimum Completeness Criteria) where the KKM value set is 70. To calculate the percentage of Classical completeness scores, the following formula is used:

$$Classical\ Mastery = \frac{Number\ of\ Completed\ Students}{Number\ of\ Research\ Subjects}\ x\ 100\%$$

According to Mulyasa [45], a class is said to have completed learning (Classical completeness) if in that class there are ≥ 85% of students who have completed learning. After the students' classical mastery is analyzed, then to test the effectiveness of the media, manual calculations are used with the N-Gain formula.

The normalized gain test (N-Gain) was carried out to determine the increase in student learning outcomes after being given treatment. The normalized Gain score can be calculated by the following formula:

$$N\text{-}Gain = \frac{SkorPosttest\ score - pretest\ score}{SkMaximum\ score - Pretest\ score}\ x\ 100$$

To see the level of effectiveness of the developed media, the results of the n-gain calculation are then interpreted as follows

Table 4. N-gain Score Classification

N-Gain score intervals	Classification
g > 0,7	High
0,3 ≤ g ≤ 0,7	Moderate
g < 0,3	Low

(source: Hake, 1999)

The interpretation of the effectiveness of the N-gain score on students' learning abilities can be interpreted as follows:

Table 5. Categories of N-gain effectiveness interpretation

Percentage (%)	Interpretation
< 40	Not Effective
40 - 55	Less Effective
56 – 75	Moderately Effective
>76	Effective

(source: Hake, 1999)

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of assessments by media experts, material experts, learning design experts, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment are then analyzed and determined whether or not it is appropriate to develop interactive learning media based on the Hierarchy of Concepts Tutorial model. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is shown in Table 6 below:

Table 6. Average Percentage of Assessment Results of interactive learning media Tutorial Models based on Hierarchy of Concepts

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	80,42	feasible
2.	Media Expert Validation	81,94	feasible
3.	Learning Design Validation	83,61	feasible
4.	Small Group Trial	95,33	very feasible
5.	Field Test	89,57	very feasible
Rata-rata		86,17	very feasible

Based on Table 6 above, it can be concluded that interactive learning media products based on the Concept Hierarchy Tutorial model developed include very feasible criteria, thus it is known that the average rating (μo) from experts and field trials is 91.3% while the criterion value the feasibility threshold (μ) is 70%, then μo > μ. So it can be concluded that interactive learning media based on the Hierarchy of Concepts Tutorial

model is said to be very feasible to use and can meet the needs of implementing chemistry learning.

The recapitulation of students' pretest-posttest values obtained can be seen in Table 7 below.

Table 7. Students' pretest and posttest scores on salt hydrolysis material

No	test value interval	Pretest		Posttest		Information
		Number of Students	Percent (%)	Number of Students	Percent (%)	
1	0 – 49	10	35,71	0	0	Incomplete
2	50 – 59	2	7,14	0	0	Incomplete
3	60 – 69	1	3,57	4	14,29	Incomplete
4	70 – 79	13	46,43	6	21,43	Completed
5	80 – 89	2	7,14	10	35,71	Completed
6	90 – 100	0	0	8	28,57	Completed
	Total	28	100	28	100	

Table 7 above shows that during the pretest, 10 students scored 0-49 or 35.71%, while 2 students scored in the 50-59 range or 7.14%, while students who scored in the 50-59 range a scored 60-69 1 person or 3.57%, while 13 students or 46.43% of students get scores in the 70-79 range, and finally 2 students or 7.14% of students get scores in the 80- 89.

Table 8 Comparison of students' pretest and posttest classical completeness scores

No	Classical Mastery	Pretest		Post-test		Description
		total	Persentase (%)	total	Persentase (%)	
1	Completed	15	53,57	24	85,71	Increased
2	Incomplete	13	46,43	4	14,29	Decreasing

Based on Table 8 above, the percentage of students' classical completeness in the pretest results was 53.57%, and the number of classical completeness in the post-test results increased, namely 85.71%. Meanwhile, classical incompleteness decreased from 46.43% in the pretest to 14.29% in the post-test. The comparison of the percentage of student completeness in the pretest and post-test is presented in the following diagram 9.

The results of the N-gain calculation can be seen in Table 9 below.

Table 9. Students' N-gain Scores on Pretest and Post-test Scores

Gain score interval	Number of students	Category
g > 0,7	3	High
0,3 ≤ g ≤ 0,7	25	Moderate
g < 0,3	0	Low

Based on Table 9, it can be seen that 3 students got an increase in the high classification with an n-gain score > 0.7, while 25 students got an increase in the medium classification with an n-gain score at intervals of 0.3 ≤ g ≤ 0, 7. While the number of students who got an increase in the low category, namely at a score of n-gain <0.3, was 0 students.

After obtaining the n-gain value for each student, the effectiveness of the media in increasing student test results as a whole can be interpreted based on the acquisition of the n-gain percentage as shown in the following 10 recapitulation table.

Table 10. Interpretation of the effectiveness of N-gain

∑ Students	Pretest		Post-test		∑ *N-gain*	Percentage of N-gain *(%)*	Interpretation
	∑nilai	x̄	∑nilai	x̄			
28	1590	56,78	2255	80,53	0,5634	56,34	Effective enough

Based on Table 10 above, it can be seen that the n-gain percentage value obtained was 56.34%, which means that the media developed was included in the category which was quite effective in increasing student test results on salt hydrolysis material.


Figure 3. Display of Interactive Media Tutorial Model Based on Hierarchy of Concepts in Salt Hydrolysis Material

3.2 DISCUSSION

Several studies related to the validity of the interactive media tutorial model were found in the results of Yanti and Fatisa's research [46] which stated that the validation of media experts and material experts obtained values of 88% and 88.75% with very valid criteria. The teacher's practicality test got a result of 88.5% with very practical criteria, and the students' practicality test got a result of 86.40% with very practical criteria. Based on these results, this interactive media is very feasible to be used in learning chemistry materials for reduction and oxidation reactions.

The results of Yanto's research [47] that interactive learning media are very practical to use by teachers and students in the learning process of electric circuits. In addition, the results of Saputri's research [48] found that the results of data analysis on the validity of learning multimedia had an average value of Aiken's V of 0.85 with the valid category and the practicality level of the teacher is 88% in the very practical category and the student's practicality level is 86% in the very practical category. The results of the validity and practicality analysis show that the PowerPoint-iSpring learning multimedia integrated with prompting questions developed is valid and practical.

In addition, the results of research by Nelmira, et al [49] showed that the validity test of Interactive CD media was 90.42% (very valid), the practicality test of the media was 94.58% (very practical) and the effectiveness test of Interactive CD media showed an increase in learning outcomes students after using the Interactive CD. So the interactive media for this Embroidery course can already be used in learning.

This is in line with the statement of Wardani et al. [50]) that multimedia tutorials are problem solvers in terms of learning media, by utilizing multimedia tutorials it is proven that they can add positive value to students' learning achievements. Multimedia tutorials include audio-visual in the form of text, images, animation, audio, and video, so that they motivate and make students interested in learning, and can support the achievement of learning objectives [51].

Further results of research conducted by Anggraeni, et al. [52] found that by using the multimedia tutorial program student learning outcomes were more optimal than student learning outcomes without using multimedia tutorials and the percentage value of the experimental class was higher than the percentage value in the controlled class.

The same results were also found in the research of Riasti, et al [53] which stated that the interactive media tutorial model on Impulse and momentum material was very useful in learning and proved to be effective in learning as demonstrated by an increase in KKM mastery of 79%.

4. CONCLUSION

Based on the results and discussion of research on the development of interactive media tutorials based on a concept hierarchy of salt hydrolysis, the following conclusions can be drawn:

1. The interactive media tutorial based on the concept hierarchy developed for class XI chemistry lessons on salt hydrolysis material has met the validity of the very valid category with an average percentage score of material experts of 80.42%, media experts 81.94% and design experts learning 83.61%.
2. Practicality The interactive media tutorial based on the concept hierarchy developed for class XI chemistry lessons on salt hydrolysis material is stated to be very practical with the acquisition of a media practicality percentage score of 89.57%.
3. The effectiveness of the interactive media tutorial based on the concept hierarchy developed for class XI chemistry lessons on salt hydrolysis material on students' learning abilities was obtained through the results of the N-gain test where the average N-gain score obtained was 0.5 (moderate category) or of 56.34% which is included in the quite effective category.

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Project-Based Learning Interactive Canva Media: Improving High School Students' English Learning Outcomes

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Abstract: The purpose of this research is to produce interactive media based on the Canva application PjBL that is feasible and effective in improving students' English learning outcomes at SMA Negeri 1 Padang Bolak. The type of research used is the development model from Borg and Gall and the instructional design step from Dick and Carey which is divided into 4 stages including the needs analysis stage, the product design stage, the validation and evaluation stage, and the final product stage. The results showed that: product validation showed a score percentage of 89.16% for material expert validation, 80% for media expert validation, 93.75% for design expert validation, and 98.56% for student responses. The results of the normality and homogeneity tests show that the research data has been declared normal and homogeneous. The results of the hypothesis test show that the value of t count is 3.03 and the value of t table is 1.66, where t count > t table. The results of this study indicate that interactive media based on the project-based learning model assisted by the Canva application is effective in improving student learning outcomes.

Keywords: interactive media; canvas; English

1. INTRODUCTION

English proficiency in Indonesia is generally still low. In January 2020, English First (EF) released the English Proficiency Index (EPI) of 100 countries which shows the level of English proficiency in Indonesia is in 74th position, below the Philippines and Malaysia which have a high level of proficiency (advanced). Whereas in 2020, the IMF stated that these three countries were included as developing countries on the Asian continent, however, Indonesia was still quite far behind. English Proficiency covers the fields of education, society, economics, and technology.

These failures involve mastery of skills in reading, writing, or mathematics. Irham and Wiyani [1] said that there are several factors because experiencing earning difficulties is caused by two factors, namely internal and external factors. Internal factors include; (1) students' attitudes toward learning, (2) student motivation, (3) student learning concentration, (4) the way students process teaching materials, (5) students' ability to store learning outcomes, (6) student processes in exploring learning outcomes stored, (7) student achievement and performance, (8) student self-confidence, (9) student intelligence and success, (10) student study habits, and (11) student goals themselves. While external factors that influence student difficulties in terms of learning include: (1) teachers as student coaches, (2) learning facilities and infrastructure, (3) assessment policies, (4) students' social environment at school, and (5) school curriculum.

Interactive learning media has advantages, including being able to combine text, images, audio, animation, and video in one unit, can increase learning motivation, learning becomes interactive, can visualize material, and training independent learning [2]. Interactive learning media can contain things that can help the student's analysis process and develop students' thinking skills so that it can be used as a learning media that play a role in increasing student understanding and has a positive effect on improving student learning outcomes [3].

The PjBL model is a learning model that focuses on making products by involving students directly, the learning process is integrated with the real world, is student-centered, and of course, can support the improvement of student learning outcomes [4]. So, this interactive learning media will be packaged with project-based learning. The application of PjBL in the teaching and learning process is very important to improve students' ability to think critically and give a sense of independence in learning [5].

In learning English using the learning model students are not only fixated on books and written texts that they are used to seeing, but how can visual literacy in Canva take advantage of English subjects written by students by directly pouring their thoughts, creativity, and emotions they rely on color, atmosphere, images, and other symbols that can be used through designs in the Canva application. With the development and elaboration that will be presented in the development of this research, it is hoped that it will be able to provide positive lessons on how an application that has been widely provided can be utilized as a technology-based learning medium.

1.1 The Nature of English Learning Outcomes

According to Gagne [6] learning is a kind of change that is shown in changes in behavior, which are different from before the individual is in a learning situation and after carrying out similar actions. Change occurs due to an experience or practice. Unlike the sudden changes due to reflex or instinctive behavior. Ihsana [7] says that learning is a process in which there is a shift in the process from not knowing to knowing, from ignorance to understanding, and from the inability to get the best results.

According to Purwanto [8], learning outcomes can be explained by understanding the two words that make them up, namely "results" and "learning". The definition of result (product) indicates an acquisition as a result of carrying out an activity or process that results in a functional change in input. Production results are acquisitions that are obtained due to the activity of converting raw materials into finished goods.

Learning outcomes are evidence that someone has learned, which can be seen from changes in behavior in that person from not knowing to knowing and not understanding to understanding [9]. Meanwhile, Susanto [10] states that learning outcomes are obtained through the learning process that has been carried out. a mature and structured learning process will produce maximum learning outcomes.

Good language skills according to Soenardi [11] are divided into four types of abilities, including listening skills, reading skills, speaking skills, and writing skills. Soenardi's opinion is reinforced by several opinions experts and figures who state that, to know a person's language skills, it is necessary to pay attention to listening skills; reading ability; speaking ability and writing ability. According to Zaim [12] in the concept of language learning, four language skills must be mastered by a language learner, namely speaking skills, listening skills, reading skills, and writing skills.

1.2 The Nature of Reading Ability

Reading is a very important skill to be mastered by every individual. According to Lado [13] in his book Language Teaching states that "reading is understanding language through written images". Meanwhile, according to Burnes [14], reading is understanding writing. Somadayo [15] explained that reading is an interactive activity to pick and understand the meaning contained in written material. Furthermore, it is said that reading is a process carried out and used by the reader to obtain the message conveyed by the author.

According to Nuriadi [16] reading is a process that involves physical and mental activity. One of the physical activities in reading is when the reader moves his eyes along the lines of writing in a reading text. Reading involves mental activity that can guarantee maximum understanding. Reading is not just moving the eyeball from the left margin to the right but far from it, namely the activity of thinking to understand writing after writing. According to Harjasujana [17] reading is a complex ability. The reader does not only look at the written symbols but tries to understand the meaning of the written symbols.

The purpose of reading according to Ahuja [18] is formulated as nine reasons someone reads, including the following: (a) to laugh, (b) to relive everyday experiences, (c) to enjoy emotional life with other people, (d) to satisfy curiosity, especially why people do things the way they do, (e) to enjoy dramatic situations as if they were experiencing it themselves, (f) to obtain information about the world we live in, (g) to compare or contrast the contents of the reading with real life (reading to compare or contrast).

Reading has various purposes. Nurhadi [19] the objectives of reading skills are: (a) to increase students' reading speed, (b) to improve reading comprehension skills (c) to enrich or increase language competence (d) to increase vocabulary richness, and (e) to broaden students' knowledge schemes.

1.3 The Nature of the Canva Application Interactive Learning Media

Munadi [20] defines learning media as anything that can convey and channel messages from sources in a planned manner to create a conducive learning environment where recipients can carry out the learning process efficiently and effectively. This definition is in line with the definition presented by the Association of Education and Communication Technology (AECT) in America, which is all forms and channels used by people to convey messages or information.

According to Suryani [21] states that learning media are all forms and means of conveying information that is made or used by learning theory, and can be used for learning purposes in conveying messages, stimulating students' thoughts, feelings, attention, and willingness so that they can encourage the learning process. intentional, purposeful, and controlled.

One of the main functions of learning media is as a teaching aid that also influences the climate, conditions, and learning environment, which are arranged and created by the teacher [22]. Meanwhile, Sanaky [23] argues that the benefits of learning media for students are: (1) Increasing learning motivation; (2) Providing and increasing learning variations; (3) Providing structure of subject matter and making it easier for students to study independently; (4) Provide core information and points systematically to facilitate the learning process; (5) Stimulating students to think and analyze; (6) Creating conditions and learning situations without pressure; and (7) students can understand the subject matter systematically presented through learning media.

Meanwhile, according to Daryanto [24] the functions of learning media are as follows: (1) Clarify messages so that they are not too verbal; (2) Overcome the limitations of space, time, energy, and sensory power; (3) Generating passion for learning, more direct interaction between students and learning resources; (4) Allows students to learn independently according to their talents and visual, auditory, and kinesthetic abilities; and (5) Giving the same stimulus, equating experience and giving rise to the same perception.

According to Prastowo [25] when you hear the word "interactive" one thing that might immediately come to mind is something related to interactions or relationships. According to the Big Indonesian Dictionary, the word "interactive" implies mutual action or inter-relationship or mutual activity. Thus, interactive teaching materials can be interpreted as active teaching materials, meaning that the teaching materials are designed to be able to return orders to the user to carry out an activity. So, this teaching material is not like printed teaching materials which are only passive and cannot exercise control over their users.

According to Daryanto [26] Interactive multimedia is multimedia that is equipped with a controller that can be operated by the user so that the user can choose what he wants for the next process. Examples of interactive multimedia are interactive learning multimedia, game applications, and animated videos.

According to Wulandari & Mudinillah [27] Canva is an application that is popular among teachers to use it in making learning media. Various interesting template features can be used to create learning media and can be developed to design learning media as creatively as possible so that learning media

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has a more communicative meaning and the visualization of learning media is more attractive to students. Among the many applications used by teachers in making learning media, namely the Canva application. Canva is an online design application that provides various graphic designs such as infographics, ppt, resumes, flyers, posters, and so on. Canva can make it easier for teachers to design learning media, as Triningsih [28] explains that Canva can make it easier for teachers and students to carry out learning process activities based on technology, skills, creativity, and other benefits, this is because it can attract the attention of students' interest in learning by presenting interesting learning media and learning materials.

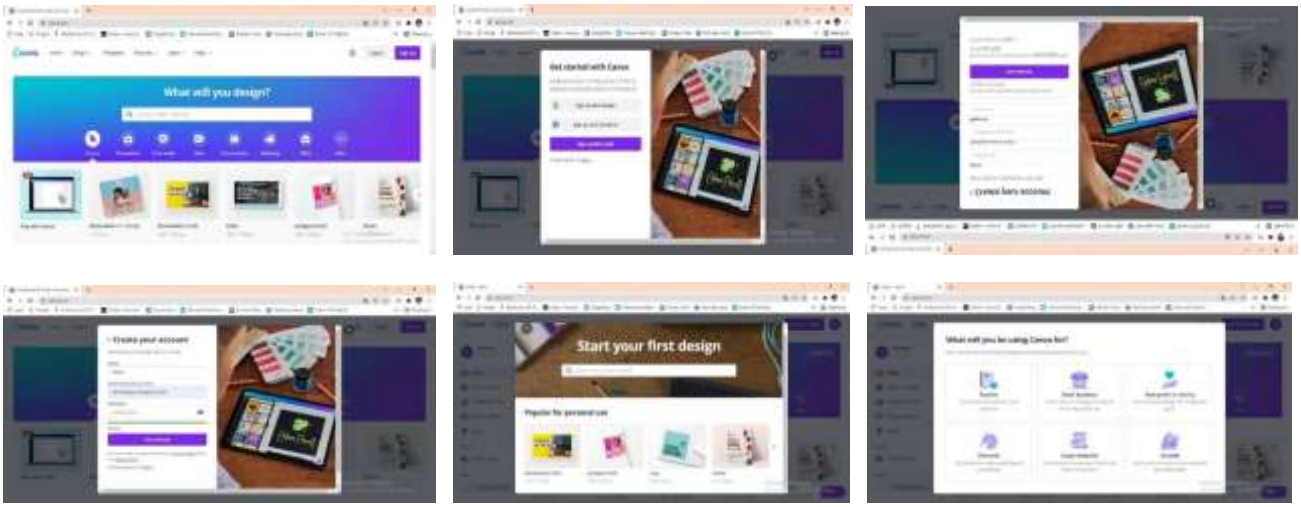

Figure 1. Steps to use the Canva application

1.4 The Nature of the Project-Based Learning (PjBL) Learning Model

According to Nayono [29], PjBL is an innovative learning that emphasizes contextual learning through complex activities. Meanwhile, according to Mulyadi [29], the PjBL model is a learning model that provides opportunities for teachers to manage classroom learning by involving project work. Project work contains complex assignments based on problems (problems) given to students as a first step in gathering and integrating new knowledge based on their experience in real activities, and requires students to carry out design activities, carry out investigative activities, solve problems, make decisions, provide opportunities for students to work independently or in groups. The result of the project work is a product that includes written reports, presentations, or recommendations.

According to Faizah [31], PjBL is a learning strategy that empowers students to gain new knowledge and understanding based on their experiences through various presentations. PjBL is an innovative learning model that emphasizes contextual learning through complex activities such as giving students the freedom to explore planning learning activities, implementing projects collaboratively, and ultimately producing PjBL products to help students develop various abilities such as intellectual, social, economic and morals.

Majid and Rochman [32] the characteristics of PjBL are as follows: (1) Students make decisions about a framework; (2) There are problems or challenges posed to students; (3) Students design processes to determine proposed solutions or challenges; (4) Learners are collaboratively responsible for accessing and managing information to solve problems, and (5) The evaluation process is carried out continuously.

The research problems are formulated as follows: (1) Is the Canva application PjBL-based interactive media feasible and (2) Is the Canva application PjBL-based interactive media effective in improving English learning outcomes?

2. METHOD

This type of research is a type of development research commonly called development (Research & Development). Research development is research that aims to produce a product through the development process [33]. According to Sugiyono [34] research and development is research that produces products and also other activities, namely testing the effectiveness of the products to be produced.

According to Borg and Gall [35], development research is a process used to develop and validate products. The purpose of development research is not only to develop products but more than that to find new knowledge or to answer specific questions about practical problems (through applied research).

This research will be conducted at SMA Negeri 1 Padang Bolak which is located in Gunung Tua City, Padang Bolak District, North Padang Lawas Regency. The subjects of this study were students of class X. Class X IPA 1 was the experimental class and class X IPA 2 was the control class. The selection of subjects in this study used a purposive sampling technique, namely the determination of the research sample based on the consideration of the researcher who considered that the desired research elements already existed in the members of the sample taken and based on suggestions from the English language study teacher at school.

The research and development procedures in this research: (1) The Needs Analysis Phase includes: Front-end Analysis; Student analysis; concept analysis; task analysis; formulation of learning objectives; (2) product design stage: preparation of benchmark reference tests; selection of teaching materials; format selection; preliminary design; (3) validation and

evaluation stages: expert/practitioner validation; (4) final product stage.

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and student responses. Respondents assessed the quality of Canvas PjBL-based interactive media with the provisions of the research criteria in Table 1 below:

Table 1. Scoring Rules

No	Category	Score
1	Very good	5
2	Good	4
3	Pretty good	3
4	Not good	2
5	Not good	1

(Source: Arikunto [36])

Table 2. Interpretation of Media Feasibility

No	Mean Score Intervals	Interpretation	Acceptance
1	1,00 – 2,49	Not feasible	Low acceptance
2	2,50 – 3,32	Less feasible	Acceptance is sufficient
3	3,33 – 4,16	Decent	High Acceptance
4	4,17 – 5,00	Very decent	Acceptance is very high

(Source: Sriadhi, [37])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum xi} \times 100\ \%$$

Information:
x : The answer score from the validator
x_i : Score the highest answer
P : Presentation of eligibility level

The feasibility and effectiveness criteria achieved are used in the development of the Canva application PjBL-based interactive media described in Table 3 below.

Table 3. Product Validation Criteria

Percentage %	Validity Level	Information
81,00 – 100,00	Very valid	No Revision
61,00 – 80,00	Valid	No Revision
41,00 – 60,00	Invalid	Partial Revision
21,00 – 40,00	Invalid	Revision
00,00 – 20,00	Very invalid	Revision

(Source: Sriadhi, [37])

The interactive media based on the Canva PjBL application that was developed received a positive response from students if the percentage obtained from the student response questionnaire reached a score of ≥ 60%, then the interactive media based on the Canva application PjBL was categorized as feasible and effective.

Product Eligibility:
Ho: μ < μo; Ho = null hypothesis; μ = criterion with a value of 70.00; μo = score from a material expert, media expert, and respondent.
So it can be concluded that PjBL-based interactive multimedia in this study is said to be inappropriate if it is less than 70.00 from material experts, media experts, and respondents.
Ha : μ > μo; Ha = Alternative hypothesis ; μ = criterion with a value of 70.01; μo = score from material expert, media expert and respondent
So it can be concluded that PjBL-based interactive multimedia in this study is feasible if it is greater than 70.01 from material experts, media experts, and respondents.

Product Effectiveness:
Testing the hypothesis in this study was carried out using the one-party t-test formula where the statistical hypothesis being tested can be formulated as follows:
Ha: There are differences in the learning outcomes of students who study using interactive media based on Canva's PjBL application and students who study with printed books.
Ho: There is no difference in the learning outcomes of students who study using interactive media based on Canva's PjBL application and students who study with printed books.
To find out significant differences in student learning outcomes, the t test formula is as follows:

Furthermore, to test the hypothesis, the two-party test formula is used. The t test is used if the alternative hypothesis reads "bigger" or above (>). For research data that is normally distributed and homogeneous, the hypothesis testing uses the t-test with the formula:

$$t = \frac{\overline{x_1} - \overline{x_2}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where S is the root of the combined variance calculated by the formula:

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}, \text{Where } S = \sqrt{S^2}$$

Where :
$\overline{x_1}$ = average score of the experimental class
$\overline{x_2}$ = average score of the control class
n_1 = the average number of experimental classes
n_2 = the average number of control classes
S_1^2 = variance of the experimental class group
S_2^2 = variance of control class group
S = combined variance
t = calculation price

The test criteria are that Ha is accepted if tcount < ttable and Ho is rejected if tcount > ttable which is obtained from the t distribution list with dk = (n – 1) and level α = 0.05. To see the value of the effectiveness of PjBL-based interactive media assisted by the Canva application, the effectiveness calculation formula is used as follows:

$$X = \frac{\text{number of students who completed}}{\text{total number of students}} \text{x } 100\%$$

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment are then analyzed

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and determined whether or not it is appropriate to develop interactive media based on the Canva application PjBL. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials and field trials is shown in table 4 below:

Table 4. Average Percentage of Assessment Results for Canva Application Pjbl-Based Interactive Media

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	89,16	very feasible
2.	Media Expert Validation	80,00	worth
3.	Learning Design Validation	93,75	very feasible
4.	Individual Trial	92,66	very feasible
5.	Small Group Trial	95,40	very feasible
6.	Field Test	98,56	very feasible
The average		91,59	very feasible

Based on the data in table 4 above, it can be seen that the feasibility of expert validation: media validation; material validation, and learning design validation as well as from individual trials; small group trials, and field trials on students showed very good or very feasible criteria, namely 91.59%. Overall, the assessment aspects from experts/experts and trials on students are "Very Good/Decent".

Data on Student Learning Outcomes Taught Using interactive media based on Canva's PjBL application. Based on the learning outcomes of students who were taught using interactive media based on the Canva application PjBL, the lowest score was 77.14 and the highest score was 97.14. The mean score is 86.20, the mode is 84.50, the median is 85.50 and the standard deviation is 6.10. To see student scores, class intervals are used, namely scores between absolute frequencies (the number of students who have learning achievement scores) and relative frequencies (the number of percent of learning achievement scores). A complete description of learning outcomes using interactive media based on the Canva application PjBL is shown in Table 5.

Table 5. Frequency Distribution of Experiment Class Student Learning Outcomes

Class	Interval Class	Absolute Frequency	Relative Frequency
1	74 - 77	3	9,38%
2	78 - 81	5	15,62%
3	82 - 85	8	25%
4	86 - 89	7	21,88%
5	90 - 93	5	15,62%
6	94 - 97	4	12,5%
Total		32	100%

Data on Student Learning Outcomes Taught Using Print Books. Based on the learning outcomes of students who were taught using printed books in English subjects, the lowest score was 69 and the highest score was 89. The mean score was 79.25, mode 79.50, median 80.5, and standard deviation 5.80. A complete description of learning outcomes using printed books is shown in Table 6.

Table 6. Frequency Distribution of Control Class Student Learning Outcomes

Class	Interval Class	Absolute Frequency	Relative Frequency
1	69 - 72	4	9,38%
2	73 - 76	6	15,62%
3	77 - 80	9	25%
4	81 - 84	8	21,88%
5	85 - 88	2	15,62%
6	89 - 92	3	12,5%
Total		32	32

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 7 below:

Table 7. Summary of Data Normality Test with Liliefors

No.	Data	Class	L count	L table	Conclusion
1	Pretest	Experiment	0,119	0,157	Normal
2	Pretest	Control	0,096	0,157	Normal
3	Posttest	Experiment	0,112	0,157	Normal
4	Posttest	Control	0,107	0,157	Normal

Based on Table 7 it can be seen that the results of the pretest data normality test in the experimental class obtained Lcount < Ltable (0.119 < 0.157) and in the control class also obtained Lcount < Ltable (0.096 < 0.157). The same thing also happened to the posttest data normality test results for the experimental class with Lcount < Ltable (0.112 < 0.157) and in the control class obtained Lcount < Ltable (0.107 < 0.157). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes were normally distributed at the significance level $\alpha = 0{,}05$.

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{Varian\ terbesar}{Varian\ terkecil} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 8 below:

Table 8. Summary of Data Homogeneity Test with Fisher's Test

No.	Data	Class	F count	F table	Conclusion
1	Pretest	Experiment	1,11	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	1,08	1,83	Homogeneous
4	Posttest	Control			

Based on Table 8 it can be seen that the results of the calculation of the pretest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount < Ftable (1.11 < 1.83), it can be concluded that the pretest data in the two classes have the same or homogeneous variance. Then in the posttest data homogeneity test in the experimental class and control class at a significant level α = 0.05 obtained Fcount < Ftable (1.08 <

1.83), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there were significant differences between learning outcomes in classes taught using interactive media based on Canva's PjBL application (experimental class) and learning outcomes taught using printed books (control class). The calculation results obtained tcount = 3.03 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$.

Based on these results, H0 is rejected and Ha is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at the significance level $\alpha = 0.05$. Thus, the learning outcomes of students who are taught using interactive media based on Canva's PjBL application are different from the learning outcomes of students who are taught with printed books.

To test the effectiveness of the Canva application PjBL-based interactive media that was developed, the following calculations were carried out:
X= (number of students who complete)/(total number of students) x 100%
= 27/32 x 100%
= 84.37%

The value of the effectiveness of printed books can be seen as follows:
X= (number of students who complete)/(total number of students) x 100%
= 20/32 x 100%
= 62.50%

Based on the calculation of the effectiveness test in the two classes, the learning outcomes of students taught with Canva application PjBL-based interactive media were higher compared to student learning outcomes with printed books (84.37% > 62.50%). Thus it can be concluded that Canva's PjBL-based interactive media is more effectively used in English subjects than using printed books.

3.2 DISCUSSION

Based on the results of the validation that has been carried out, the Canva application's PjBL-based interactive media product is declared feasible to continue in field trials. The interactive media based on Canva's PjBL application that has been developed meets standards based on the design of the development of learning materials, learning media, and learning design. For the assessment of learning material experts, a score of 89.16% was obtained which was categorized as very feasible, an assessment from learning media experts obtained a score of 80% which was categorized as very feasible and an assessment from learning design experts obtained a score of 93.75% which was categorized as very feasible. After the experts stated that the Canva application's PjBL-based interactive media product was very feasible to be tested in the field, field trials were carried out according to the procedure, namely individual trials, small group trials, and field trials. The score of student responses in individual trials was 92.66% (Very Eligible), small group trials were 95.40% (Very Eligible), and field trials were 98.65% (Very Eligible).

The effectiveness test of the Canva application PjBL-based interactive media that has been developed was carried out to fulfill the instructional design procedures by Dick and Carey at the summative evaluation stage. The purpose of testing the effectiveness of this product is to determine whether the product needs to be used continuously because it is effective or discontinued. After all, it is not effective.

Testing the effectiveness of the product on Canva application PjBL-based interactive media that was developed was carried out by comparing the average value of student learning outcomes taught using interactive media based on the Canva application PjBL-based interactive media using printed books. From the results of research data processing conducted, there were differences in learning outcomes between students who were taught using interactive media based on Canva's PjBL application and those who used printed books (84.37% > 62.50%).

This is in line with Santyasa [38] which states that the learning process should contain five communication components, namely the teacher (communicator), learning materials, learning media, students (communicants), and learning objectives. While learning media are all physical devices that can present messages and stimulate students to learn in the form of books, films, tapes, and so on [39].

Furthermore, Suryani [40] states that learning media are all forms and means of conveying information that is made or used by learning theory that can be used for learning purposes and convey messages, stimulate thoughts, feelings, attention, and willingness of students to encourage a learning process that is intentional, purposeful and controlled.

One of the technological developments as a learning medium today is the Canva application. Canva is an online design application in which there are various designs for posters, graphics, brochures, presentations, logos, videos, book covers, and more, and can also be connected to the social media we have. Its use and benefits are to create attractive teaching media with existing designs. Teachers and students are creative in creating interesting works to be displayed as learning media in class.

According to Wulandari & Mudinillah [41] Canva is one of the most popular applications among teachers to use in making learning media. Various interesting template features can be used to create learning media and can be developed to design learning media as creatively as possible so that learning media has a more communicative meaning and the visualization of learning media is more attractive to students [42].

This is in line with Wulandari & Mudinillah's statement [43] which states that Canva is an online design application that provides various graphic designs such as infographics, ppt, resumes, flyers, posters, and so on. Canva can make it easier for teachers to design learning media, as Triningsih [44] explains that Canva can make it easier for teachers and students to carry out learning process activities based on technology, skills, creativity, and other benefits, this because it can attract the attention of students' interest in learning by presenting interesting learning media and learning materials.

According to Raaihani [45] the advantages of the Canva application are as follows: (1) It has an attractive graphic design template variant, (2) It can train teachers' creativity in making learning media, (3) In making learning media it can save time, (4) Students can study again the material that has been distributed by the teacher.

Based on some of the explanations above, it can be concluded that interactive media based on the Canva application PjBL can be called a good learning media if the learning media can improve student learning outcomes. The use of interactive media based on Canva's PjBL application allows students to more easily understand learning and master learning material. This is also by the results of the Canva application PjBL-based interactive media development which obtained feasible results in terms of product development and was effective in improving student learning outcomes in the English subject.

4. CONCLUSION

1. The Canva application PjBL-based interactive media products that have been developed meet the requirements and are suitable for use as learning media. This was concluded based on research results from learning material experts (89.16%), media experts (80%), design experts (93.75%), student responses to individual trials (92.66%), small group trials (95.40%), field trials (98.56%) which as a whole stated that Canva's PjBL application-based interactive media was in the "very good" category.
2. The effectiveness of interactive media based on Canva's PjBL application developed is considered more effective than printed books. The results of hypothesis testing prove that there is a significant difference between the learning outcomes of students who are taught using interactive media based on the Canva PjBL application and the learning outcomes of students who are taught using printed books. This is indicated by the results of data processing obtained tcount = 3.03 and ttable = 1.66 so that tcount > ttable at a significant level $\alpha = 0.05$. Then the learning outcomes of students who are taught with interactive media based on interactive media based on Canva's PjBL application have effectiveness of 84.37% higher than the learning outcomes using printed books with an effectiveness of 62.50%.

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Optimization of Water Wells Production for Water Cleaning Process

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Abstract: This paper presents a model to optimize water Well production for a water cleaning process to maintain the pollution level of a polluted ground water area with 20 Wells of varied pollution concentrations. In Hungary, a pharmaceutical company contaminated an area by using different chemicals to manufacture drugs. The production area has Wells with different concentrations and needs to be cleaned to maintain a constant pollution concentration. I cannot discuss the company, its location, or the production area. My model will tackle this complex real-life problem based on this problem. Mathematically, the problem is simpler, but it involves numerous Wells with varied concentrations. We will start by defining the values of our 20 Wells, computing the weighted average, comparing two and three Wells to understand how they operate, and then using MATLAB to graph their relationship. Second, as the model becomes more sophisticated, we will group the Wells into four groups and analyse them to find the best operating combination. We will next utilize our best combination from the analysis to create a process algorithm for our model. Our main goal is to design a process algorithm optimization controller for our model so that the Wells can function at a constant capacity of 16 litre/mins to generate water with 55% average pollution even if one or two Wells are not working at full capacity. The optimization controller will iteratively adjust the Well production capacity until the weighted average pollution level reaches 55%.

Keywords: Optimization; Pollution; Optimization controller; Process Algorithm; Weighted Average; Linear programming

1. INTRODUCTION

Pollution is a worldwide environmental problem that has negative effects on human health as Well as biodiversity and ecosystems. Both natural and human-made processes can be contributors to pollution, which in turn can cause a wide variety of issues for both the environment and human health.. Human activity either industrial or residential contaminates water supplies in many countries [1]. Water contamination contributes to the global water deficit because it can't be used for drinking or irrigation. Groundwater is necessary for drinking, irrigation, and industry. Groundwater remediation is aided by optimizing water Well production, especially in areas with many Wells with different pollution levels[2]. The issue requires knowledge of the location's hydrogeology, the pollutants' qualities, and the Wells' operation. The model in this study optimizes water Well production for water cleansing. This model aims to maintain a consistent pollution level in a contaminated groundwater region with (20) Wells with different pollution concentrations. A pharmaceutical firm in Hungary polluted a region by using different chemicals and making different drugs. Remediating the production site's several Wells with different contamination levels is the goal. Our model will solve this complex real-life problem based on this problem. The objective of this study is to develop a model that optimizes the production capacity of the Wells to achieve a constant level of pollution concentration. The proposed model will take into account the varying pollution concentrations of the Wells, their respective production capacities, and the linear constraints inherent in the system. The iterative process employed by the optimization controller will be utilized to modify the production capacity of individual Wells, with the ultimate aim of achieving a weighted average pollution level of 55%. The present research endeavors to make a valuable contribution towards the advancement of a cost-efficient and effective strategy for the remediation of groundwater in regions that have numerous Wells with diverse levels of pollution concentrations.

1.1 Chemical Contamination by Pharmaceutical Companies In Hungary

Reports have emerged in Hungary regarding chemical contamination resulting from the activities of pharmaceutical enterprises, particularly in the water bodies adjacent to their production facilities. The presence of contamination has been detected in certain geographical locations. In the course of their manufacturing operations, these corporations utilize a diverse array of chemicals and compounds. There exists a potential for certain substances to enter the environment, thereby presenting a hazard to both the ecosystem and public health.

In 2018, the Danube Networkers for Europe, an environmental organization based in Hungary, reported that several pharmaceutical companies operating within the country were discharging untreated or inadequately treated wastewater into the Danube River. The Danube River is considered to be a crucial water resource in Hungary. The organization made a claim that the wastewater comprises of compounds that have the potential to be hazardous, such as antibiotics, hormones, and other pharmaceutical residues.

These compounds could have adverse impacts on both human health and aquatic ecosystems. [3]

To address chemical contamination from pharmaceutical industries, Hungary needs greater limits and monitoring of their production processes and wastewater discharges. Businesses should use green chemistry and improved wastewater treatment to reduce their environmental impact and improve public health.

1.2 Process Optimization

The act of optimizing a process involves the attainment of its maximum potential with regards to its efficiency, effectiveness, and profitability. The term used to describe this procedure is "process optimization." The achievement of this objective can be realized through a diverse range of techniques, spanning from uncomplicated enhancements in procedures to elaborate modeling and simulation methodologies. The primary aim of optimizing a process is to achieve the highest possible outcome while minimizing the utilization of time, resources, and materials that are expended during the process. Process optimization refers to the utilization of structured methodologies, strategies, disciplines, and tactics to enhance a specific process within the confines of a project or initiative. The optimization of processes has led to a growing need for real-time monitoring of various parameters associated with said processes [4].

Optimization strategies are numerous. Lean Six Sigma, TQM, and other statistical and modeling methodologies are examples. The optimization technique and operating goals will determine the strategy used. Process optimization involves identifying key variables, measuring performance, identifying areas for improvement, and implementing those changes. "Process mapping," "statistical process control," "root cause analysis," and "simulation modeling" are all optimization tools utilized in the optimization of a process [5].

1.3 Importance of the optimized Well production , in case of automated water cleaning process

Within the context of automated water cleaning, the optimization of Well production holds significant significance. This is due to the fact that the extraction rate of water from Wells has an impact on the concentration of pollutants in the water. In the event that the extraction rate surpasses a certain threshold, there exists a likelihood that the purification procedure would be inadequate in eliminating the contaminants, thereby leading to the production of substandard water. Conversely, in the event that the extraction rate is insufficiently high, the cleaning process may not be optimally utilized, leading to a depletion of resources. This issue could potentially be mitigated by augmenting the extraction rate [6].

Optimal Well production ensures that the Wells operate at a constant capacity to generate water with the required pollution level for the automated water cleaning procedure. In this research, the optimization controller will keep pollution at 55% even if one or more Wells are not working at full capacity. Weighted averages will modify each Well's and group's output capability. The weighted average pollution level will linearly constrain this adjustment.

Optimizing Well production ensures that the water cleaning procedure is sustainable and within parameters. The complete study shows that improving Well production in an automated water cleaning process is necessary to maintain a consistent pollutant concentration and ensure effective and sustainable operation.

2. METHODOLOGY

The materials employed in the development of this study are categorized into two distinct categories, namely resources and tools. The resources comprise of academic and scientific journals, as Well as online resources. The tools utilized include Microsoft Excel, Python, MATLAB software, and TwinCAT PLC automation software.

2.1 Model of the Polluted Ground Water

The proposed model comprises of twenty (20) Wells, each exhibiting varying levels of pollution and distinct water production capacities. A randomized allocation approach was employed to assign pollution concentration levels to individual Wells, ranging from 33% to 75%, aswell as water production capacities between 0.8 liters/min and 2.5 liters/min.

Presented in the following table are the established parameters for the Model, which includes the water production capacity and pollution concentration of each Well.

A formula was derived to calculate the weighted average of the entire contaminated area, which comprises 20 distinct Wells. The formula is derived as follows:

$$y = \frac{\sum_{ij=1}^{n} xiKj}{\sum_{i=1}^{n} xi}$$ [7].

The formula will be utilized to determine the weighted average of the entire contaminated area, with the aim of ascertaining the consistent level of pollution within the model.

Where:

XiKj= 1966.8

Xi= 34.8.

y = 1966.8/34.8

y=56.52%

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Table 1: Assigned values for the 20 wells of our model.

Wells	Production Capacity (Liter/mins)Xi	Level Of Pollution Concentration (%)Kj	Xi.Kj
1	0.8	33%	26.4%
2	0.9	36%	32.4%
3	1.2	38%	45.6%
4	1.1	41%	45.1%
5	1.6	45%	72%
6	2.0	51%	102%
7	2.3	62%	142.6%
8	2.5	57%	142.5%
9	2.1	42%	88.2%
10	1.7	68%	115.6%
11	1.8	71%	127.8%
12	1.9	38%	72.2%
13	2.1	44%	92.4%
14	1.0	43%	43%
15	1.3	56%	72.8%
16	1.1	58%	63.8%
17	2.2	69%	151.8%
18	2.3	72%	165.6%
19	2.5	74%	185%
20	2.4	75%	180%
	∑Xi = 34.8		∑XiKj=1966.8

Weighted average: The term "Weighted Average" is also commonly referred to as the "Weighted Mean". The aforementioned is a computation that considers the diverse levels of significance attributed to the numerical values within a given set of data. A weighted average is a statistical measure that assigns different weights to each number in a set, reflecting their relative importance or significance in the calculation of the average value. The nomenclature of the statistical measure suggests its significance [8].

Weighted average is define the formular below:

$$W = \frac{\sum_{i=1}^{n} wiXi}{\sum_{i=1}^{n} wi}$$

W = weighted Average

n = number of terms to be averaged

wi = weight applied to x values

Xi = data values to be averaged

The concept of Weighted Average was employed in the derivation of the aforementioned formula for computing the Weighted Average of our model.

2.2 Comparison between two Wells with respect to each other

A comparative analysis was conducted on two Wells to determine their operational characteristics and generate a graphical representation using MATLAB.

Here, we utilized Well 1 and Well 20 as sources of data.

We will use Well 1 and Well 20

Well 1 = 0.8 liter/mins and 33%

Well 20 – 2.4 liter/mins and 75%

The formula utilized is $y = \frac{\sum_{ij=1}^{n} xiKj}{\sum_{i=1}^{n} xi}$ [7]

$$y = \frac{(0.8 * 0.33) + (2.4 * 0.75)}{(0.8 + 2.4)}, \quad y = \frac{2.064}{3.2}$$

y = 0.645 __ 64.5%

Thus, the weighted average obtained from Well 1 and Well 20 is 64.5% when weighted by their respective contributions.

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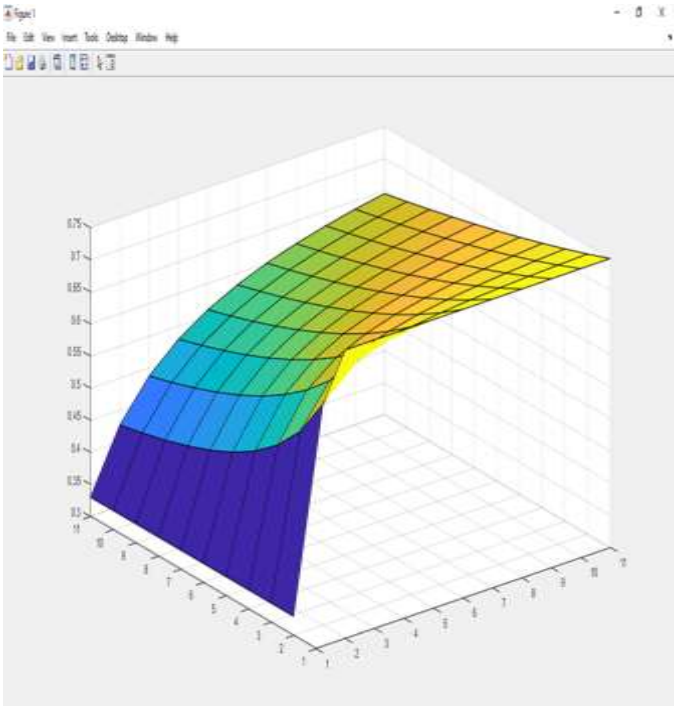

Fig 1 : Visualization of Well 1 and Well 20 relationships.

The diagram presented above illustrates the interdependence of Well 1 and Well 20, depicting their operational dynamics in relation to one another.

2.3 Comparison between three Wells with respect to each other

Here, a comparison was made among three Wells to determine their operational characteristics relative to one another. However, the visualization of the resulting graph depicting the performance of these Three (3) Wells on MATLAB was found to be challenging and arduous.

Here, we utilized Well 1, Well 10, and Well 20.

Well 1 –(0.8 liter/mins & 33%), Well 10 – (1.7 liter/mins & 68%) and Well 20 – (2.4 liter/mins & 75%)

Using $y = \frac{\sum_{ij=1}^{n} xixj}{\sum_{i=1}^{n} xi}$ [7]

$$y = \frac{(0.8 * 0.33) + (1.7 * 0.68) + (2.4 * 0.75)}{(0.8 + 1.7 + 2.4)}$$

$$y = \frac{3.22}{4.9}$$

y = 0.657 __ 65.7%

Thus, the calculated weighted average of Well 1, Well 10, and Well 20 is 65.7%. Visualizing the graph of the three (3) Wells becomes challenging when dealing with more than two Wells, as the model complexity increases when working with three or more Wells. The proposed approach involves the grouping of Wells to facilitate the operationalization of the model.

2.4 Grouped Data

Table 2: Grouped data

Production Capacity [Xi] (Liter/mins)	Level Of Pollution Concentration [Kj] (%)
Group 1	
0.8+0.9+1.2+1.9+1.1+2.1+1.0 Sum= 9 liter/mins	33%, 36%, 38%, 38%, 41%, 42%, 43% Group Avg= 38.71%. Weighted Avg=39.21%
Group 2	
2.1+1.6+2.0 Sum= 5.7 liter/mins	44%, 45%, 51% Group Avg= 46.67%. Weighted Avg=46.74%
Group 3	
1.3+2.5+1.1+2.3 Sum= 7.2 liter/mins	56%, 57%, 58%, 62% Group Avg= 58.25%. Weighted Avg=58.57%
Group 4	
1.7+2.2+1.8+2.3+2.5+2.4 Sum= 12.9 liter/mins	68%, 69%, 71%, 72%, 74%, 75% Group Avg= 71.5%. Weighted Avg=71.77%

The contaminated area comprises of a total of 20 wells exhibiting varying degrees of pollution. Managing a set of 20 wells presents a complex and challenging task in achieving a consistent level of pollution control. Due to the intricate nature of the data, we opted to categorize the wells into four distinct groups based on their pollution levels' similarity. This approach was taken to streamline the model and facilitate calibration and manipulation.

2.5 Finding the best possible Combination to operate on

The collective maximum performance of the 20 wells is 34.8 liters per minute. However, it is preferred to operate the model at a capacity lower than the maximum to allow for greater flexibility in addressing potential issues or errors. Therefore, it is recommended to operate the model at no more than half of the maximum capacity of the wells. Utilizing the model at a reduced capacity in comparison to its maximum water production capability would afford us greater flexibility in experimenting with various combinations. Determining the optimal combination for operation will provide greater latitude and understanding regarding the optimal value at which our model will function and produce the intended output. The task at hand necessitates the examination of three distinct data sets to authenticate and corroborate the hypotheses under scrutiny. In order to identify the optimal combination for operation, a sample of 1000 random numbers

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was generated. Each number in the sample consisted of four distinct random digits, with the constraint that the sum of these digits equaled 16. The maximum capacity of each group was taken into consideration during the generation process. The experiment was conducted thrice, resulting in three distinct datasets. The purpose of this analysis was to confirm our hypothesis regarding the identification of the optimal combination for operate upon.

Table 3: Analysis of the three distinct dataset generated.

	First Dataset	Second Dataset	Third Dataset
Min Weighted Avg	44.42%	44.66%	44.13%
Max Weighted Avg	69.68%	70.17%	70.28%
Difference	25.25	25.50	26.15
WA Range with highest Combination	50-58%	50-60%	50-58%

The primary objective of this study is to develop a process optimization controller for our model, aimed at achieving a consistent level of production capacity of 16 liters per minute across all wells, while maintaining an average pollution level of 55%. This optimization controller will be designed to accommodate scenarios where one or more wells may not be operating at full capacity. Additionally, the study aims to determine the maximum limit of the optimization controller in optimizing water production in situations where multiple wells are not functioning at full capacity.

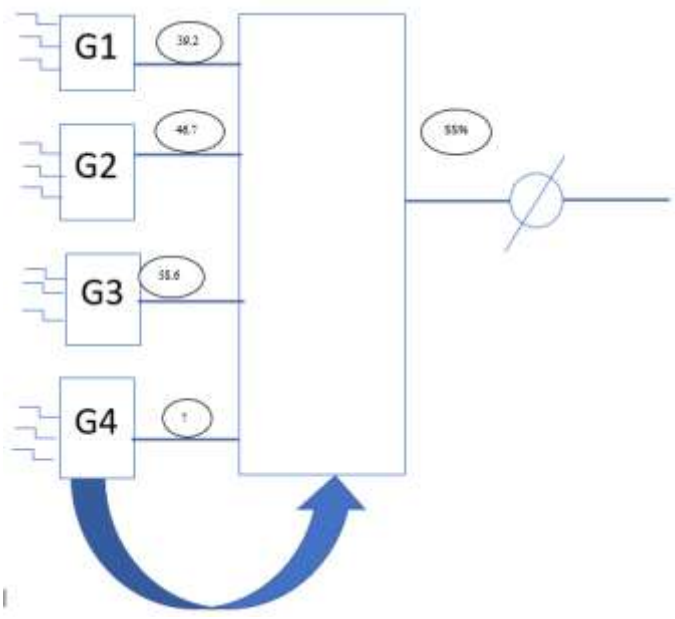

Fig 2 : Process Optimization of the model.

Optimal Interval is 50-60% = 55% Avg.

3. RESULT

The concept of linear programming constitutes the basis for the creation of the optimization controller. The optimization controller employs an iterative approach to modify the production capacity of individual wells, with the aim of achieving a targeted value of 55% for the total weighted average pollution level.

The iterative methodology bears resemblance to the simplex algorithm, which is commonly employed in linear programming to determine the optimal solution for a linearly constrained linear programming problem.

One of the optimization controller's tasks was to compare the pollution level of the well with the weighted average pollution level, with the aim of optimizing the pollution amount to 55% of the average. If such a scenario arises, the output capability of the well is enhanced by the quotient of the cumulative weighted average contamination level and the contamination level specific to the well.

Consequently, the optimization controller modifies the production capacity of individual wells to maintain a consistent pollution level of 55%. The aforementioned task is achieved through the utilization of a weighted average methodology that considers both the output potential of individual wells and the level of contamination generated by each cluster of wells. Upon completion of this process, it guarantees the optimization of production capacity while concurrently minimizing the degree of pollution.

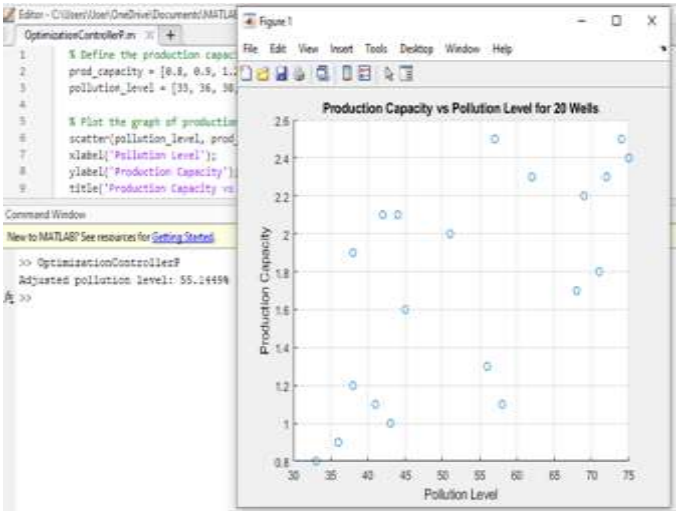

Fig 3: The optimization controller optimizing the assigned values of the model at 55% Average Pollution level [9].

The figure above shows the optimization controller developed in MATLAB optimizing the model's original assigned values to give us the desired target pollution of 55% average. The model has been optimized to operate at a constant capacity of 16 liter/mins to produce water with 55% average pollution.

The optimized model plots the relationship between each well's production capacity and pollution level at 16 liter/mins to produce water with 55% average pollution. Our model produces 0.8–2.5 liters/minute and pollutes 33%–75%.

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3.1 Comparison of the Optimization Controller while Working at a Less Capacity

We will compare and analyze the optimization controller's behavior when one, two, or more wells are not working at full capacity and determine the threshold of production capacity reduction beyond which the system can optimize water production while maintaining a constant level of 16 liters per minute and an average pollution level of 55%.

Table 4 : Summary of Wells Production Capacity and its Optimized result.

S/N	Reduced Well(s)	Optimization Result
1	0 Well Reduction	55%
2	1 Well Reduction	55.4554%
3	2 Wells Reduction	55.6614%
4	3 Wells Reduction	55.7865%
5	4 Wells Reduction	55.9987%
6	5 Wells Reduction	56.1587%
7	6 Wells Reduction	56.4194%
8	7 Wells Reduction	56.4292%
9	8 Wells Reduction	56.666%

The optimization controller can only optimize water production to 55% average pollution when four of the twenty wells have their water production capacity reduced to a lesser capacity. When five or more wells are reduced, the optimization controller cannot optimize production capacity at the stipulated 55% pollution average, as we saw in our analysis. After reducing Four Wells, our Twenty Wells' overall output capacity dropped to 33.5liter/minute from our model's 34.8liter/minute. The Optimization controller optimized the outcome to 55% pollution level average at 33.5liter/minute, the same as at 34.8liter/minute.

3.2 Production Capacity Generator

A code generator was developed to generate random values for our model's Production Capacity to determine and analyze our optimization controller's efficiency in optimizing water production to an average pollution level of 55% even if one or more wells are not working at full capacity of our model's assigned values.

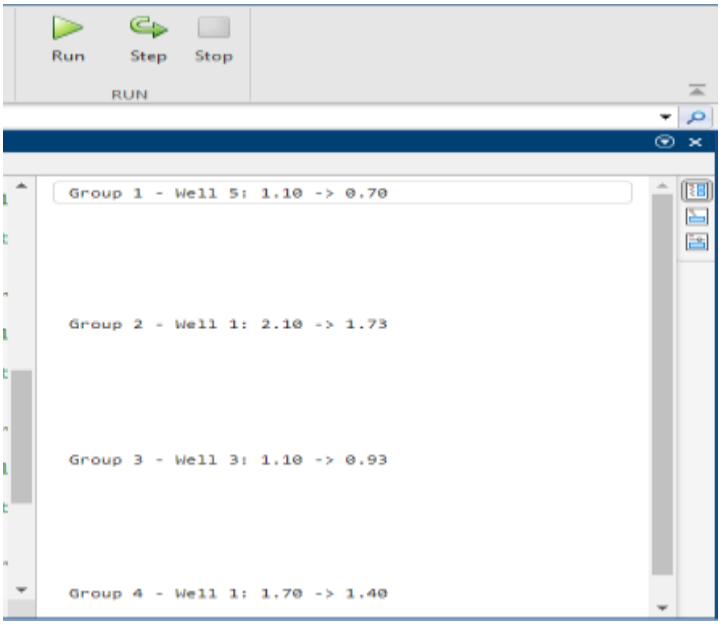

Fig 4 : New Production Capacity value Generator [9].

4. CONCLUSION

In conclusion, the study has presented a model for optimizing water wells production for a water cleaning process in a real-life scenario where an area was contaminated by a pharmaceutical company's production activities. The model was based on linear programming principles and involved finding the optimal solution to adjust the production capacity of each well to maintain a constant pollution level of 55% given the initial production capacity and pollution level of each well. The optimization controller used a weighted average approach that takes into account the production capacity and pollution level of each well and each group of wells. The limit of the optimization controller was found to be reducing the water production capacity of four wells, beyond which it was unable to optimize the production capacity at the stipulated 55% pollution average. Overall, the study's model can be useful in optimizing water production for cleaning processes in contaminated areas with multiple wells of different pollution concentrations. Subsequent to this study, the forthcoming endeavors will encompass the deployment of the optimization controller onto a designated Programmable Logic Controller (PLC) via Twincat programming. The implementation of this technology will enable the automation of water purification in real-time. Further testing and validation are necessary for the optimization controller, utilizing data obtained directly from the site affected by the corporation's contamination. Upon completion of simulated testing, the optimization controller is expected to be implemented in practical applications.

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Scandura Structure-Based E-Learning: Improving Science Learning Outcomes (Natural Science) for Junior High School Students

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Abstract: The aims of this study were to: (1) determine the feasibility of Scandura structure-based e-learning in science subjects; (2) know the practicality of Scandura structure-based e-learning in science subjects; and (3) determine the effectiveness of Scandura structure-based e-learning in science subjects. The type used by researchers is Research and development (R&D). The research subjects were students of SMP Negeri 2 Balige, Toba Regency. The object of this study was an e-learning tool that was used by 64 students in classes VIIIA and VIIIB (32 students in each class). The results showed that the feasibility of e-learning based on Scandura's structure was tested through the validation of material and media experts, with an average score of 3.85% and a percentage of 96% on the criteria of very Suitable for Science subjects at SMP Negeri 2 Balige. The practicality of e-learning based on Scandura's learning structure was tested on science teachers, with an average percentage of 3.22 (80.56%) in the Very Suitable category for science subjects. The effectiveness of e-learning based on Scandura's structure learning tested with N-Gain was found to be 61.84% in the Moderate criteria. The feasibility of e-learning in VIII IPA in Phase D can be said to be feasible for use in enhancing science learning in class and outside the classroom for students.

Keywords: e-learning; learn the structure of scandura; IPA

1. INTRODUCTION

Teaching materials are one of the learning tools developed by the teacher for the learning process in the classroom. According to Prastowo [1], teaching materials are all forms of materials used to assist teachers or instructors in carrying out the learning process in class. The material in question can be written or unwritten. Teaching materials are very helpful for students to practice at home. From the teaching materials given to students, students can repeat lessons that have been received in class by getting homework from the teacher, so that independence will grow and can help students evaluate their abilities in learning.

In science in class VIII, students feel confused about accessing the right learning for them even though the devices they have are able to access them from various sources. Teachers experience problems managing science learning when the resources used are still in the form of student worksheets. The development of learning tools that strengthen students' scientific thinking is not yet well structured, such as using web organizers or charts that make it easier for students to analyze. Vitti and Torres [2] wrote that scientific processes occur naturally and spontaneously in our minds. By logically outlining the steps in our thinking, we can use the process of science to figure out how to answer our questions about how the world works. The scientific process is useful not only in science but in any situation that requires critical thinking. Science process skills include the quality of observing, measuring quantities, sorting or classifying, concluding, predicting, experimenting, and communicating.

The problem of learning science, as stated by Jufrida et al. [3], is that learning science itself not only emphasizes and focuses students on aspects of knowledge but rather provides direct experience (experiments) of how scientists think about and explore a symptom or phenomenon so as to find scientific products. Science learning is expected to be able to increase scientific knowledge and develop the material itself so that students can apply it in everyday life.

Salamah [4] explained that in structural learning theory, all learned knowledge is called rules. In particular, the principles of knowledge have three components, namely: (a) the domain or field, namely the consistency of the internal relationship between the cognitive structure and the elements of the learning situation environment, so that students learn based on Structural Learning Theory or by George H. Stevens and Joseph M. Scandura Structural Learning Theory Rules Domain can obtain a specific result from instructional objectives: (b) distance, namely the structure of students' expectations of the rules of their learning outcomes and related to variations in behavior or decisions directed at achieving learning objectives; (c) operation, namely the sum of all decisions and the sequence of student actions in producing the expected knowledge rules. Therefore, the researcher wants to develop an e-learning learning tool in which structured learning principles can be used as the basis for developing learning that can increase the effectiveness of student learning, namely by what students are interested in, student learning variations that can be grouped, the development of knowledge charts, and students' scientific thinking. Based on the description of the problems in this study, the authors are interested in conducting research entitled "Development of e-Learning Learning Devices Based on Scandura Structure Learning for Science Subjects at SMP Negeri 2 Balige, Toba Regency."

1.1 The Nature of Learning and Science Learning Outcomes

Samatowa [5] also stated that natural science is a science that deals with natural phenomena and objects that are systematic, regularly arranged, and generally accepted in the form of a collection of observations and experiments. Systematic in science, according to the meaning of the Merriam Webster Dictionary, is the more common word; it most often describes something that is done according to a system or method. The method used in learning natural science is studied and structured to help someone study nature and all its phenomena.

UNESCO, on a page entitled Science for Society [6], writes that natural science produces solutions for everyday life and helps us answer the great mysteries of the universe. In other words, natural science is one of the most important channels of knowledge and has a specific role as well as multiple functions for the benefit of society: creating new knowledge, enhancing education, and improving the quality of life.

The American Meteorological Society [7] also explains that most scientists recognize that the pursuit of objectivity in research, even though it may be impossible for humans to fully achieve it, is the cornerstone of science. The natural sciences generate knowledge and understanding by trying to eliminate potential sources of bias, often through controlled experiments. This pursuit of objectivity enhances the credibility of scientific progress and broadens people's willingness to take in and use the new knowledge and understanding that science provides.

Based on the Guidelines for Implementing the Curriculum in the Context of Learning Recovery, it is explained how the structure of the SMP/MTs curriculum consists of one (one) phase, namely Phase D. Phase D is for classes VII, VIII, and IX. The structure of the SMP/MTs curriculum is divided into two parts, namely: (a) intra-curricular learning; and (b) The project to strengthen the profile of Pancasila students, which is allocated around 25% (twenty five percent) of the total JP per year.

The implementation of the project to strengthen the Pancasila student profile is carried out flexibly, both in terms of content and in terms of implementation time. In terms of content, the profile project must refer to the achievement of the Pancasila student profile in accordance with the student phase and does not have to be linked to learning achievement in the subject. In managing implementation time, projects can be carried out by adding up the allocation of project study hours from all subjects, and the total amount of implementation time for each project does not have to be the same.

1.2 Evaluation of e-Learning

The most widely used e-learning interactive learning model in learning design is the Edmodo-assisted interactive learning model [8] [9]. Edmodo has a website that is used by teachers, lecturers, and students and parents to facilitate online learning. Edmodo offers a more secure and connected classroom by offering a real-time class-based platform to exchange ideas, content and to access homework, grades, and important information from the school. This interactive learning model helps in planning, analyzing, implementing, and managing learning. It also provides access to learning materials whenever and wherever students are. Apart from Edmodo, there are still many applications that can be used to evaluate student learning.

Evaluation is an assessment of the data collected through assessment activities [10]. Hilda Taba in Hermawan [11] revealed that, in principle, the focus of evaluation is the level at which students achieve goals. The definition of evaluation itself is how to achieve an activity objective based on an assessment of existing data through testing. Ruslan [12] writes that the meaning of assessment is a general term that includes all methods that can be used to assess the performance of individual students or groups. The assessment process includes collecting evidence to demonstrate students learning achievements. The definition of assessment relates to every part of the educational process, not just learning success but all teaching and learning processes.

Assessment, also according to Siregar and Nara [13], is a process for making decisions using information obtained through measuring learning outcomes, using either test or non-test instruments. Pramono [14] suggests that the implementation of evaluation is a condition of planning carried out in the field. Implementation of evaluation in the field is very dependent on the choice of model and evaluation objectives that have been previously planned. Teachers who want to carry out the process of assessing teaching and learning outcomes can use tests, and teachers can also use non-tests. The process of implementing evaluation in the field is certainly in accordance with the choice of each teacher in choosing the test instrument.

Mustusilo [15] suggests homework that can be developed for students so that it is not monotonous and creates stress for students by providing instructions for making projects that are adapted to learning materials, utilizing the Ministry of Education and Culture's Learning House portal as a virtual lab (e-laboratory) for students to study, making vlogs or existing application-based videos, and leveraging Google Sites with content using Google Forms. Homework that does not burden students will actually increase their interest in learning in class and at home. Homework that increases students' creativity will further excite them to learn. Student homework can be used as a learning evaluation where Student Activity sheets, which are part of student teaching materials at home, are a guide and assessment for the students themselves to assess the extent to which they understand the lessons they receive from class.

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Figure 1. Material chart of IPA Phase D Human Digestive System

Figure 2. Online tests or quizzes on e-learning learning devices

1.3 The Nature of Learning the Scandura Structure

Cognitive and constructive roles can be seen in Scandura's theory of structural learning. Scandura's theory is known as Structural Learning Theory (TBS), which pays major attention to (1) the specifications of what students must learn, (2) the characteristics of students, and (3) the process of continuous interaction between teachers and students based on predetermined goals. The learning principles expressed in Scandura's theory contribute to learning theory, namely (1) choosing higher rules, rules, and atomic components and (2) sorting simple to complex. Next to reveal are: (1) the specifications of what must be learned; (2) the characteristics of the cognitive problems of the learner; and (3) the process of interaction between the teacher and the students according to the existing goals.

Ikegulu [16] explains in his journal that structural learning theory provides a basis for the unification of declarative and procedural knowledge necessary for various common problem-solving tasks in an effort to explain observed individual performance with various experiences. The basic principle of structural learning theory is that the basic activities associated with a particular task are essentially the same for all individuals with prior task exposure, regardless of skill and experience, and that differences in individual performance that are observed are due to the declarative task-specific knowledge possessed and utilized by individuals.

The structured learning approach is a structured approach developed from learning theory and behavior modification in psychology. In Cowie & Dawn [17], the structured learning approach has a pattern of training steps consisting of five hierarchical components. The five components, namely (1) Instruction, (2) Modeling, (3) Role Playing, (4) Feedback, and (5) Transfer of Training, each of which is defined as a social skills training procedure, These steps aim to provide comprehensive skills training through structured stages. Each is defined as a procedure for changing behavior. Among these components, Miltenberg [18] explained that the learning given to students to practice skills must be specific and clear. Instruction in learning helps students see an outline of what will be learned.

According to Smith & Ananiadou in Rahayu et al. [19], practicing certain tasks facilitates learning at a later time only for similar tasks; this is referred to as transfer of training exercises. The tasks given are in the form of (1) interpersonal tasks related to various tasks to overcome any difficulties experienced during assertive behavior training; (2) writing on reflection sheets about their feelings during and after carrying out assertive training; and (3) transferring and directly practicing the behavior that has been learned in people's lives.

Structural learning theory has been widely applied to mathematics and also provides an interpretation of Piaget's theory. The main focus of this theory is problem-solving instructions [21]. Scandura [20] has applied a theoretical framework for the development of writing tools and software engineering. The principles of Scandura's structure learning theory include: (1) If possible, teach high-level rules that can be used to derive lower-level rules; (2) Teach the simplest solution path first, then teach the more complex path or set of rules; (3) Teaching must consist of the minimum abilities possessed by students. The basic principle of structural learning theory is that the basic activities associated with a particular task are essentially the same for all individuals with prior task exposure, regardless of skill and experience, and that differences in individual performance that are observed are due to the declarative task-specific knowledge possessed and utilized by individuals.

The research problem is formulated as follows: (1) Is the Scandura structure-based e-learning learning tool developed suitable for use in science subjects? (2) Is the developed Scandura structure-based e-learning learning tool practically used in science subjects? (3) Is the e-learning learning tool developed on the basis of Scandura's learning structure effective in Science Subjects?

2. METHOD

The type used by researchers is research and development, or what is called research and development (R&D). Sugiono [22] explains that research and development methods, or in English, research and development, are research methods used to produce certain products and test their effectiveness. This study developed an e-learning learning tool based on Scandura task analysis in science subjects at SMP Negeri 2 Balige.

The implementation of this research was carried out at SMP Negeri 2 Balige. And, the implementation time for the development of e-learning learning tools and research will be carried out in March 2022, in the Even Semester of the 2022–2023 Academic Year. Research subjects are individuals who participate in research. The subjects of this study were students of SMP Negeri 2 Balige, Toba Regency. The object of this study was an e-learning tool that was used by 64 class VIIIA and VIIIB students (32 students in each class) during the lesson.

Learning Achievements Based on the Independent Curriculum by studying science in an integrated manner, students develop themselves according to the profile of Pancasila students and can: (1) Develop interest and curiosity so that students are motivated to examine phenomena that exist around humans, understand how the universe system work and provide a reciprocal impact on human life; (2) Playing an active role in maintaining, protecting, preserving the natural environment, managing natural resources and the environment wisely; (3) Develop inquiry process skills to identify, formulate and solve problems through real action; (4) Understand the requirements needed by students to become members of a community and nation group and understand the meaning of being a member of the nation and world community, so that they can contribute to solving problems related to themselves and the environment around them; and (5) Developing knowledge and understanding of concepts in science and applying them in everyday life.

The procedure in this study is to produce certain products or improve existing products and test their effectiveness. According to Thiagarajan, it is known as the 4D Model, which consists of four stages, namely: (1) Define; (2) Front-end analysis; (3) Learner analysis; and (4) Task analysis. Concept analysis, Specifying instructional objectives, (2) Design, Compile test criteria, and choose learning media by utilizing Google Sites and free websites that are appropriate to the material and characteristics of students; Selection of the form of presentation of learning; Simulating the presentation of material with media and learning steps that have been designed; (3) Develop; expert appraisal and developmental testing. Expert appraisal is a technique to validate or assess the feasibility of a product design. In this activity, evaluation is carried out by experts in their fields. (4) Disseminate: The packaging of the learning model can be done by printing a guidebook for the application of the learning model. After the e-learning learning tools are published online, they are disseminated so that they can be absorbed (diffusion) or understood by others and used (adopted) in their classes.

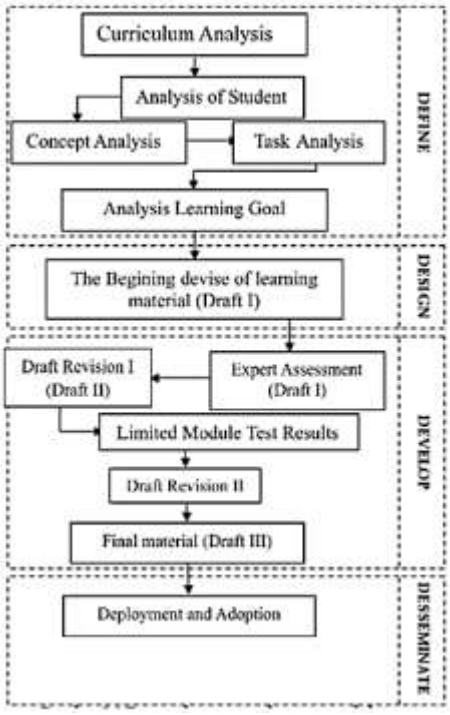

Figure 3. 4-D Model Development Flow by Thiagarajan

The total assessment score can be calculated using the following formula:

$$\text{Percentage of eligibility} = \frac{\text{Total score of data collection results}}{\text{total ideal maximum score}}\ x\ 100\%$$

The percentages obtained from the feasibility testing of experts and the practicality of using teachers and students are converted into tabular form that can be read in the research results. The determination of the criteria is done by: (1) Determine the percentage of the ideal score (maximum score) = 100%; (2) Determine the percentage of the lowest score (minimum score) = 0%; (3) Determine the range = 100 – 0 = 100; (4) Determine the desired interval = 4 (very feasible, feasible, sufficiently feasible, and less feasible); (5) Determine the internal width (100/4 = 25).

Applying a study of the percentage table that presents the feasibility aspect, Sugiono [22] makes the percentage scale table as follows:

Table 1. Eligibility Percentage Scale

Achievement Percentage	Value Scale	Interpretation
76% ≤ skor ≤ 100%	4	Very Eligible
51% ≤ skor ≤ 75%	3	Eligible
26% ≤ skor ≤ 50%	2	Fairly Decent
0% ≤ skor ≤ 25%	1	Fairly Decent

Table 2. Practicality Percentage Scale

Achievement Percentage	Value Scale	Interpretation
76% ≤ skor ≤ 100%	4	Very Practical
51% ≤ skor ≤ 75%	3	Practical
26% ≤ skor ≤ 50%	2	Practical enough
0% ≤ skor ≤ 25%	1	Less practical

The validation questionnaire related to the suitability of the material and design of the product being developed has four answer choices according to the question content. The suitability data is used to determine the feasibility level of the resulting product. The following is a table of assessment scores according to Sugiyono [23]:

Table 3. Answer Choice Rating Score

No	Category	Score
1	Very good	4
2	Good	3
3	Good	2
4	Not good	1

Table 4. Eligibility Criteria

No	Percentagee (%)	Validity
1	81 – 100	Very Valid
2	61 – 80	Valid
3	41 – 60	Invalid
4	0 - 40	Very Invalid

Before testing the hypothesis, a prerequisite test is carried out with the normality test and the data homogeneity test. The test given did not test the homogeneity of pre-test and post-test scores; the test tested on students was valid because it used a test developed by the Bookkeeping Center. Conduct a difference test (t test) to see the significance of the difference between the pretest and posttest scores. Statistical test results with the following conditions: (a) If the probability value, or Sig. (2-tailed), is 0.05, then there is a significant difference in the pretest and posttest values. (b) If the probability value, or Sig. (2-tailed), is > 0.05, then there is no significant difference in the pretest and posttest scores.

The effectiveness of e-learning learning tools is measured by measuring the increase in the extent to which targets are achieved from the start before treatment (initial ability test or pretest) to the target learning outcomes after being given posttest treatment. Oktavia et al. [24] wrote that in the one group pretest and posttest design, the pretest was carried out on the research subject group, after which treatment was given, and then a posttest was carried out with the same measurements. Students who were subjected to the pretest and posttest came from the same class (within subject design), namely in Class VIII-B, while Class VIII-A was a product trial class. The pretest is carried out by asking a number of questions related to the material that will be reviewed in the class. Furthermore, the treatment is carried out in the form of procuring a strengthening program and providing modules. Then, after the treatment, a posttest is given in the form of filling in the questions again.

Testing the effectiveness of Scandura structure-based e-learning tools uses manual calculations, namely the N-Gain effectiveness formula. The Normalized Gain Test (N-Gain) was carried out to find out how much effect the Scandura structure-based e-learning tool received after being given learning on it.

Archambault [25] explains the calculation of the normalized Gain score with the formula: N-Gain Score = $Skor\ Posttest - Skor\ Pretest\ Skor\ Maksimal - Skor\ Pretest\ x$ 100% Normality This gain is also analyzed for the mean value of pretest and post scores test. The following is presented the formula to determine the mean value: $Mean\ Sk$or Pre fix = Total Pretest Value Number

Hake [26] explained that the results of the Normalized Gain calculations were then interpreted based on the N-Gain interpretation table.

Table 5. Criteria for N-Gain Score e-Learning Learning Devices Based on Scandura Structure Learning

No	N-Gain Presentation	Criteria
1	71 – 100%	High
2	31 – 70%	Moderate
3	1 – 30%	Low

3. RESULTS AND DISCUSSION

3.1 RESULTS

The results of the evaluation of e-learning learning tools in the form of a website were validated for material experts, media experts, individual trials, small group trials, and limited field trials for all aspects of the assessment determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop Scandura structure-based e-learning tools. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials, and field trials is shown in Table 6 below:

Table 6. Results of the Feasibility Assessment of Scandura Structure-Based E-Learning Learning Tools

No	Categorization	Percentage of average score%	Criteria
1.	Material Expert Validation	96,00	very worth it
2.	Media Expert Validation	86,54	very worth it
3.	Individual Trial	80,00	very worth it
4.	Field Trials	81,67	very worth it
The average		86,05	very worth it

Scandura structure-based learning e-learning learning tools show that the results of material expert validation, media expert validation, individual trials, and field trials show an average of 86.05% in the very feasible category, which means the use of e-learning media Scandura's learning-based structure meets the needs of learners.

The practicality test of e-learning learning products in the form of a website was conducted for VIII grade science teachers to find out whether Scandura structure-based e-learning learning tools were practical or not to be used in the next grade of science learning. The results of the practicality test can be seen from the validation questionnaire analysis data as follows:

Table 7. Product Use Practicality Test Results

No	Aspect	Percentage of average score%	Criteria
1.	Effective	81,25	very practical
2.	Interactive	79.17	Practical
3.	Efficient	87,50	very practical
4.	Creative	75,00	Practical
The average		81,25	very practical

E-learning learning tools based on Scandura structure practicality show that the use of effective, interactive, efficient, and creative aspects as a whole averages 81.25% in the very practical category, which means the use of e-learning learning media based on Scandura structure learning very practical to use in the learning process for students.

The results of the SPSS t-test from the results of the pretest and posttest in class VIII-B are as follows:

Table 8. T-test results

t-Test

	40	*85*
Mean	57,258065	83,225806
Variance	84,731183	47,580645
Observations	31	31
Pearson Correlation	0,3539375	
Hypothesized Mean Difference	0	
df	30	
t Stat	-15,46838	
P(T<=t) one-tail	3,861E-16	
t Critical one-tail	1,6972609	
P(T<=t) two-tail	7,722E-16	
t Critical two-tail	2,0422725	

From the test results above, it shows that the average pretest value is 57.25 and the posttest value is 83.22. The value of t is 1.69 and the value of t from the distribution of t table is 2.04, where if the probability value or Sig. (2-tailed) < 0.05, then there is a significant difference in the pretest and posttest scores.

The pretest result scores and the pottest result scores were obtained from the questions given to students and calculating the N-Gain. The effectiveness of science learning through Scandura structure-based e-learning learning tools according to Archambault (2008) is calculated from the normalized Gain score with the formula:

$$N - Gain\ Score = \frac{\text{Posttest Score} - \text{Pretest Scoret}}{Maximum\ Score - Pretest\ Score}\ x\ 100\%$$

From the processing of the pretest and posttest data above, it was found that:
a. Pretest score ($\bar{X}Pretest$) : 57,83
b. Posttest score ($\bar{X}Posttest$) : 83,91
c. Maximum Score: 100

$$N - Gain\ Score\ = \frac{83{,}91\ - 57{,}83}{100\ - 57{,}83}\ x\ 100\%$$

Then the N-Gain Score = 61,84%

Table 9. N-Gain Scores of Scandura Structure-based e-Learning Learning Devices in class VIII

Score	Result
Pretest	57,25
Post-Test	83,22
N-Gains	70,23
Criteria	Moderate

In Hake's explanation [28] regarding the calculation of the Normalized gain, which is interpreted based on the N-Gain interpretation table, a value of 70.23 is obtained in the Moderate criteria. The effectiveness of the e-learning learning tools in class VIII IPA in Phase D is used to improve science learning in class and outside the classroom for students.

3.2 DISCUSSION

Development research was carried out to develop e-learning learning tools consisting of teaching materials and the evaluation of learning science in class VIII with the Scandura Learning Structure. Utilizing websites and Google Sites in developing learning content is a practical way for materials to be used in class, at home, or wherever students want. Websites and Google Sites can be effective in the process of distance learning and blended learning in schools.

Rosiyana [29] wrote in his research that learning using websites and Google Sites provides benefits for students and teachers, namely as follows: (1) Websites and Google Sites can make students lives more interesting and fun; (2) Websites and Google Sites can provide learning materials that can be downloaded so that students can learn from them anywhere and anytime. (3) Websites and Google Sites can provide material from the beginning to the end of the meeting; students can re-read the material provided by the teacher because the material does not automatically disappear. (4) Students can upload assignments that have been assigned separately; (5) Websites and Google Sites may provide separate announcements regarding assignments or other information.

The feasibility of this e-learning tool using websites, Google Sites, and e-tests obtained by 91% of material and media experts can lead students to learn structure, according to Scandura. Barnwell [30] suggests that structural analysis is a specification of the problem domain and an identification of the rules needed to solve the problem. Science learning in class VIII SMP Negeri 2 Balige is carried out by identifying all problems related to the Human Digestive System, Additives and Addictive Substances, and the Human Circulatory System. The problems raised in certain parts of the e-learning tool lead students to identify a rule, such as practicing.

The practicality of this e-learning learning tool, seen from the aspects of Effective, Interactive, efficient, and creative, was obtained at 80.56% from the response of science teachers at SMP Negeri 2 Balige. The practicality of these e-learning tools helps teachers carry out a series of Scandura-structured learning activities, where Barnwell [31] explains that the first step requires students to do an analysis to decide which way is right to represent the facts given to the problem and how to find a suitable solution. related to the big question of what will be studied. Then do an analysis to choose what problems students must solve through an analysis of learning material or content available on e-learning learning tools at dapenda.yolasite.com, where students will be directed to follow further learning steps in class or assignments from the teacher through Cause and Effect, Compare and Contrast, and others as explained in Chapter II. Furthermore, a set of problem-solving methods and strategies that can be traced through learning content on e-learning learning tools that have been developed and the consistency of students to complete assignments or assignments given.

4. CONCLUSION

Based on the results of the research and discussion above, it can be concluded that:

1. The feasibility of the Scandura structure-based e-learning tool was tested through the validation of material and media experts, with an average score of 3.85% and a percentage of 96% on the criteria. Very suitable for use in science subjects at SMP Negeri 2 Balige.
2. The practicality of the Scandura structure-based e-learning learning tool, which was tested on science teachers with an average percentage of 3.22 (80.56%) in the Very Suitable category for use in science subjects at SMP Negeri 2 Balige.
3. The effectiveness of the Scandura structure-based e-learning learning tool tested with the N-Gain calculation was found to be 61.84% in the Moderate criteria. The feasibility of e-learning learning device products in class VIII IPA in Phase D can be said to be feasible for use in enhancing science learning in class and outside the classroom for students.

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Batak Culture-Based Learning Model: Character Building and Improving Learning Outcomes in Pancasila and Citizenship Education

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Abstract: The purpose of this study was to find out whether the Batak Culture-Based Learning Model that had been developed was valid for use in Shaping Student Character in Pancasila and Citizenship Education Subjects (PPKn) Class IV and whether the Batak Culture-Based Learning Model that had been developed was effective in increasing student learning outcomes in PPKn Subjects. The type used in this study is the Research and Development (R&D) Four-D development model. The subjects of this study were all fourth grade students at the Integrated Islamic Elementary School (SDIT) Alam Arrazaq Rantauprapat, consisting of 52 students, distributed into 2 classes. The results showed that: (a) The validation results from the learning design expert, material expert, and graphic design expert showed a score of 4.62 with Very Good criteria, after several revisions were made so that the teaching materials used by Civics in Elementary Schools used the Practice Learning Model Advanced Organizer Inquiry and Learning Model. (b) The results of the pretest and posttest tests on Civics learning using developed teaching materials show that the average learning outcomes of students with the Batak culture-based learning model have an effect on learning in Civics subjects. (c) The affective assessment of fourth grade elementary school students shows Moderate," where the values of cultured character have been achieved in the progress stage.

Keywords: learning models based on Batak culture; character; advanced organizer; Pancasila and civic education

1. INTRODUCTION

North Sumatra is a province in which there are various ethnic groups that live, such as Karo, Malay, Javanese, Pakpak, Angkola, Simalungun, and Nias, including the Toba Batak ethnicity. The Toba Batak ethnicity is one of the various ethnic groups known as tribes that often migrate from the Toba highlands to various parts of the archipelago, and one of these areas is Labuhanbatu Regency, which is dominated by the Batak ethnicity. Labuhanbatu is a regency located in the North Sumatra region of Indonesia. Inside there are 12 (twelve) ethnicities, including Malay, Sundanese, Nias, Javanese, Pak-Pak Dairi, Karo, Minang, Acehnese, Toba Batak, Tapsel, Chinese, and Simalungun. The residents of Labuhanbatu Regency have different ethnic backgrounds, which are dominated by the Batak ethnic group. However, Malay cultural values as an indigenous ethnic group in Labuhanbatu are still an important part of the Labuhanbatu community. Based on data from the Central Statistics Agency, 44.43% of Labuhanbatu residents come from the Batak ethnic group.

Local and national cultural values that are deeply instilled in the educational process regarding customs that are recognized and used as national identity. The process of developing cultural values becomes the foundation of character and requires a continuous process carried out in various subjects, educational activity programs in schools, and the environment students interact with. In developing character education, awareness of who one is and one's culture is a very important part [1].

According to Sapriya [2], education is a vehicle for the transformation of culture, values, science, and technology, and even art has become the center for the development of national character, both through formal and non-formal education. Character development is instilled at an early age. Quality human resources are the main capital needed to achieve the welfare of the nation. Intellectual improvement, emotional intelligence, and character development are prerequisites for the successful development of Indonesians.

According to Majid [3], the learning process to shape the character of students requires the integration of three components: (1) Moral Knowing (moral awareness, knowing moral values, perspective talking, moral reasoning, decision making, and self-knowledge); (2) Moral Feeling (conscience, self-esteem, empathy, loving the good, self-control, humility); and (3) moral action, competence, will, and habit. Through character, it is hoped that commendable student behavior will be formed in line with universal values and noble cultural traditions.

According to Kaelan [4], Citizenship Education is a subject that must be followed at every level of education. In accordance with Permendiknas No. 22 of 2006, the Citizenship Education subject is a subject that focuses on the formation of citizens who understand and are able to carry out their rights and obligations to become Indonesian citizens who are intelligent, skilled, and have the character mandated by the Pancasila of the 1945 Constitution. In general, the aim of Citizenship Education in the 2013 curriculum at the elementary and secondary levels is to develop the potential of students in all dimensions of citizenship.

1.1 The Nature of PPKn Learning Outcomes

Hamalik [5] emphasized that learning outcomes appear as changes in behavior in students, which are observed and measured as changes in knowledge, attitudes, and skills.

Change can be interpreted as an increase and development that is better than before, for example, from not knowing to knowing, from being impolite to being polite, and so on.

Citizenship Education is a subject that is studied from elementary to university level. According to Azra [6], Citizenship Education can be interpreted as a vehicle for developing and preserving noble and moral values rooted in Indonesian culture, which are expected to be realized in the form of behavior in the daily lives of students as individual members of society in the life of the nation and state.

Citizenship Education is a subject that focuses on self-development in various aspects, for example, in terms of religion, socio-culture, language, age, and ethnicity, to become intelligent, skilled, and characterized Indonesian citizens based on Pancasila and the 1945 Constitution [7]. This is in accordance with what was stated by the Ministry of National Education [8] that Citizenship Education is a subject that generally aims to develop the potential of individual Indonesian citizens so that they have insight, attitudes, and citizenship skills that are adequate and enable them to participate intelligently and responsibly in various aspects of life, including society, nation, and state.

According to Hamalik [9], teaching and learning are interactions that have normative value and are carried out consciously and purposefully. The purpose here is to guide the direction in which the teaching and learning process will take. The teaching and learning process will be successful if the results are able to bring about changes in knowledge, understanding, skills, and attitude values in students. Teaching and learning activities will eventually produce new abilities possessed by students, or, in other words, learning outcomes. Learning outcomes are patterns of behavior, values, notions, attitudes, appreciation, and skills.

According to Kunandar [10], learning outcomes are a result of the learning process using measurement tools, namely tests that are arranged in a planned manner, both written and oral tests, and action tests. Meanwhile, according to Ghuftron and Risnawati [11], learning outcomes are a change in individuals who learn, not only regarding changes but also forming skills and appreciation in individuals who learn. Based on this opinion, it can be concluded that learning outcomes are the results obtained by students after the learning process has taken place, which are indicated by the test scores given by the teacher after each time they finish giving subject matter on one subject.

According to Ruminiati [12], Citizenship Education is a subject that aims to form or foster good citizens, namely citizens who know, want, and are aware of their rights and obligations. Citizenship Education in Elementary Schools is a subject that focuses on the formation of citizens who understand and are able to exercise their rights and obligations to become Indonesian citizens who are intelligent, skilled, and have the character mandated by Pancasila and the 1945 Constitution.

1.2 The Nature of Character Learning

Tsauri [13] explains that character literally comes from the Latin word character, which means, among other things, character, psychological traits, manners,personality, or morals. So that the character can be understood as having a basic nature, personality, behavior, and patterned habits. From the perspective of character education, education plays a role in building the character of students. Character education is an effort to prepare students' wealth with religious, social, and cultural dimensions, which can be realized in the form of good manners in words, deeds, thoughts, attitudes, and personalities.

Haryati [14] writes that the development of national character can be done through the development of one's individual character. Character development can be carried out in an educational process that does not separate students from the social environment, society, and national culture. The nation's social and cultural environment is Pancasila, so cultural and character education is developing Pancasila values in students through heart, brain, and physical education.

Kepmendiknas describes character as typical good values where a person knows the value of goodness, wants to do good, has a real good life, and has a good impact on the environment, which is ingrained in oneself and actualized in behavior [15]. Andrianto [16] also revealed the notion of character, which includes a series of attitudes such as the desire to do the best; intellectual capacities such as critical thinking and moral reasoning; behavior such as being honest and responsible; defending moral principles in situations of injustice; interpersonal and emotional skills that enable a person to interact effectively in various circumstances; and a commitment to contribute to the community and its people.

Djumali [17] writes that character education is an effort to shape a child's personality both physically and mentally so that he becomes a better human being. The character of a good student is one that shows that he is an educated student. Character itself is a moral and mental quality of a person whose formation is influenced by innate and environmental factors.

1.3 The Nature of Culture-Based Education

According to Wibowo [18], local wisdom is a view of life and knowledge as well as various life strategies in the form of activities carried out by local communities in responding to various problems and meeting their needs. In foreign languages, it is often conceptualized as local policy, local wisdom, or local knowledge, or local genius.

Istiawati [19] is of the view that local wisdom is the way people behave and act in response to changes in the physical and cultural environment. A conceptual idea that lives in society and grows and develops continuously in people's awareness, from those related to life that are sacred to those that are profane (everyday parts of life that are mundane in nature). Local wisdom can be understood as local ideas that are wise, full of wisdom, and of good value and that are embedded and followed by members of the community.

Local wisdom, according to Ratna [20], is a binding cement in the form of an existing culture, so that it is based on existence. Local wisdom can be defined as a culture created by local actors through an iterative process through the internalization and interpretation of religious and cultural teachings, which are socialized in the form of norms and used as guidelines in the daily life of the community. Local wisdom-based learning is learning that places students as student-centered learning centers rather than teacher-centered.

Meaning is created from what students see, hear, feel, and experience. For teachers, teaching is an activity of facilitating students in constructing their own knowledge through their involvement. This is in line with Suparno's statement [21], which states that learning is not just a passive activity of receiving material from the teacher but an active process of

exploring old experiences, seeking and finding new experiences, as well as assimilating and connecting between the two so as to form meaning.

It was also said by Alfian [22] that local wisdom is defined as a way of life and knowledge as well as a life strategy in the form of activities carried out by local communities to meet their needs. Based on Alfian's opinion, it can be interpreted that local wisdom is a custom and habit that has been traditionally carried out by a group of people from generation to generation and that, until now, has been maintained by certain indigenous peoples in certain areas.

Haryanto [23] states that the characteristics of local wisdom are religious harmony in the form of social practices that are based on cultural wisdom. Forms of local wisdom in society can take the form of culture (values, norms, ethics, beliefs, customs, customary law, and special rules). Noble values related to local wisdom include love for God, the nature of the semester and its contents, responsibility, discipline, independence, honesty, respect and courtesy, compassion and care, confidence, creativity, hard work, never giving up, justice and leadership, being kind and humble, tolerance, peace-loving, and unity.

The same thing was stated by Wahyudi [24]. Local wisdom is an unwritten order of rules that is a reference for society and covers all aspects of life in the form of rules concerning relations between human beings, for example, in social interactions between individuals and groups, which are related to hierarchy. in governance and customs, inter-clan marriage rules, and manners in everyday life.

According to Ratna [25], in society, local wisdom can be found in folklore, songs, proverbs, sasanti, advice, mottos, customs, and ancient books that are embedded in everyday behavior. This local wisdom will manifest in a traditional culture, and local wisdom will be reflected in the values prevailing among certain groups of people. Local wisdom is expressed in the form of words of wisdom (philosophy) in the form of advice, sayings, rhymes, poetry, folklore (oral stories), and so on; rules, principles, norms, and social and moral rules that make up the social system; rites, ceremonial or traditional ceremonies, and rituals; as well as habits seen in everyday behavior in social interaction [26].

1.4 Batak Culture Based Learning Model

In his book "Adat and the Batak Cultural War," he writes that the character values of the Batak tribe that have been attached to every 74 Batak people are: religious, disciplined, hard work, mutual assistance, responsibility, honesty, friendliness, and courtesy. The true character of the Batak people must be maintained and developed within generations of Batak people through education. Education practically cannot be separated from cultural values. In maintaining and preserving local culture, the process of transferring it to be more effective is through education. For example, in Sidikalang District, which has a majority population of Batak ethnicity, in developing an educational program, it is necessary to consider the Batak cultural values themselves to improve educational programs through a local cultural approach. The cultural value in question is the dominant character value of a group of ethnic groups.

Armawi [27] writes in his article that one of the cultural values that is the pride of the Toba Batak people is the system of social relations, dalihan na tolu, which is manifested in very strong kinship based on blood descent (genealogy) and marriage, which has been hereditary until now. In the Batak cultural system, dalihan na tolu, which is termed nan tiga, will certainly have a different understanding and meaning from other cultural values in Sumatra, such as the tiga sejarangan stoves, the three seplin threads, the three-foot umbrellas, and so on, which function as guidelines that regulate, control, and give direction to the behavior (behavior) and actions (attitudes or patterns of action) of the Toba Batak people. Therefore, dalihan na tolu is a cultural system that, for the Toba Batak people, uses the values it contains as a way of life and, at the same time, a source of motivation for behavior. The Toba Batak people live the dalihan na tolu as a system of cultural values that provide guidelines for orientation, perception, and the definition of reality [28].

Nur et al. [29] explained that the Batak tribe has basic principles in life that are philosophized as Dalihan Natolu, which, if interpreted in Indonesian, is a stove with three supports. The teachings in Dalihan Natolu are explained with examples of social application in Batak Toba customs quoted from gobatak.com as follows (Gobatak [29]): (1) Somba marhula-hula. This means that hulahula in Batak tribal custom is a man's family from the wife's side. In a civilized life, a person must respect his hula-hula and may not act as he pleases. (2) Manat mardongan tubu Dongan tubu, in Batak custom, is a group of people in one clan family. The picture of Dongan Tubu is that of a brother or brother and sister. In this philosophy, one is taught to love one's brother and help one another, lest there be conflict that can destroy brotherhood. (3) Elek Marboru. Boru is a group of people from the sister's side and the side of the sister's husband. In this term, it is taught to love one another so that this life is blessed.

Parenduri [30] writes that in the tradition of the Toba Batak people, both Christian and Muslim, the family is an adhesive component even though there are various religious differences. For the Toba Batak people, the philosophical values of Dalihan Na Tolu play a very big role and are the basis for strengthening family relationships.

Figure 1. Display of PPKn teaching materials in Growing Student Character Based on Toba Batak Culture

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The Syntax of the Learning Model can be seen in the Syntax of the Batak Culture-Based Learning model, "SAGIA" (Strategy; Approach; Guidance; Implementation; and Assessment).

Table 1. Syntax and Activities

Syntax	Learning Activity
Strategy	Integration of character values through Citizenship Education, daily activities at school, programmed or planned activities, and building communication and collaboration between schools and parents through the media
Approach	Recognizing the value as their own and being responsible for the decisions they make; Application of the moral thinking process through discussion of moral issues so that students can make decisions about their moral opinions from the perspective of Dalihan Na Tolu and the Toba Batak cultural manners approach contextual management with the ability to think logically and scientifically in analyzing social issues related to attitude values and certain morals; Growing awareness and developing students' abilities to identify their own values and the values of others; Developing abilities with a value analysis and clarification approach
Guidance	Habituation or acculturation of the cultural values and behaviors of students that are commendable and in line with universal values and religious national cultural traditions; Instilling a spirit of leadership and student responsibility; Making a summary through a simple drama or performance and other forms of portfolio of character values, cultural values, and inculcation of manners from the Batak Culture
Implementation	Strengthening character values through student worksheets and embodiment of Batak cultural values through learning models; identification of symptoms or findings of facts and concepts related to the material; Demonstrations and role plays of mastery of character values that students must have through exemplary, polite activities, reprimands, environmental conditioning, and routine activities
Assesment	Writing tests, performance tests, and assignments; Anecdotes on character learning based on Batak culture using the SAGIA learning model

The research problem is formulated as follows: (1) Is the Batak culture-based learning model valid for use in shaping student character in Civics subjects? (2) Does the Batak culture-based learning model that was developed effectively improve student learning outcomes in Civics subjects?

2. METHOD

The type used in this study is Research and Development (R&D), namely the development model. The method used in this study is the research and development (R&D) Four-D development model. According to Thiagarajan (F-D), the Four-D development model stands for define, design, develop, and disseminate, which was developed by Thiagarajan. This model consists of four development stages: define, design, develop, and disseminate, or be adapted into the F-D model, namely definition, design, development, and deployment.

The place for conducting this research was the Alam Arrazaq Rantauprapat Integrated Islamic Elementary School (SDIT), which is located at Jl. Alinafiah Rantauprapat, South Rantau District, Labuhanbatu Regency, North Sumatra. According to Sugiono [31], writing about a population is a generalization consisting of objects or subjects that have qualities, and then conclusions are drawn. The population of this study was all students in class IV for the 2022–2023 academic year, which consisted of 52 students, distributed into 2 classes.

Research and Development Procedures The development that will be carried out is to develop a learning model, namely the Learning Implementation Plan (RPP), and Teaching Materials for Grade IV Elementary Schools. The development stages follow the Semmel model development procedure (1974); the development model used refers to the F-D model. The F-D model consists of four stages, namely: define, design, develop, and disseminate. The learning model that will be developed in this study is the Batak Culture-Based Learning Model.

Thiagarajan [32] divides this stage into four parts, namely: construction, criteria-referenced test, media selection, format selection, and initial design. Some things that need to be explained in the initial design of the lesson plan are related to: (1) Compiling a criterion test is the first action to determine students' initial abilities and serves as an evaluation tool after implementing activities. (2) Choose learning media that are appropriate to the material and characteristics of the students. (3) The selection of the form of presentation of learning is adjusted to the learning media used. If the teacher is going to use audio-visual media at certain learning times, students are asked to see and appreciate the visual media display. (4) Carrying out material simulations with media and learning steps that have been designed During the learning simulation, peer assessments were also carried out.

The aspects that are measured are too high on the questionnaire. To be able to calculate the quantitative aspect, alternative answers are given with a score of 4 = very good, 3 = good, 2 = sufficient, and 1 = poor, as shown in table 2 below:

Table 2. Table of Questionnaire Scores and Learning Design Assessments

No	Categorization	Score Range	Description
1	Very good	85% - 100%	No revision needed
2	Good	75% - 84%	No revision needed
3	Enough	65% - 74%	Need to be revised
4	Less	55% - 64%	Need to be revised

Table 3. Eligibility Percentage Scale

No	Percentage of Attainment	Scale Value	Interpretation
1	76% ≤ skor ≤100%	4	Very Eligible
2	51% ≤ skor ≤ 75%	3	Eligible
3	26% ≤ skor ≤ 50%	2	Fairly Decent
4	0% ≤ skor ≤ 25%	1	Inadequate

Product feasibility data for the Batak Culture-based SAGIA learning model were obtained based on suggestions, input, and criticism from validators and users, namely teachers. Data analysis was carried out by tabulating all the data obtained from the assessors. The data obtained is in the form of quantitative

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data, which is then analyzed descriptively by converting it into a range of scores and product eligibility criteria.

The data analysis on the validation questionnaire uses percentages. The resulting product feasibility data is determined through an analysis of the validation results of material experts, media experts, and trial use by teachers and students. Data validation results from material experts and media experts were analyzed descriptively. The steps are as follows: (a) Changing the assessment from qualitative to quantitative with the scoring table above; (b) Calculating the data using the average score using the formula: $\bar{X} = \sum x\ N$, when $\bar{X}$: the average score of each component; $\sum x$: tscore; and N is; N:numbe indicator assessed; (c) Converting the average score to a qualitative value.

3. RESULTS AND DISCUSSION

3.1 RESULTS

Graphic design experts assess the Teaching Material "Pancasila and Citizenship Education in Growing Student Character Based on Toba Batak Culture" based on three aspects from the table above, showing that the average is 4.6 with the criteria "Very Good". Graphic design experts view that the layout, graphics, and visual communication contained in these teaching materials meet the criteria because they have pictures. Placing "keywords" in each material will make it easier for students to remember the learning flow. This is in line with the visual communication presented in the teaching materials. Overall validation from several experts, namely learning design experts, graphic designers, and materials experts, indicates the feasibility of teaching material products that contain Batak Culture-based Learning Model Development to shape student character in Civics Subjects, as follows:

Table 4. Percentage of Feasibility of Teaching Material Products Based on Experts

No	Categorization	Percentage of average score	Criteria
1.	Material Expert Validation	4,62	very feasible
2.	Graphic Design Validation	4,67	very feasible
3.	Learning Design Validation	4,57	very feasible
The average		4,62	very feasible

Product Effectiveness Test Learning Citizenship Education by developing the "SAGIA" learning model based on Batak Toba culture to shape student character is assessed by how students in grades IV-A and IV-B complete the tests in the teaching materials.

Learning Outcomes on the Topic of Rights and Obligations of a State Test on Teaching Materials in Chapter I with the Topic "Rights and Obligations of a State" where the material has been synergized with the cultural content of the Toba Batak, so the test results are obtained with the tabulation of calculations from 52 students of class IVA and class IVB, respectively, as follows:

Column1	
Mean	83,42307692
Standard Error	0,68508466
Median	82,5
Mode	80
Standard Deviation	4,940215737
Sample Variance	24,40573152
Kurtosis	-0,800919232
Skewness	0,274714171
Range	20
Minimum	75
Maximum	95
Sum	4338
Count	52
Confidence Level (95,0%)	1,375364844

Based on the results of data processing in Test 1, there is an average score of 83.42, the maximum score obtained by students during learning is 95, and the minimum is 75. It can be said from the tests given to teaching materials developed to support the Learning Model The SAGIA shows good learning outcomes where students study sustainable governance in Indonesia with material on the Government System of the Toba Batak Tribe and the Leadership Characteristics of the Toba Batak Tribe.

Learning Outcomes on the Topic of Globalization Tests on Teaching Materials in Chapter II with the topic Globalization," where the material has been synergized with the cultural content of the Toba Batak, the test results obtained by tabulating calculations from 52 students of classes IV-A and IV-B, respectively, are as follows:

Column2	
Mean	85,05769231
Standard Error	0,598145362
Median	85
Mode	85
Standard Deviation	4,313287548
Sample Variance	18,60444947
Kurtosis	-0,639634649
Skewness	-0,065367157
Range	20
Minimum	75
Maximum	95
Sum	4423
Count	52
Confidence Level (95,0%)	1,200826922

Based on the results of data processing in Test 2, there is an average score of 85.05, the maximum score obtained by students during learning is 95, and the minimum is 75. The processing results show good learning outcomes when students study sustainable globalization materials on Current Globalization, The Role of Globalization, Advances in Transportation and Communication Tools, and Attitudes Against Globalization.

Learning Outcomes on the Topic of Indonesian Culture Tests on Teaching Materials in Chapter III with the topic "Indonesian Culture," where the material has been synergized with Toba Batak cultural content, the test results obtained with tabulation calculations from 52 students of classes IV-A and IV-B, respectively, are as follows:

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Column3	
Mean	85,44231
Standard Error	0,527818
Median	85
Mode	85
Standard Deviation	3,806153
Sample Variance	14,4868
Kurtosis	-1,07723
Skewness	-0,21371
Range	12
Minimum	78
Maximum	90
Sum	4443
Count	52
Confidence Level (95,0%)	1,05964

Based on the results of data processing in Test 3, there is an average score of 85.44, the maximum score obtained by students during learning is 90, and the minimum is 78. The processing results show good learning outcomes where students study continuous Indonesian culture material with material on Culture in Indonesia, Culture of the Batak Tribe in its tribe, and Speech in the Toba Batak Tribe.

The assessment was carried out by PPKn teachers on the character values that were built in students through Toba Batak cultural education from Teaching Materials entitled "Pancasila Education and Citizenship in Growing Student Character Based on Toba Batak Culture", as follows:

Table 5. Students' Affective Assessment in the Toba Batak Culture-Based Learning Model, Classes IV-A and IV-B

No	Assessment of Student Character	Student Indicator	Average Class Implementations
1	Religious	Pray before and after lessons; Provide opportunities for students to carry out worship; Give a smile, say hello, greetings, and be polite.	Moderate
2	Be honest	Provide facilities for finding lost items; moderate the cheating ban; Keep promises	Moderate
3	Tolerance	Say something polite or offend others; There is mutual respect between religious adherents.	Moderate
4	Discipline	Get used to being present on time; Get used to obeying the High rules.	High
5	Hard Work	Creating an atmosphere of healthy competition; trying to learn as much as possible to get the best results	Moderate
6	Creative	Creating learning situations that can foster thinking and creativity; Giving assignments that challenge the emergence of new works	High
7	Independent	Not dependent on others; Carry out activities on the basis of ability.	High
8	Democratic	Respect the opinions and rights of others; Do not impose your will on others; Carry out deliberations in making decisions; Open-minded (willing to accept new ideas or other people's opinions even though they are different); Accepting defeat in an honest and fair competition	Moderate
9	Curiosity	Creating a class atmosphere that invites curiosity Programmatic exploration of the environment; Available media of communication or information (print media or electronic media).	Moderate
10	National Spirit	Working together with classmates of different races, ethnicities, and socioeconomic status; Loyal friends to a fellow nation's children	Moderate
11	Love the Motherland	Display: photos of the president and vice president, state flag, state symbol, maps of Indonesia, pictures of Indonesian people's lives; Using domestic production; Speak Indonesian properly and correctly.	Moderate
12	Appreciating Achievement	Giving awards for the results of student work; Creating a learning atmosphere to motivate students to excel Says and acts correctly and accurately	Moderate
13	Friendly/ Communicative	Class arrangements that facilitate interaction between students; Teachers listen to student complaints. In communicating, the teacher does not keep a distance from students.	High
14	Love Peace	Creating a peaceful classroom atmosphere; Getting used to anti-violence school behavior; Kinship in the class is full of affection	Moderate
15	Likes to Read	Availability of library visit schedules so that students are motivated to read; exchange readings; Learning that motivates students to use references	High
16	Care for the Environment	Maintaining the classroom environment; There are trash bins in the classroom; Installing stickers commanding you to turn off the lights and close the water faucets in each room	High
17	Social Care	Empathizing with fellow classmates; Carrying out social action; Building harmony among class citizens	High
18	Responsibilities	Carry out tasks properly and on time; Willing to apologize if guilty and try not to repeat it; Dare to bear the risk or the consequences of all his actions.	High

Assessment in classes IV-A and IV-B by each teacher based on an affective assessment instrument shows that the average student is "moderate" in assessing cultured character. However, several aspects of students show a sense of discipline:

creativity, independence, friendliness, communication, enjoyment of reading, Care for the Environment, social responsibility, and "High" Responsibility.

3.2 DISCUSSION

The validation of developing a Batak culture-based learning model with the help of this teaching material as a whole can be said to be Very Feasible. This can be seen from the average score of PPKn teachers' assessment of the SAGIA learning model which was developed with a score of 3.88 with a percentage of 77.69% which can be said to be in the Very Eligible category, material experts assess the Teaching Material "Pancasila Education and Citizenship in Growing Student-Based Character Toba Batak Culture "based on 8 (eight) aspects shows that the average value of the questionnaire is 4.62 with Very Good criteria, learning design experts assess Teaching Materials based on 7 (seven) aspects indicating that the average value of the questionnaire is 4.57 with Very Good criteria, and graphic design experts assess Teaching materials based on 3 (three) aspects from the table above shows that the average is 4.6 with the "Very Good" criterion, and the average pretest results in class IV-A get a score of 58 ,01. These results were obtained when students in class IV-A did not receive the Batak Culture-based SAGIA learning model with the same material as class IV-B in the experimental class. The average result of the posttest in class IV-B was 84.64. This shows that the Batak Culture-based SAGIA learning model with teaching materials can develop student character.

Siahaan [33] stated in his research that Batak culture-based learning is a process of forming the attitudes, knowledge, and skills competencies of students through the integration of Batak cultural values and patterns of social interaction. Dalihan Na Tolu is also a development of knowledge involving problems based on facts and the Batak cultural environment.

Batak cultural wisdom values are used as a guide in developing talents, cognition, and student character in the learning process. This is based on the idea that the way each student thinks, perceives, and acts towards a problem or piece of information is influenced by cultural values, the environment, and other people around them. To assess the affective character education of students through the Toba Batak culture, Civics teachers assess students through affective assessments that are seen in their daily lives in class.

Akbar et al. [34] explained that affective assessment is an assessment that includes behavioral characteristics such as attitudes, feelings, emotions, interests, and values. The application of affective assessment has been considered difficult and complicated compared to other domain assessments.

Tausih [35] also added that affective assessment is often interpreted as a measure of ability that prioritizes emotions, feelings, and responses that are different from reasoning. This affective domain assessment is also closely related to the attitudes and interests of students, for example, self-confidence, responsibility, courtesy, discipline, honesty, cooperation, and so on.

Culture-based learning can currently be used as a strategy for creating a learning environment and developing a learning experience design that is integrated with culture as part of the learning process. Culture-based learning is based on the recognition of culture as a fundamental part of education as an expression of the communication of an idea, the development of knowledge, and the originality of an ethnic group that is appointed as a learning model. In culture-based learning, culture serves as a medium for students to transform their observations into creative forms and principles about nature. Thus, through culture-based learning, students do not just imitate or accept the information conveyed; they create meaning, understanding, and meaning from the information they receive.

4. CONCLUSION

1) The validation results from learning design experts, materials experts, and graphic design experts showed a score of 4.62 with Very Good criteria. Inquiry Exercise Learning Model and the advance organizer learning model.
2) The results of the pretest and posttest tests on Civics learning using the developed teaching materials show that the average learning outcomes of students with the Batak culture-based learning model have an effect on learning in Civics subjects.
3) The affective assessment of grade IV students shows "medium," where the values of cultured character have been achieved in the progress stage.

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