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The Effect of Learning Models and Ability Thinking Creatively on the Outcomes of Learning Course

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Abstract: The aims of the research were: (1) to find out the results of learning the grammar of the student group which was taught using the PjBL learning model and the group of students who were taught using the direct instruction model; (2) to find out the results of learning the grammar of the group of students who have high creative thinking skills higher than the group of students who have low creative thinking abilities; and (3) knowing that there is an interaction between the PjBL learning model and the ability to think creatively in influencing the learning outcomes of dish administration. The method applied in this learning model is Quasi Experiment with 2 x 2 factorial design with Analysis of Variance (Anava). This research was conducted at SMK Negeri 1 Beringin, Deli Serdang Regency, North Sumatra. The population of this study were all students of class XI Catering parallel classes, namely XI TB 1 and XI TB 2. The entire study sample consisted of 56 students. The results of the study show that: (1) PjBL is higher than students who are taught with the direct instruction learning model. (2) The results of learning Tata Dishes among students who have high creative thinking skills are better than students who have low creative thinking abilities; (3) There is an interaction between the learning model and the ability to think creatively on the results of learning serving arrangements.

Keywords: learning models, creative thinking skills, serving arrangements, catering arrangements

1. INTRODUCTION

The Culinary Course subject is one of the subjects that appear in class XI Culinary Course in odd and even semesters, with 12 basic competencies. There are 6 basic competencies in the even semester, namely, (1) analyzing table set-up, (2) evaluating food and drink services, (3) applying hot drinks, (4) making cold drinks (mocktails), (5) implementing telephone calls, (6) implementing order taking for room service. Based on the results of interview observations on January 12, 2022 with teachers who teach cooking at SMK Negeri 1 Beringin, researchers found several problems, including the learning model that was applied tended to be monotonous with one learning model. In the learning process, innovative learning models have not been implemented, while innovative learning is based on a constructivist paradigm, which can help students internalize, reshape, or transform new information.

Transformation occurs through the creation of new understandings which are the result of the emergence of new cognitive structures [1]. So that this results in less attracting students' attention when the teacher delivers the material. Students are less active in participating in the learning process, there are no positive activities carried out by students in learning. Based on these problems the learning model is an important aspect of the learning process. The expected learning objectives of the designed learning model are to build students' habits of active learning by utilizing their potential and using existing learning resources and facilities, so that they are able to solve problems faced jointly and the results can be accounted for. For this reason, students need to be given the opportunity to learn freely and diversely so that they can increase various interactions between individuals, which in turn can improve the learning process optimally. So, the appropriate learning model to be applied to create an active situation is project-based learning.

In the 2013 curriculum the terms model and approach imply different meanings [2]. The project-based learning model or (PjBL) provides several advantages that will increase student understanding, including students having the opportunity to become "experts" by conducting their research, projects can familiarize students with deeper investigations. PjBL is seen as a learning philosophy that gives teachers the freedom to apply it. Project basic steps to prepare and realize the work namely; (a) preparatory work, (b) background reading, c) literature search, (d) realization, (e) reports, (f) presentations, (g) discussions, (h) conclusions [3].

The PjBL learning model is a learning model that involves students in activities that provide opportunities for students to work autonomously solving problems and constructing their own learning and ultimately producing valuable and realistic student work [4]. According to Sutirman [5] states that, "project-based learning is a learning model to produce real products or projects in which students play an active role". In

line with this opinion, Rusman [6], states that, "project-based learning is a learning model that is supported by or based on constructivist learning theory". The theory requires students to build their own knowledge through the experiences they get.

1.1 The Nature of Learning and Learning

Learning means a learning process that occurs because of the existence of teachers as teachers and educators and the presence of students or students as those who are taught or as recipients of knowledge or skills. In general, the term learning is interpreted as an activity that results in a change in behavior. With this understanding, learning can be interpreted as an activity carried out by the teacher in such a way that the behavior of students changes in a better direction [7].

Learning is a set of events (events) that affect students in such a way that students get convenience (Briggs, 1992). This set of events builds a learning that is internal if students carry out self-instruction and on the other hand it may also be external, that is, if it comes from, among other things, the educator. So teaching is only a part of instruction, as a form of learning. The main element of learning is the child's experience as a set of events so that the learning process occurs.

1.2 Learning Outcomes of Dishes

Learning outcomes are the most important part of learning. Sudjana [9] states that learning outcomes are the abilities possessed by students after they receive their learning experience. Learning outcomes are also the results of students after carrying out a series of learning activities which are then evaluated by exams. What is meant in this study is student learning outcomes in the form of scores.

According to Sardiman [10] "learning outcomes are real abilities which are the result of interactions between various factors that influence both internal and external individuals in learning." According to Gagne's thinking (in Suprijono [11]) learning is patterns of action, scores, understanding, attitudes, appreciation and skills learning outcomes in the form of: (1) Verbal information, namely the capacity to express knowledge in the form of language, both spoken and writing; (2) Intellectual skills, namely the ability to present concepts and symbols; (3) Cognitive strategies, namely skills and directing their own cognitive activities; (4) Motor skills, namely the ability to carry out a series of physical affairs and coordination, so that it is realized; (5) automatism of physical movement; and (6) Attitude is the ability to accept and reject objects based on the score on the object.

Reigeluth [12] classifies learning outcomes into 3 (three) aspects namely: (1) learning effectiveness, (2) learning efficiency, (3) learning attractiveness. Aspects of learning effectiveness are usually measured by the level of student achievement at predetermined learning goals, efficiency is usually measured by the ratio between effectiveness and the amount of time and/or cost used, while the attractiveness aspect of learning is usually measured by the tendency of students to keep/continue learning (in Uno, 2014).

Scores of learning outcomes are all kinds of procedures used to obtain information about student performance or how far students can achieve the learning objectives that have been set [14]. There are several ways that can be used to collect evidence of student learning progress, namely: (a) Scoring portfolios, (b) Scoring through performance, (c) Scoring through assignments, (d) Scoring through work results, and (e) Escort through a written test.

The test is a research data collection method that serves to measure a person's ability. Tests can be used to measure abilities that have right or wrong responses/answers. In the field of education, tests are usually carried out to measure academic achievement and vocational competence. Learning achievement can be measured by various types of tests, namely written tests, oral tests and tests for work [15].

The forms of tests used in educational institutions can be categorized into two, namely objective tests and non-objective tests. The forms of objective tests that are often used are multiple choice, true-false, matching, and objective descriptions [16].

A multiple choice test is a test whose answers can be obtained by selecting alternative answers that have been provided. In this multiple choice test, the form of the test consists of: statements (subject matter), alternative answers that include answer keys and distractors. Statements (subject matter) are sentences that contain information or notifications about a particular material that are incomplete and must be supplemented by selecting the available alternative answers. The answer key is an alternative answer which is the correct choice which is the desired answer, while the distractor is an alternative that is not an answer key [17].

The term Tata Dish is very beautiful to hear, and is commonly used by many people. The meaning of the Tata Serving itself when viewed from the meaning of each word is Tata which means arranging to beautify, and Dish means food and drinks served to guests or consumers. So we can conclude that the Tata Serving is a way of preparing food to beautify the food and drinks served to guests or consumers (2013 curriculum implementation module).

As is well known, Food and Beverage Department is part of the Food and Beverage Department which basically directly supports and carries out all the functions of the Food and Beverage Department. The catering department can generally be defined as one that handles eating and drinking. Whereas specifically, it is part of a hotel or a place that manages and is responsible for food and beverage services and other needs tied to the hotel or place in a commercial and professional manner. However, separately it can be seen that the main duties or main functions of Governance Dish is "provide food and beverage service".

1.3 The essence of the Project Based Learning Model

Project Based Learning or PjBL is an effective approach that focuses on creative thinking, problem solving and student interaction among their peers to create projects and use new knowledge. PjBL is a learning model that uses projects/activities as a learning process to achieve competency attitudes, knowledge and skills. PjBL is a learning model that provides opportunities for teachers to manage learning in class by involving project work. PjBL uses problems as a first step in gathering knowledge based on students' experiences in real activities. PjBL is designed to be used on complex issues that are required in conducting investigations [18].

PjBL is a teaching method by organizing teaching materials in such a way that they form a whole or unified whole that is meaningful and contains a subject matter. The project method is rarely used by teachers, because in practice it requires sufficient preparation and takes a long time to complete. However, this method has a very important and beneficial advantage for students, namely getting students used to working scientifically [19].

The PjBL model can be applied at various levels of education starting from Elementary School (SD), Junior High School (SMP), to Vocational High School (SMK), but it is still used in accordance with KD in the material. Learning about table setting, especially table set up. Students can work directly in the field and students are required to develop new knowledge, creative thinking patterns and ways to find solutions to existing problems. The success of students in making work/projects as the final result will give pride to students and will motivate students to move forward in the next project, so that students are indirectly able to develop their concepts from the various scientific fields they have studied. According to Alamaki, apart from being carried out collaboratively, projects must also be innovative, unique and focus on solving problems related to learning or the needs of the community or local industry [20]

Project-Based Learning or PjBL is student-centered learning, can be interdisciplinary in nature (subject integration), and long-term. Usually PjBL is related to the discussion of real problems. In the 2013 Curriculum Implementation module (2014) it is explained that PjBL is a learning model that uses projects or activities as the core of learning. Students explore, interpret, synthesize, and collect information to produce various forms of learning outcomes. PjBL is a learning model that uses problems as a first step in gathering and integrating new knowledge based on experience in real activities. Through PjBL the inquiry process begins by raising a guiding question and guiding students in a collaborative project that integrates various subjects or materials in the curriculum.

1.4 Direct Instruction learning model

The direct instruction model was first introduced in 1968 by Siegfried Engellman. He uses this approach to help children learn and master subject matter. This approach was successful in increasing student learning outcomes, regardless of their economic background. Direct instruction is a learning model specifically designed to support student learning processes related to well-structured declarative knowledge and procedural knowledge that can be taught with a gradual pattern of activities, step by step. "Direct instruction is a learning model that consists of teacher explanations of new concepts or skills to students."

The Direct instruction learning model there are five very important phases. The model syntax is presented in five stages, including: (1) Phase 1: Orientation / Delivering Objectives In this phase the teacher provides a lesson framework and orientation to the subject matter. Activities in this phase include: (a) Preliminary activities to determine knowledge that is relevant to the knowledge that students already have. (b) Delivering learning objectives. (c) Give an explanation or direction regarding the activities to be carried out. (d) Inform the material or concept that will be used and the activities that will be carried out during learning. (e) Inform the lesson framework f) Motivate students. (2) Phase 2: Presentation/Demonstration In this phase the teacher can present subject matter, either in the form of concepts or skills. This framework includes: a) Presentation of material in steps b) Providing examples of concepts c) Modeling/demonstration of skills d) Re-explaining things that are considered difficult or poorly understood by students (3) Phase 3: guided practice In this phase the teacher plans and provides guidance to students to do the initial exercises. The teacher provides reinforcement for the correct student response and corrects the wrong one. (4) Phase 4: Checking Understanding and Providing Feedback In the next phase, students are given the opportunity to practice concepts and skills and apply the knowledge or skills to real-life situations. This guided exercise is also good for teachers to access students' abilities in carrying out assignments, check whether students have successfully carried out tasks properly or not, and provide feedback. The teacher monitors and provides guidance if necessary. (5) Phase 5: Independent Practice Students carry out exercise activities independently. This phase can be passed by students well if they have mastered the stages of doing assignments 85% - 90% in the guided practice phase. The teacher provides feedback for student success.

1.5 The Nature of Creative Thinking Ability

The ability to think creatively is an ability that involves intelligence that develops within individuals, in the form of attitudes, habits, and actions in creating something new and original to solve problems [24]. The ability to think creatively can be raised if students are given the opportunity to think of new ideas [25]. According to the Ministry of National Education, creative thinking is thinking about doing something by producing a way or result of something you already have. Class indicators of creative thinking are creating learning situations that foster creative thinking and acting as well as giving assignments that challenge the emergence of new, authentic and modified works.

According to Wallas, as explained by Satiadarma & Waruwu [26], creative thinking is a thinking process that has steps: (1) preparation, (2) incubation, (3) illumination, and (4) verification. In the preparation step one tries to collect various kinds of information that is relevant to the problem at hand. In the incubation step, a person deliberately temporarily does not think about the problem to which the solution is being sought. In the illumination step, an idea or solution plan has been found. However, these ideas are usually still in the form of main ideas or outlines. The final step is verification, which is evaluating or re-confirming that the answer to the problem is correct, and then implementing the ideas found. If successful then the creative thinking process is complete.

Hurlock, as revealed by Satiadarma & Waruwu [27], suggests several conditions that can improve children's creative thinking skills, including: time given to children to think; a chance to be alone to think; facilities that support students' creative thinking; stimulating environment; less possessive parent and child relationships; democratic way of educating children; opportunity to acquire knowledge; conducive classroom setting; a pleasant teaching atmosphere; mature teacher preparation; the attitude of teachers who give freedom to students to be creative; and student-centered teaching methods.
The research problems are as follows: (1) Is the result of learning the grammar of the group of students who are taught using the PjBL learning model higher than the group of students who are taught using the direct instruction / Direct Instruction model?; (2) Are the learning outcomes of the group of students who have high creative thinking skills higher than the group of students who have low creative thinking abilities?; and (3) Is there an interaction between the PjBL learning model and the ability to think creatively in influencing the learning outcomes of dish administration?

2. METHOD

This research was conducted at SMK Negeri 1 Beringin Kec. Banyan tree, Deli Serdang Regency, North Sumatra. The population of this study were all students of class XI Catering at SMK Negeri 1 Beringin which consisted of 2 parallel classes, namely XI TB 1 and XI TB 2. From the population of

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class XI SMK Negeri 1 Beringin, one class was determined as a sample for the treatment of the PjBL learning model, namely class XI TB I. and one class as a sample to treat the direct learning model, namely class XI TB 2. The entire study sample consisted of 56 students.

The method applied in this learning model is a Quasi Experiment with a 2 x 2 factorial design. Through this design, we compare the effect of the PjBL learning model and the direct learning model on the Learning Outcomes of Tata Dish in terms of creative thinking ability. The research design is then included in the study in Table 1.

Table 1. 2 x 2 Factorial Design Experiment

Learning model (A) / Ability Creative Thinking (B)	Project based Learning (A_1)	Direct Learning Model (A_2)
Height (B_1)	($\mu A_1 B_1$)	($\mu A_2 B_1$)
Low (B_2)	($\mu A_1 B_2$)	($\mu A_2 B_2$)

The data analysis technique used is descriptive and inferential statistical techniques. Descriptive statistical techniques are used to describe the data, including: the average value, median, standard deviation and trend of the data. The inferential statistical technique was used to test the research hypothesis, where the inferential technique to be used was the two-way Anava analysis of variance technique (2x2 factorial design) with a significant level of α = 0.05. Before the two-way anava was carried out, the analysis requirements were first determined, namely the normality requirements using the Liliefors test, while the Homogeneity requirements test used Fisher's test (F) and Barlett's test at 5% significance level. Fisher's test was used to test the homogeneity of each sample group (treatment), while Barlett's test was used to test the homogeneity of the sample group (treatment) together.

After testing the analysis requirements, then a two-way Anova test was carried out. If it turns out that the interaction is significant, then a further test is carried out to find out the comparison between cells, then if the sample size of each cell in this research design is the same, then it will be continued with the Tukey test. Furthermore, if the sample size of each cell in the research design is not the same, then the Scheffe test will be continued. For the purposes of testing the hypothesis, the statistics are formulated as follows:

First Hypothesis:

Ho : $\mu A_1 = \mu A_2$

Ha : $\mu A_1 > \mu A_2$

Second Hypothesis:

Ho : $\mu B_1 = \mu B_2$

Ha : $\mu B_1 > \mu B_2$

Third Hypothesis:

Ho : A $><$ B = 0

Ha : A $><$ B $\neq$ 0

3. RESULTS AND DISCUSSION

3.1 RESULTS

The following is presented sequentially descriptive data regarding: (1) the learning outcomes of students who have high creative thinking skills, (2) the learning outcomes of students who have low creative thinking skills, (3) the learning outcomes of students who are taught dishes with PjBL learning model and have high creative thinking skills, (4) student learning outcomes taught by PjBL learning model and have low creative thinking ability, (5) student dish learning outcomes taught by direct instruction learning model and have the ability to think high creative, (6) learning outcomes of students who are taught with the direct instruction learning model and have low creative thinking ability.

Table 2. Summary of Descriptive Analysis Calculation Data

Data Summary		Learning models		Total
		PjBL	direct learning	
Creative Thinking Ability	Tall	N = 15 $\sum X$ = 580 $\sum X^2$ = 22476 $\bar{X}$ = 38,67	N = 13 $\sum X$ = 452 $\sum X^2$ = 15792 $\bar{X}$ = 34,77	N = 28 $\sum X$ = 1032 $\sum X^2$ = 38268 $\bar{X}$ = 36,72
	Low	N = 15 $\sum X$ = 515 $\sum X^2$ = 17747 $\bar{X}$ = 34,33	N = 13 $\sum X$ = 427 $\sum X^2$ = 14183 $\bar{X}$ = 32,85	N = 28 $\sum X$ = 942 $\sum X^2$ = 31930 $\bar{X}$ = 33,59
Total		N = 30 $\sum X$ = 1095 $\sum X^2$ = 40223 $\bar{X}$ =36,50	N = 26 $\sum X$ =879 $\sum X^2$ = 29975 $\bar{X}$ = 33,81	N = 56 $\sum X$ = 1974 $\sum X^2$ = 70198 $\bar{X}$ = 35,16

For the purposes of testing the hypothesis using the 2x2 factorial two-way analysis of variance (ANOVA) technique and Tukey's follow-up test, the average value of each group is needed. The summary of learning outcomes data can be seen in Table 2 above by using descriptive analysis. After the table data above is processed with ANOVA 2 factorial path 2x2, the results of the analysis are obtained as shown in Table 3.

Table 3. Summary of 2x2 Factorial ANOVA Calculation Results

Source of Variance	JK	dk	RJK	Fcount	Ftable
Between Columns	100,96	1	100,96	15,06	4,02
Between Lines	144,64	1	144,64	21,58	
IInteraction	40,21	1	40,21	6,001	
Error	368,21	52	6,7	-	
TOTAL	654,02	55	-	-	

Based on the summary above, the hypothesis testing is detailed as follows:

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First Hypothesis
Testing the first hypothesis, namely: student learning outcomes taught using the PjBL learning model are higher than students taught using the direct instruction learning model.

$H_o : \mu_{A_1} \leq \mu_{A_2}$

$H_a : \mu_{A_1} > \mu_{A_2}$

From the results of the data analysis, it was found that the average learning achievement for cooking procedures for students who were taught using the PjBL learning model was 36.50 and the average learning achievement for serving dishes for students who were taught using the direct instruction learning model was 33.81. Based on Anava calculations, it is obtained Fcount = 15.06 while the value of Ftable = 4.02 so that Ho is rejected. Thus it can be concluded that the learning outcomes of students who are taught with the PjBL learning model are higher than students who are taught with the proven direct instruction learning model.

Second Hypothesis
Testing the second hypothesis, namely the learning outcomes of students who have high creative thinking skills are higher than students who have low creative thinking abilities. The statistical hypothesis is:

$H_o : \mu_{B_1} \leq \mu_{B_2}$

$H_a : \mu_{B_1} > \mu_{B_2}$

From the results of data analysis, it was found that the average learning achievement of students who had high creative thinking skills was 36.72 and the average learning achievement of students who had low creative thinking skills was 33.59. based on anava calculations obtained Fcount = 21.58 while the value of Ftable = 4.02 for dk (1.52) and a significance level of 5%, it turns out that the value of Fcount = 21.58>Ftable = 4.02 so that Ho is rejected. Thus it can be concluded that the learning outcomes of students who have high creative thinking skills are higher than students who have low creative thinking abilities.

Third Hypothesis
Testing the third hypothesis, namely: there is an interaction between the learning model and the ability to think creatively on student cooking learning outcomes.

$H_o : \mu_{A><B} = 0$

$H_a : \mu_{A><B} \neq 0$

Based on data analysis, it was found that the average value of the learning outcomes for students who were taught using the PjBL learning model who had high creative thinking skills was 38.67 and the average learning outcomes for students who were taught using the PjBL learning model who had low creative thinking abilities of 34.33. Furthermore, the average learning outcomes for students who were taught using the direct instruction learning model who had high creative thinking skills were 34.77 and the average learning outcomes for students who were taught using the direct instruction learning model who had low creative thinking skills were 32. ,85.
Based on Anava calculations, the F count is 6.001 while the F table is 4.02 for dk (1.52) with a 5% significance level, it turns out that the F count is 6.001 > Ftable 4.02 so Ho is rejected. Thus it can be concluded that there is an interaction between the learning model and students' creative thinking abilities towards proven correctness of the learning outcomes of the dishes. The complete calculation can be seen in Appendix 21. The following interaction can be presented in Figure 1.

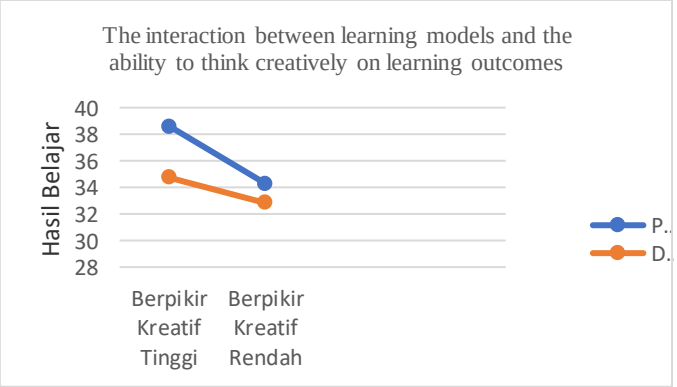

Figure 1. The interaction of learning models and the ability to think creatively on student cooking learning outcomes

By testing significantly the interaction between the learning model and cognitive style on the serving arrangement, further tests were carried out. Due to the same number of samples (n) in each group, a further test was carried out using the Tukey Test. The results of the advanced test calculations for each compared group are presented in Table 4.

Table 4. Summary of the Tukey Test

No.	Group	Uji Tukey	
		Qh	Qt = 0.05
1	A1B1 with A2B1	26,89	2.83
2	A1B1 with A2B2	40,13	
3	A1B1 with A1B2	29,93	
4	A1B2 with A2B1	$-3{,}03ts$	
5	A1B2 with A2B2	10,2	

Based on the results of the pilot test with the Tukey test above, it can be concluded that of the six test combinations, there are four follow-up tests which show significant results and two follow-up tests which show insignificant results, namely: taught with the PjBL learning model and have high creative thinking skills significantly different from the learning outcomes of students taught using the direct instruction learning model and have high creative thinking skills, (2) The learning outcomes of students taught using the PjBL learning model and have the ability high creative thinking is significantly different from the learning outcomes of students who are taught using the direct instruction learning model and have low creative thinking skills, (3) The learning outcomes of students who are taught using the PjBL learning model and have the ability to think creatively t High is significantly different from the learning outcomes of students who are taught using the PjBL learning model and have low creative thinking skills. who are taught with the direct instruction learning model and have high creative thinking skills, (5) The learning outcomes of students who are taught with the PjBL learning model and have low creative thinking abilities are different from the learning outcomes of students who are taught with the direct instruction learning model and have low creative thinking ability, (6) student learning outcomes taught by direct instruction learning model and have high creative thinking skills are different from student dish learning

outcomes taught by direct instruction model instruction and have low creative thinking ability

3.2 DISCUSSION

In the previous presentation it was known that the overall average learning outcomes for students taught using the PjBL learning model were higher than the average learning outcomes for students taught using the direct instruction learning model. this shows that the PjBL learning model has proven to be effective in improving overall student learning outcomes for both students who have high creative thinking skills and those who have low creative thinking skills. the results of these findings indicate that it is better to use the PjBL learning model to teach dishes than the direct instruction learning model.

This is in line with the expression Zulfiani, Tonih Feronika, Kinkin Suartini [28] which defines PjBL as a teaching method by organizing teaching materials in such a way that they form a whole or a unified whole which is meaningful and contains a subject matter. The PjBL model learning process is not just working together in a group but the emphasis is more on a learning process that involves a complete and fair communication process in the classroom. The application of the PjBL learning model is an alternative for students in class.

If it is further observed that in the PjBL learning model, the average learning outcomes for students who have high creative thinking skills are higher than the learning outcomes for students who have low creative thinking abilities. Whereas in the direct instruction learning model, the average learning outcomes of students who have high creative thinking skills are higher than the learning outcomes of students who have low creative thinking skills. This shows that students who have high creative thinking skills are significant for differentiating student learning outcomes, where students who have high creative thinking skills are better taught by discovery learning models, as well as students who have high creative thinking skills are better. by being taught with the direct instruction learning model. The results of the study show that all the research hypotheses that the researchers propose are acceptable.

This is acceptable because through the PjBL learning model it can encourage students to be active in learning because students are stimulated to actively observe, adjust between theory and reality, and can try to do it themselves. Besides that, the application of the PjBL learning model presents a concept of a learning model that involves students in carrying out a project so that students easily and quickly understand a material, and if students' understanding increases, they get better grades and learn faster so that schools will be easier. If they have experienced the learning process by involving a project in a lesson, they will easily understand the material. The application of the PjBL learning model is an alternative for students in class. The project-based learning model (Project Based Learning) provides opportunities for students to explore material using various methods and conduct experiments collaboratively with the aim that students have independence in completing the tasks they face

This proves students' creative thinking ability in learning is significant for differentiating dish learning outcomes. Students' creative thinking ability in this study was categorized into two categories, namely high creative thinking ability and low creative thinking ability. From the results of the overall data analysis, it was found that the average learning ability of students who had high creative thinking ability was higher than students who had high creative thinking ability. low creative thinking. Thus students with high creative thinking skills understand and master the course material better than students with low creative thinking abilities. This is in line with the results of Payong's research [29] which proves that for students who have high creative thinking skills, the PjBL learning model has a high influence on learning outcomes compared to the direct instruction learning model.

Based on the average learning outcomes of dishes for students with high creative thinking skills who are taught with the PjBL learning model is higher than the average learning outcomes for students with low creative thinking skills who are taught with the direct instruction learning model. Then the average learning outcomes for dishes on students who have low creative thinking skills who are taught using the direct instruction learning model are higher than the average learning outcomes for students who have low creative thinking skills who are taught using discovery learning models.

Furthermore, based on data analysis, it was found that the average learning outcomes of students who had high creative thinking skills who were taught using the PjBL learning model were higher than the learning outcomes of students who had low creative thinking abilities who were taught using the direct instruction learning model. This means that the PjBL learning model and high creative thinking skills are more effective than using the direct instruction learning model, because through the discovery learning model, students directly experience the process of acquiring knowledge, thus motivating students to learn.

The average learning outcomes of students who have high creative thinking skills who are taught using the discovery learning model are higher than students who have low creative thinking skills who are taught using the discovery learning model. This means that the PjBL learning model is more effective for improving the learning outcomes of cooking grammar for students who have high creative thinking skills compared to students with low creative thinking abilities, because students who have high creative thinking skills are students who always use the potential to think high. exist in him in solving problems in learning activities.

The average learning outcomes for students with high creative thinking skills who are taught using the PjBL learning model are higher than students with low creative thinking skills who are taught using the direct instruction learning model. This is because students who have high creative thinking skills tend to try to complete the assignments given with their abilities to study the teaching materials contained in the dishes.

4. CONCLUSION

1. The learning outcomes of students who were taught with the PjBL learning model were higher than students who were taught with the direct instruction learning model.
2. The results of learning Tata Dishes among students who have high creative thinking skills are better than students who have low creative thinking abilities.
3. There is an interaction between the learning model and the ability to think creatively on the results of learning Tata dish. The learning outcomes of Tata Diang students who are taught with the PjBL learning model and have high creative thinking skills are better than students who have low creative thinking skills. Meanwhile, students' learning outcomes for serving dishes were taught using the direct instruction learning model and had higher creative thinking skills than students who had low creative thinking skills.

Thus, students who have high creative thinking skills are better taught using the PjBL learning model and students who have high creative thinking skills are better taught using the direct instruction learning model.

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The Effect of the Learn to Sing Learning Model and Creativity on Student Arts and Culture Learning Outcomes

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Abstract: The aims of this study were: (1) to determine the influence of Learn to Sing media and creativity on student learning outcomes in arts and culture subjects; (2) to know the influence of student creativity with Learn to Sing media and creativity on student learning outcomes in arts and culture subjects; and (3) knowing the interaction of Learn to Sing media and creativity on student learning outcomes in arts and culture subjects. The research method used was experimental research in the first experimental group learning with Learn to Sing using an Android smartphone and the second experimental group learning directly. Creativity is divided into high and low creativity. The research was conducted at SMP Negeri 30 Medan. The population of this study was all students of classes VIII-1, and VIII-2. The research design is presented in a 2 x 2 factorial design with the analysis of variance technique (ANOVA). The results showed that: (1) there were differences in the learning outcomes of doing Learn to Sing between groups of students who were taught by the Learn to Sing learning model and students who were taught by the direct learning model, the results of doing Learn to Sing were higher than the group of students who were taught by the learning model. direct learning where (f count = 3.38 > F table = 3.26). (2) there are differences in learning outcomes that have high creativity with groups of students who have low creativity. Students who have high creativity get high learning outcomes than the group of students who have low creativity where (F count = 11.39 > F table = 3.26). There is no interaction between the application of learning with the learning model with the Learn to Sing learning model and the direct learning model with high and low levels of creativity towards learning arts and culture outcomes by doing Learn to Sing students where (F count = 0.45 < F table = 3.26).

Keywords: learn to sing learning model, creativity, learning outcomes of arts and culture

1. INTRODUCTION

Cultural arts learning is a programmed activity that teaches aesthetic values in which there are cultural aspects that are integrated with art. Cultural arts education has multilingual, multidimensional, and multicultural characteristics [1]. Multilingual means the development of the ability to express oneself creatively in various ways and media such as visual language, sounds, movements, roles, and various combinations. Multidimensional means the development of various competencies including conception, appreciation, and creation by harmoniously integrating elements of aesthetics, logic, kinesthetics, and ethics. Multicultural nature implies that art education develops awareness and the ability to appreciate the various cultures of the Archipelago and International. In general, learning arts and culture requires a basic understanding of the application and development of musical elements used for the learning process, including composition, arrangement, mastery of musical instruments, and knowledge of music [2].

Music is a branch of art that has long existed in the world and makes life more colorful. It is undeniable that music also changes the lifestyle of today's people. Music education has experienced very rapid development so various learning methods in music are also innovating. Mobile learning media using smartphones are very varied and interesting so we can spend a long time studying the material available in the application. Learning media must be packaged as attractively as possible so that students can comfortably understand it. Learn to Sing learning media installed on students' smartphones. Music lessons are usually given to junior high school students in the subject of Cultural Arts, especially Music.

Art and culture subjects are subjects that provide opportunities for students to be involved in various experiences of appreciation and creative experiences to produce a product in the form of real objects that are directly beneficial to the lives of students. Based on this, the means to assist in the delivery of learning material is to use tools. In order for students to learn more actively, feel challenged, and be interested in the learning process, one of the learning tools that can be chosen is to use Learn to Sing media.

The world is at your fingertips and students can get accessibility to all kinds of information from anywhere. This minimizes the opportunity to go into collections as well as lookup data. Therefore, mobile phones can be used for some of these functions. What makes information easily available is the mobile application. Each mobile application has a unique functionality that provides its own set of solutions. Mobile apps

for schools have done great for students, making learning fun as well as easy. The application's various attributes increase engagement through knowledge-oriented tasks. Based on the explanations that have been written on the background of the problem, this study aims to advance the Learn to Sing media experiment which will be applied in learning arts and culture for class VIII students of SMP Negeri 30 Medan. Therefore the researcher is interested in examining this study with the title "The Influence of Media Learn to Sing and Creativity on the Learning Outcomes of Arts and Culture for Grade VIII Students at SMP Negeri 30 Medan", namely the Experiment of Learn to Sing learning media to improve learning outcomes for Grade VIII students

1.1 Cultural Arts Learning

Learning arts and culture Art and culture are two things that cannot be separated. Because every art must contain a distinctive culture and vice versa, every culture must contain beautiful artistic values. According to Sachari [3] Art is an absorption word from Sanskrit, namely sani. Which means, worship, service, and offerings. So the word has close ties with a religious ceremony or commonly known as "art". Art itself can also be interpreted as the opposite of nature, namely as a result of human intervention (touch). Art is a diligent human self-management to change an object for the spiritual and physical interests of humans. Art is a human expression that will develop into human culture.

Culture also contains the results of activities in a society such as the opinion put forward by Edward B. Taylor in Ahmad [4] that culture is a complex whole, which includes knowledge, beliefs, arts, morals, laws, customs, and other abilities. other abilities that a person acquires as a member of society. From the explanation above, it can be obtained an understanding of culture as a system of knowledge that includes a system of ideas or ideas contained in human thought. So that in everyday life, culture is abstract, while the embodiment of culture is objects created by humans as cultured beings, in the form of behavior and objects that are real, for example, behavior patterns, language, living equipment, and organization. social, religious, artistic, and others, all of which are intended to assist humans in carrying out social life.

In the world of education, education itself is every effort, influence, protection, and assistance given to children aimed at the child's maturity, or more precisely helping children to become competent enough to carry out their life tasks. That influence comes from adults (or those created by adults such as books, schools, daily life cycles, and so on) and aims at immature people as stated by Langeveld in Hasbullah [5]. Which means education is a goal that is to help every younger person to be able to determine what to do in the future.

In arts and culture subjects, cultural aspects are not discussed separately but are integrated with art. Therefore, the subject of cultural arts is basically a culture-based art education. Arts and culture education as a subject in schools is felt to be very necessary for students because this subject has multilingual, multidimensional, and multicultural characteristics [6].

Cultural arts learning has a very important role, including instilling educational values in students to appreciate themselves freely. Rohidi [7] reveals: "art as a medium in education to increase the creativity of students" so that the potential that students have from birth moves freely and can be developed optimally. Cultural arts education according to Susanto [8] is given in schools because of the uniqueness, significance, and usefulness of a developmental need for students, which lies in the provision of aesthetic experiences in the form of an activity of expression or creation and appreciation of the "learning with art" approach. learning through art", and "learning about art". This role cannot be given by other subjects.

1.2 Learning Media

Learning media is anything that can be used to convey lesson information to students and can stimulate the thoughts, feelings, attention, and willingness of the learner so that it can encourage the learning process. This is supported by according to Arsyad [9], Learning media is anything that can be used to convey information in the teaching and learning process so that it can stimulate students' attention and interest in learning. According to Karim (2014: 7), learning media is an intermediary that connects the sender of the message with the recipient of the message, in this case, the message is in the form of learning material to achieve a goal in matters relating to educational programs. The definition of media refers to something that can transmit information (message) between the source (messenger) and the recipient of the message.

Media are all forms and channels used to convey messages or information [10]. Still from the same point of view, Kemp and Dayton [12], argued that the role of the media in the communication process is as a sender (transfer) that transmits messages from the sender (sender) to the recipient of the message or information (receiver) [13]. In line with this, Munadi [14] states that "media is 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." Media has a very important role in education as a means or device that functions as an intermediary or channel in a communication process between communicators and communicants [15].

Media is any tool that can be used as a channel for messages to achieve teaching goals [16]. Where the media can display information through sound, image, movement, and color, both natural and manipulated, thereby helping teachers to create a more lively learning atmosphere, not monotonous and not boring. Learning media can be regarded as learning aids, namely, anything that can be used to stimulate the thoughts, feelings, attention, and abilities or skills of students so that they can encourage the learning process. This limitation is still quite broad and deep, including the understanding of sources, environment, humans, and the methods used for learning purposes.

1.3 Media Learn to Sing

Mobile Learning Ally [17] explains that mobile learning is learning through mobile wireless technology that allows everyone to access information and learning materials from anywhere and anytime. Learners can set their own when he wants to learn and from which learning resources he wants. So that people have the right to access learning materials and information to improve their quality of life regardless of where they live, their status, and their culture.

Darmawan [18] explains that mobile learning is an alternative that learning services can be implemented anywhere and anytime. Mobile learning is based on the premise that learning can be done anywhere and anytime. Has wide coverage because it uses a commercial cellular network. Can be

integrated with various e-learning systems, academic systems, and instant messaging service systems. Mobile learning in the current context is the ability given to someone to use mobile network technology to access relevant information or store new information regardless of their physical location. Technically it can be said to be private learning that connects students with cloud computing using mobile devices. Mobile learning is the opposite of learning that occurs in traditional classrooms where students just sit, move, and pay attention to the teacher standing in front of the class [19].

Through mobile learning, students can access learning materials and information from anywhere and anytime. Learners do not need to wait for a certain time to study or go to a certain place to study. They can use mobile wireless technology for their formal and informal learning needs. Darmawan [20] explains the development of mobile learning is motivated by the very fast penetration of mobile devices. The number of mobile devices is more than PCs. Mobile devices are easier to operate than PCs. Mobile devices can be used as learning media.

Figure 1. Learn to Sing

Learning media has a very important role in its use as a tool to create an effective learning process. Learning media is a component of learning resources or physical vehicles that contain instructions in the environment of students and can stimulate students to learn [21]. Media in the learning process has goals and benefits to help the learning process and the effectiveness of achieving learning outcomes. The expected learning outcomes from learning arts and culture can maximize students' singing knowledge by using Learn to Sing as a reference and used for singing practice.

1.4 Creativity

Creativity comes from the word creative which means to have creativity, and have the ability to create, while creativity is a person's activity to create something with the ability of creativity that is owned. Creativity is a personal trait of a person which is reflected in the individual's ability to create something new and different from what already exists either in the form of a product or an idea. This ability can be used as a way to solve problems. Soesilo [22] defines creativity as one of the amazing human abilities in understanding and deal with situations or problems differently.

Suharnan [23] defines creativity as a cognitive activity or thought process to produce new and useful ideas. Munandar [24] defines creativity as the ability to make new combinations, and new associations based on materials, information, data, or pre-existing elements into meaningful and useful things. Torrance in Ngalimun and Fadillah, et al. [25] defines creativity as the process of being able to understand the gaps or obstacles in his life, formulate new hypotheses, and communicate the results, as well as modify and test the hypotheses as much as possible. has been formulated. Csikszentmihalyi in Munandar [26], describes creativity as a product related to discovering something, producing something new, rather than accumulating skills or practicing knowledge and studying books.

The research problem formulations are: (1) Is there an influence of Learn to Sing media and creativity on student learning outcomes in arts and culture subjects?; (2) Is there an effect of student creativity using Learn to Sing media and creativity on student learning outcomes in arts and culture subjects?; (3) Is there any interaction between Learn to Sing media and creativity on learning outcomes in arts and culture subjects?

2. METHOD

The research was carried out at SMP Negeri 30 Medan, the objects of the research were students in class VIII-1 and class VIII-2, (even semester) for the 2021/2022 academic year. The population of this study was all students of class VIII consisting of classes VIII-1, and VIII-2. Of the four classes, it was determined randomly that one class was given the Learn to Sing learning model, Class VIII-1, and Class VIII-2 was given a direct learning model.

The research method used was an experimental research method involving two study groups, namely the first experimental group learning with Learn to Sing using an Android smartphone and the second experimental group learning directly. Creativity is divided into high and low creativity. The research design is presented in a 2x2 factorial design with the analysis of variance technique (ANOVA). Data collection is closely related to problems and objectives as well as in the process of submitting hypotheses, therefore data collection techniques need to be carried out carefully and with each other.

To measure student creativity in using a smartphone is through a questionnaire with 4 answer choices. The total number of questionnaire items is 25 questions. The questionnaires created are arranged based on the grid that has been prepared before. The following is a grid of questionnaire items:

Table 1. The lattice of creativity questionnaire items

No.	Indicator	Item Number Question	Total
1	Pleasure	1,2,3,4,5,6	6
2	Interest	7,8,9,10,11,12,13,14,15,16,17,18	13
3	Knowledge	19,20,21,22,23,24,25	7
	Total		25

Validity is a test to determine the validity of the questionnaire items so that they can measure the child's ability. The validation used is item validation by looking at the validity of each questionnaire item. The validity value of an instrument can be calculated using the Person Product Moment correlation formula.

$$rxy = \frac{N\sum xy - (\sum x)(\sum y)}{\sqrt{N\sum x^2 - (\sum x)^2 (N\sum y^2 - (\sum y)^2)}}$$

Information:
rxy= Correlation coefficient between variable X and variable Y
$\sum xy$= Number of multiplications between variables X and Y
$\sum x2$= Sum of the squared values of X
$\sum y2$= Sum of the squares of the Y values
$(\sum x)2$= The sum of the values of X is then squared
$(\sum y)2$= Sum of Y values then squared

Validity is defined as a measure of how accurately a test performs its measuring function. The test can only carry out its function carefully if there is "something" being measured.

The results of the validity test of the questionnaire items, of the 25 questionnaire items made, it turned out that 6 items were invalid, namely questionnaire items number 5,12,15,21,24, and 25, so the number of questionnaire items used was 19 items.

To test the research hypothesis, data analysis techniques were used with two-way analysis of variance (ANOVA) with a significant level of 0.05. To use a two-way ANOVA, several requirements need to be fulfilled, namely: (1) the data used must be normally distributed, so a normality test is performed using the lieliefors test, and (2) the data must have a homogeneous population variance, so a homogeneity test of variance must be carried out using F test and Bartlett test.

The test criteria for the normality test are: if Lo < Ltable, then the sample is normally distributed; if Lo ≥ Ltable, then the sample is not normally distributed. The test criteria for the homogeneity test are: If Fcount < Ftable, then the sample has a homogeneous variance; if Fcount ≥ Ftable, then the sample does not have a homogeneous variance.

Hypothesis test
For the purposes of the hypothesis, it is necessary to formulate statistics:

Hypothesis 1:
Ho : μA1 ≤ μA2
Ha : μA1 ≥ μA2

Hypothesis 2:
Ho:μB1 ≤ μB2
Ha: μB1 ≥ μB2

Hypothesis 3:
Ho: interaction AXB = 0
Ha : interaction AXB ≠ 0

Information:
A = The average value of student learning outcomes in the Learn to Sing group
A = The average value of student learning outcomes in the Direct teaching group
B = The average value of student learning outcomes with high creativity
B = The average value of student learning outcomes with low creativity
AXB = 0, there is no interaction between learning and creativity models
AXB ≠ 0, there is an interaction between learning and creativity models

3. RESULTS AND DISCUSSION

The data presented in the study consisted of learning scores for the Cultural Arts subject for class VIII students of SMP Negeri 30 Medan who were taught using the Learn to Sing learning model and learning outcomes scores taught with the Direct Learning Model which were grouped on low creativity. Before the hypothesis is tested, it is necessary to test the data analysis requirements. The data requirements needed to test the hypothesis are data that are normally distributed and homogeneous so that the research results can be accounted for by research if the sample is taken randomly (random sampling). The data analysis requirements test was carried out by Liliefors for the normality test, the homogeneity test was carried out by the Bartlett test. For each research variable, the distribution is normal and homogeneous after being tested.

Testing the first, second and third research hypotheses was carried out using a 2 x 2 factorial analysis of variance. Complete calculations can be seen in the appendix. The summary of the calculation results in table 2 is as follows:

Table 2. Table Anava 2 x 2

Creativity	Statistics	learning model		Total
		Learn to Sing	Live	
Height	N	19	20	39
	∑X	544	480	1024
	$\sum X^2$	19960	11602	27562
	M	28.63	24.00	52.63
Low	N	21	20	41
	∑X	424	274	698
	$\sum X^2$	15217	5612	20829
	M	20.19	13.70	33.89
Total	N	40	40	80
	∑X	968	754	1722
	$\sum X^2$	31177	17214	48391
	M	48.82	37.70	86.52

Table 3. Summary of 2 x 2 Factorial Anava Calculations

Source Variation	JK	db	RJK	F_h	F_{tab}
A	572,45	1	572,45	3,830*)	3,26
B	1703,54	1	1703,54	11,397*)	3,26
Inter AB	68,102	1	68,102	0,456^{ns})	3,26
In	8980,86	36	149,47	--	--
Total	11324,95	39	--	--	

^{ns}) non significant
*) significant

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FA = 3.830*) → significant, meaning: There is a significant difference in student learning outcomes between those taught with the Learn to Sing and Direct learning models. The learning model influences the increase in student learning outcomes.

Thus Ho was rejected and Ha stated that there was a significant difference between the learning outcomes of students who were taught by the Learn to Sing learning model and the learning outcomes of students who were taught by the learning model which was directly tested for truth. In this case learning using the Learn to Sing learning model is better than learning using it directly because the average value of student learning outcomes taught by the Learn to Sing learning model (27.43) is higher than the average value of student learning outcomes. taught by the direct learning model (20,25).

FB = 11.397*) → significant, meaning: There is a significant difference in student learning outcomes between students who have high and low creativity. creativity affects the increase in learning outcomes.
FAB = 0.456ns) → non-significant, meaning: There is no interaction between learning models and creativity on student learning outcomes

First Hypothesis
Testing the first hypothesis to determine the effect of using the learning model on learning outcomes is written mathematically:
Ho: There is no difference in learning outcomes between students who are taught using the Learn to Sing learning model and students who are taught with the direct learning model.
Ha : There are differences in learning outcomes between students who are taught using the Learn to Sing learning model and students wo are taught with the direct learning model.
Based on table 3 it can be seen that the Fount value between columns is greater than Ftable (Fount = 3.830 > Ftable = 3.26) at a significant level of 5%. Thus Ho was rejected and Ha stated that there was a significant difference between the learning outcomes of students who were taught with the Learn to Sing learning model and the learning outcomes of students who were taught with a learning model that was directly tested for truth. In this case learning using the Learn to Sing learning model is higher than learning using direct use because the average value of student learning outcomes taught by the Learn to Sing learning model (18.7) is higher than the average value of student learning outcomes taught with the direct learning model (13.5).

Second Hypothesis
Testing the second hypothesis to determine the effect of creativity on learning outcomes mathematically written:
Ho: Student learning outcomes in the subject of Cultural Arts with the Learn to Sing learning model who has high creativity are the same as those who have low creativity
Ha: Student learning outcomes in the subject of Cultural Arts with the Learn to Sing learning model have higher creativity than those with low creativity

Based on table 4.12 it can be seen that the Fcount value between columns is greater than Ftable (Fcount = 11.397 > Ftable = 3.26) at a significant level of 5%. Thus Ho was rejected and Ha stated that student learning outcomes in the Arts and Culture subject with the Learn to Sing learning model which had higher creativity were higher than those with low creativity tested for truth.

Third Hypothesis
Testing the third hypothesis to determine the effect of using the learning model and creativity on learning outcomes is written mathematically
Ho: There is no interaction between learning models and creativity using applications on smartphones on student learning outcomes in the subject of Cultural Arts with the Learn to Sing learning model.
Ha : There is an interaction of learning models and creativity using applications on smartphones on student learning outcomes in the Subject of Cultural Arts with the Learn to Sing learning model.

Based on table 4.15 above, it can be seen that the Fhitune value between columns and rows (interaction) is smaller than Ftable (Fcount = 0.456 <Ftable = 3.26) at a significant level of 5%. Thus Ho was rejected and Ha who stated that there was no interaction between the use of learning models and creativity in influencing learning outcomes was not verified.

For more details regarding the description of the interaction between the use of learning models and creativity can be seen in the following graph.

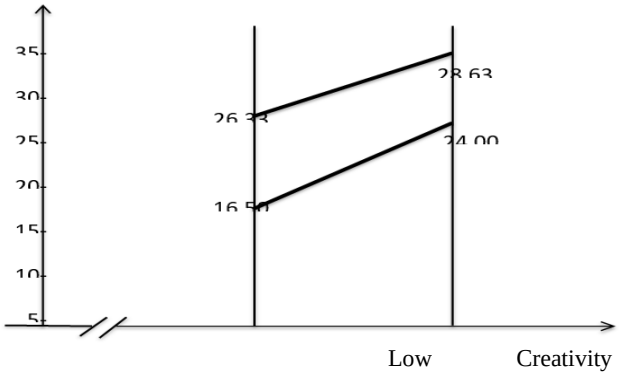

Figure 1. An overview of the interaction between the use of learning models and creativity

3.1 Learn to Sing and Learning Direct learning model

The Learn to Sing learning model is a model that is used as a model in the learning process. The use of the Learn to Sing learning model can provide real experiences for students. The real experience referred to in this case is the direct interaction of students with what they learn themselves. Models in the learning process are the most effective tools for involving the various senses in learning. This is because the Learn to Sing learning model has active, creative, effective, and fun delivery. The real experience involves the learner as a whole, both physically and senses and intellect. In this case, learning stimulates the desire to know more. Learning from books is one method. We can learn from books well if the lessons contained in them are related to something real in a real environment. All such lessons are easier to understand and better remain in memory when learned through contact with real things.

Learning using the Learn to Sing learning model is a learning process in which students are taught by associating the subject matter with the environment of the subject matter being discussed. Students are introduced directly to the original object of the subject matter. Each part of the benada is introduced directly, so students can understand more. In this

learning process, the teacher explains the subject matter with the help of using visual aids. For example, to explain the correspondence material. The teacher explains the material and introduces letters and how to write letters using computer equipment and explains each of its parts.

In this study, based on testing the first hypothesis, it was obtained that the application of learning using models gave a significantly different effect on learning outcomes where Fcount > Ftable so that for the first research hypothesis Ho was accepted and Ha was rejected. Based on the results of learning research using the direct model is less effective in facilitating students in learning. because in this learning the senses of students are less involved as a whole so it affects the process of students' comprehension of the subject matter. So that the knowledge they acquire is not as much as that obtained by students who are taught using the Learn to Sing learning model. In the Learn to Sing learning model, educators foster student creativity by explaining what the benefits are for students, bringing learning experiences that are generally understandable to students and all students naturally, giving students natural learning experiences, providing opportunities (in a variety of ways) for students to demonstrate what they learn into learning, provide opportunities for students to teach or impart their new knowledge to others and motivate students to summarize lessons and ask students to repeat them simultaneously, give students recognition for completion, participate by giving applause, praise, singing, make public posters.

So, from this research, it is clear that learning using the Learn to Sing learning model will have a better effect. on learning outcomes compared to learning using direct learning models.

3.2 Differences in Learning Outcomes from Students who Have High Creativity and Students who Have Low Creativity.

Learning is an activity to change behavior continuously through practice and experience until it becomes a new behavior that is relatively permanent. Creativity can be interpreted as a feeling of interest possessed by students in behavior-change activities that they do continuously through practice and experience.

Creativity level gives a sense of preference and a sense of interest in the field of study. About learning, a student will be more interested in learning based on his desire for something to be learned. A person who has high creativity will have a strong desire to master the material and solve the problems that will be taught so that in the end they can achieve maximum results. But on the other hand, someone who has low creativity tends to give up on the problems they face and lacks a strong desire to master the material to be taught so that in the end they are unable to achieve maximum results.

In this study, based on testing the second hypothesis it is proven that high and low levels of creativity have a significantly different effect on learning outcomes where Fcount > Ftable so that for the first research hypothesis Ha is accepted and Ho is rejected

3.3 The Interaction Between Learning Models and Creativity In Influencing Learning Outcomes

This study concluded that there was no interaction between learning using learning models and students' creativity on learning outcomes. In this study, based on testing the third hypothesis, it was found that the application of the learning model did not have a significant interaction effect with student creativity on learning outcomes, where Fcount < Ftable. It can be seen in the graph on page 82 that this study shows the application of learning with the Learn to Sing learning model and direct application give a significantly different effect on student learning outcomes regardless of student creativity. In contrast, students' high creativity and low creativity have a different influence on learning outcomes regardless of the learning model used. So the proposed hypothesis is rejected (Ha rejected). For this reason, it is necessary to review the theoretical studies in research, because the research and data analysis techniques have been carried out by the research design.

Many factors influence student learning outcomes, namely internal factors, external factors, and learning approach factors, one of which is the completeness factor of students' learning facilities, or the different perceptions of each student in viewing these subjects. These factors are also in many ways often interrelated and influence one another, but it is also possible if these things do not influence each other. This may be because these students have high internal actor intelligence so they are more likely to choose a learning approach that only prioritizes learning outcomes. Many other approach factors also influence student learning outcomes.

For this reason, the reason why there is no interaction between learning using models and student creativity on learning outcomes is possibly due to the influence of student creativity with the existence of learning models that can match other conditions in the subject that cannot be observed by intervening variables). If so, it may be accepted that student creativity and learning using models have a different effects on learning outcomes.

With the application of the Learn to Sing learning model, the learning model does not interact with student creativity. High creativity in the cultural arts lesson "Learn to Sing" is a motivation and encouragement for them to study more actively, to get high learning outcomes, besides that the Learn to Sing learning model will grow the habit of positive competition among them to achieve the best results. This encouragement also causes effective and efficient learning. So that the Learn to Sing learning model will improve student learning outcomes, even though they do not yet have high creativity in the lesson. Therefore this research is to describe what factors cause learning problems, especially in the right learning model to use and master the factors that hinder the student's learning process.

4. CONCLUSION

1. There are differences in the learning outcomes of doing Learn to Sing between groups of students who are taught with the Learn to Sing learning model and students who are taught with the direct learning model get higher results from doing Learn to Sing than the group of students who are taught with the direct learning model where (Fcount = 3.380 > F table = 3.26)
2. There are differences in learning outcomes in carrying out administrative procedures between groups of students who have a high interest in learning and groups of students who have a low interest in learning. Students who have a high learning interest obtain high learning outcomes than the

group of students who have a low learning interest where (F count = 11.397 > F table = 3.26)

3. There is no interaction between the application of learning with the learning model with the Learn to Sing learning model and the direct learning model with high and low creativity towards arts and culture learning outcomes by conducting Learn to Sing for class VIII students of SMP Negeri 30 Medan where (F count = 0.456 < F table = 3 , 26).

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Development of Learning Media In The Form of Microsoft Team Applications in Digital Information and Communication System Learning

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Abstract: The purpose of this study was to determine (1) the feasibility of learning media in the form of Microsoft team applications in digital information and communication systems learning in class XI students of SMK Negeri 1 Idi; and (2) to determine the effectiveness of learning media in the form of Microsoft team applications in learning information systems and Digital Communication in Class XI Students of SMK Negeri 1 Idi. This type of research uses the R & D development model. The subjects of this study consisted of one material expert, one instructional media expert, one instructional design expert, and class XI students of SMK Negeri 1 Idi. The results showed: (1) the expert test of learning materials was very good (88%); (2) the expert test of learning media is very good (92.94%); (3) the expert test of very good learning design (97.35%); (4) E-Module Basic Learning Sewing Technology Based on Discovery Learning Learning Media in the form of Microsoft Team Applications in Digital Information and Communication Systems Learning is feasible to use; (4) there is a significant difference between the learning outcomes of students who use media and textbooks. This is indicated by the results of processing the data on the posttest results obtained by the price of t count = 10.691, At a significant level ($\alpha = 0.05$) with dk 58 obtained $t_{table} = 1.167$ so that $t_{count} > t_{table}$ for practical results obtained price of t count = 11.023, At significant level ($\alpha = 0.05$) with dk 58 obtained ttable = 1.167 so that $t_{count} > t_{table}$. The average effectiveness of learning outcomes in the use of Learning Media in the form of Microsoft Team Applications is 85%, while groups of students using textbooks are 68%. This data proves that the use of Learning Media in the form of Microsoft Team Applications is more effective than without using media.

Keywords: learning media, microsoft team, digital information and communication systems

1. INTRODUCTION

1.1 The Nature of Digital Information and Communication Systems Learning

The use of Information Technology and the internet is currently very developed in society, this is due to the use of technology which cannot be separated from people's lives who are facing the Industrial Revolution 4.0 era [1]. It can be said that one of the most important factors in the Industrial Revolution 4.0 is the emphasis on the digital revolution. This refers to the digital revolution due to the development of computer systems and file automation in all fields [2].

Technological developments also continue to increase along with increasing human needs, especially in the field of Education Especially in the daily learning process. With today's increasingly advanced technological developments, teachers and students can now seek material from anyone, anytime, anywhere Uhomoibhi [3], thus requiring the readiness of teachers and schools to facilitate learning processes that are integrated with technology [4].

Teachers and schools have a big role in the application of technology in learning, teachers are not only to convey information to students but also facilitators so that students can develop their potential during learning. Teachers can create a quality learning process by providing meaningful learning experiences and can foster a student learning culture [5]. Facing the era of the industrial revolution 4.0, which emphasizes the concept of independent learning, every educational institution is expected to have competitiveness and innovation that can collaborate so as not to be left behind. In the era of revolution 4.0, the education system is expected to be able to create students who have critical thinking skills and can solve problems, are creative and innovative as well as have the skills to communicate and collaborate [6].

The concept of independent learning is a response to the needs of the education system in the industrial revolution 4.0 era. Nadiem Makarin as the Minister of Education of the Republic of Indonesia, emphasized that independent learning is freedom of thought that starts with the teacher. Educating as a practice of freedom is a form of teaching and learning that is interesting and fun for teachers and students. In the practice of this freedom, both parties are players in contributing and sharing learning experiences [7]. Learners are not only taught information that they expect to recall and remember when asked, instead they learn to think critically in a non-conformist and unfettered way.

In the context of independent learning, educators or teachers must encourage students to work collaboratively and ask questions creatively about ideas and problems in various disciplines [8] [9]. As creative thinkers, they try to imagine and explore alternatives, and think in different ways. Such an approach is needed as a solid academic foundation to improve their intelligence, including "soft skills" such as understanding, empathy, and communication skills. The use

of different learning materials and various sources allows students with various learning styles to understand the information in the most effective way [10].

One way to work collaboratively teachers and students can use learning media such as Microsoft Teams. According to Ilag B.N. [11], Microsoft Teams is a communication platform that is integrated with Microsoft Office 365. This application provides meeting features, video conferencing, file storage, and access which is easy for the user. Users can create virtual classes and manage them like real classes anywhere, in this virtual class Students can exchange ideas with classmates and teachers [12]. These interactions are like online meetings, chatting, posting, and online assessment. Microsoft Teams also provides data security for application users [13]. The features and convenience provided by Microsoft Teams make this application very suitable when used as a medium for online learning [14].

Danker [15] states that in today's digital era, the learning process is more modern and student-centered (Student-Centered Approach). Ertmer & Ottenbreit [16] further stated that the teacher only acts as a motivator and facilitates students by utilizing existing internet technology as a way to access teaching materials and materials from anywhere, anytime, with anyone, and anything online or e-learning.
E-learning is a system that can facilitate learners to learn more widely, more and varied. Furthermore, according to Clark Aldrich, and Derek Stockley [17], e-learning is the use of computer technology and computer networks accompanied by the application of innovative learning models in the context of implementing learning activities that will provide broad access to students to knowledge so that they can acquire new skills.

Educational technology exists to mediate and enhance learning and student performance through the strategic design of learning processes and resources. Thus designing learning to meet student needs is an important effort that is expected to improve student learning outcomes [18].

The use of E-learning by using the Microsoft Teams application helps the learning process, one of which is in the Digital Information and Communication Systems or SIMDIG subject. According to Indahini, Sulton, and Husna [19] SIMKOMDIG is one of the subjects taught to SMK students. This subject is related to information and communication technology. For SMK students, this subject is a means of communicating their concepts and ideas through digital presentations. As a tool, the function of this course is to provide a skills mapping tool for students to use when needed.

According to McVey, M., Edmond, A., and Montgomery, D. [20], another advantage is that teachers can quickly communicate with students, share files and websites, create OneNote Class Notebooks, and distribute and grade assignments. Integrated OneNote Class Notebooks and end-to-end assignment management allow teachers to organize interactive lessons and provide effective, timely feedback. Educators can share teaching materials using Professional Learning Communities. Class Teams can be used to create collaborative classrooms, provide a virtual meeting platform, facilitate learning with assignments and feedback, and lead live calls with students.

General Principles Microsoft Teams is a collaboration program with application and file facilities, meetings, phone calls, chats, and conversations in the same space, where users can use any device, so users can collaborate with other users with confidence. In other words, learning can be carried out effectively and efficiently because students are actively involved in learning [21].

1.2 The Nature of Microsoft Team Application Learning Media

The learning media are all tools and materials that can be used for educational purposes, such as radio, television, books, newspapers, magazines, and so on. Tools such as radio and television are used and programmed for education, so they are learning media. The National Education Association (NEA) defines media as all objects that can be manipulated, seen, heard, read, or discussed along with the instruments used for these learning activities [22].

Learning media is an integral part of the learning system. Many kinds of learning media can be used. Its use includes many benefits as well. The use of learning media must be based on the right selection. So that it can enlarge the meaning and function in supporting the effectiveness and efficiency of the learning process. Learning media can also be interpreted as anything that can be used to convey messages, and stimulate thoughts, feelings, attention, and willingness of students so that they can encourage the learning process. Forms of learning media are used to enhance the learning experience so that it becomes concrete [23].

According to the Educational Communication Technology Association learning media is everything that people use to convey messages. Meanwhile, according to Miarso, et al [24] stated that learning media is anything that can stimulate the teaching and learning process. Based on some of these descriptions, it can be concluded that learning media is a tool used to channel messages or information (learning material) as well as to stimulate students in the teaching and learning process to achieve the learning objectives that have been formulated.

Online learning media that have been used by teachers and teachers recently to deal with online teaching and learning processes due to the Covid-19 pandemic are very diverse. Of course, this learning media is used to convey material to students. In fact, it has been around for a long time, but it is still rare for schools or educational institutions to apply it in their learning process. Online learning media that is ready to be used for learning and teaching activities is Microsoft Teams for Education. This application is one of the online learning media designed in Microsoft 365.

Microsoft Teams itself is a chat/conversation-based platform that has very perfect features that can support file sharing, online meetings, and other features that are needed for communication. Having a very special team room is key to making creative decisions and communicating effectively among users with each other. The shared workspace platform makes work easier, especially in the world of education during this pandemic. In Hanung and Sutama's notes, they explained that Microsoft Teams is an application made by Microsoft which is indeed designed as a package that has a complete program. This application is designed that way to make it easier for its users to access information flexibly that is not bound by time and place. This application also has the advantage of being able to collaborate with other software. The advantages of using Teams are getting more advantages in productivity and communication, more focus on work and school, higher transparency, promoting collaboration which is

good in digital workplaces/schools, and makes it easier for new team members to enter faster To increase speed [15].

1.3 The Essence of Project-Based Learning Strategy

Sanjaya [26] suggests that a learning strategy is a learning activity that must be carried out by teachers and students so that learning objectives can be achieved effectively and efficiently. According to Muhaimin in Riyanto [27] that learning is an effort to teach students to learn. Learning activities will involve students learning something effectively and efficiently. The strategy according to Slameto [28] is a plan regarding the utilization and use of existing potential and facilities to increase teacher effectiveness and efficiency.

According to Seels and Richey [29], said that learning strategies are specifications for choosing, and designing processes and activities in a lesson. Furthermore, quoting David's thoughts Sanjaya [30] strategy is defined as a plan, method, or activities designed to achieve a particular educational goal. So, thus the learning strategy can be interpreted as a plan that contains a series of activities designed to achieve certain educational goals.

Dick & Carrey [31], said that learning strategies usually explain the general components of a set of learning materials and procedures that will be used with other materials to produce certain learning outcomes from the learner. Furthermore, Dick & Carey also details the five components of learning strategies, namely: (1) pre-instructional activities, (2) presentation of information, (3) student participation, (4) tests, and (5) follow-up. Miarso [32] defines a learning strategy as a comprehensive approach to learning in the form of a general guideline and an activity framework that is translated from a philosophical or theoretical view of learning under certain conditions and set to achieve general goals. In contrast to the strategy components proposed by Dick and Carey, a learning strategy contains several components namely: (1) General objectives, (2) Learning Techniques, (3) Organizing teaching and learning activities which include organizing students, teachers, and education staff, (4) learning events, (5) learning sequence, (6) assessment, (7) management of learning activities in class (8) place and setting, and (9) time.

The learning strategy is a way of determining all aspects related to the achievement of learning or learning objectives, including the preparation of plans, implementation of learning activities, and assessment of learning processes and outcomes. The learning strategy applied by the teacher will depend on the approach used, while how to carry out the strategy can be determined by various learning methods. To carry out the teacher's learning method, the teacher can determine the techniques that are considered relevant to the method or use of the technique, each teacher has a different way from one another [33].

1.4 Project Based Learning

Project-based learning is a project-based learning method that involves students working in groups to compile a report, experiment, or another project [34]. Ministry of National Education [35] emphasized that structured project/task learning (Project-Based Learning) is a learning approach that requires comprehensive learning where the student learning environment (class) is designed so that students can carry out investigations of authentic problems including deepening the material of a subject matter, and perform other meaningful tasks.

Project Based Learning is a learning approach that requires students to create a "bridge" that connects various subject matters. In this way, students can view knowledge holistically. More than that, Project Based Learning is an in-depth investigation of a real-world topic, and this will be valuable for student attention and effort. Project Based Learning is a learning approach that pays attention to understanding. Students explore, assess, interpret and synthesize information in a meaningful way. According to Cord et al [36], project-based learning is an innovative learning model or approach, which emphasizes contextual learning through complex activities. Project-based learning is the use of projects as a learning model. Projects put students in an active role, namely as problem solvers, decision-makers, researchers, and document makers.

Joel L Klein et. Al (Widyanthi [37]) explained that project-based learning is a learning strategy that empowers students to acquire new knowledge and understanding based on their experiences through various presentations. The characteristics of project-based learning are that students investigate important ideas and ask questions, students find understanding in the process of investigating, according to their 4 needs and interests, produce products and think creatively, critically and skillfully investigate, conclude material, and connect with real-world problems. authentic and issues. Meanwhile, explains that in project-based learning, students plan and carry out investigations of several topics or themes that use cross-subjects or cross-materials. Thomas, et al, (Wena [38]) stated that Project Based Learning is a learning model that provides opportunities for teachers to manage learning in class by involving project work.

The problems of this research are: (1) Is the Microsoft team's media in developing digital information and communication systems appropriate to use in understanding the material for making e-books?; and (2) Is the Microsoft team's media on learning digital information and communication systems developed effectively used in understanding the material for making e-books?

2. METHOD

The R&D (Research and Development) model is the type of research used in this study. Gall, Gall & Borg [39] in their book entitled "Educational Research" says that R&D in education is an industry-based development model, where research findings are used to design learning products which are then systematically tested in the field, evaluated, and perfected until they are produced. a learning product that meets effective, efficient, and quality standards. This research will be conducted at Vocational High School (SMK) Negeri 1 Idi, at the Department of TKJ Class X.

Procedures and design of the Dick, Carey & Carey learning design model. Gall, Gall & Borg said that the stages of research and development in the realm of education are the stages contained in the model developed by Dick, Carey & Carey. The following are the 10 steps of the Gall, Gall & Borg model in research and development as shown in Figure 1 below:

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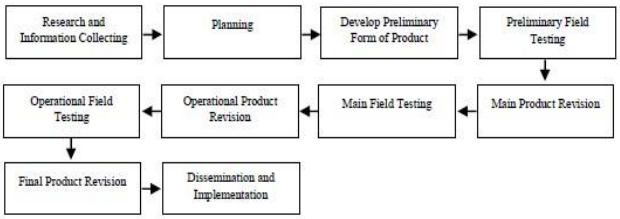

Figure 1. Gall, Gall & Borg Development Model

2.1 Data analysis technique

The data collected through the validation of the expert team (Learning Media) and material experts (SIMDIG) and the questionnaire given to students is data regarding the quality of learning media on the SIMDIG material that has been developed. This instrument for media expert and material expert validators is made on a Likert scale that has been given a score, as shown in Table 1 below:

Table 1. Criteria for Answering Instrument Validation Items with a Likert Scale Type

No.	Answer	Score
1.	Strongly Agree	5
2.	Agree	4
3.	Doubtful	3
4.	Disagree	2
5.	Strongly Disagree	1

Then the data is analyzed descriptively quantitatively, namely calculating the percentage of indicators for each category in the learning media that has been developed.

$$\text{Score Presentation} = \frac{Jumlah\ indikator\ per\ kategori}{Jumlah\ Indikator\ Total\ Kategori} \times 100\%$$

From the calculation using the formula above, the resulting number is in the form of a percent (%). The score classification is then converted into a classification in the form of a presentation, then interpreted with qualitative sentences listed in the table below:

1.

Table 2. Criteria for Indicator Presentation in SIMDIG Learning Media Materials That Have Been Developed

score	Criteria	intervals
A	Very good	81% ≥ score ≤ 100%
B	Well	61% ≤ score < 80%
C	Currently	41% ≤ score < 60%
D	Not good	21% ≤ score < 40%
E	Very Less Good	0% ≤ score < 20%

(Ridwan [42])

Knowing the final score uses the average analysis of the items concerned in the expert validation questionnaire, namely by calculating the eligibility value of the questionnaire for each aspect divided by the number of statements. The results of the percentage scores obtained from the study are interpreted in the following table criteria:

Table 3. Learning Media Feasibility Scale

No.	Answer (%)	Assessment Criteria
1.	81-100	Very Worth it
2.	61-80	Worthy
3.	41- 60	Decent Enough
4.	21-40	Less Eligible
5.	≤ 20	Very Inadequate

(Arikunto [43])

2.2 Product effectiveness test data analysis techniques

Data analysis in this study used quantitative analysis techniques on the data obtained were the results of student learning from classes that had taken the course Analyzing e-book creation without using media and classes that were taking the course Analyzing e-book creation using media. To see whether there is a significant difference between the learning outcomes of students who are taught using the media and without being taught using the media, a hypothesis test is carried out with the t-test.

Hypothesis testing

According to Sudjana (2013), the research hypotheses to be tested are:

$H_0: \mu_1 = \mu_2$

$H_a: \mu_1 > \mu_2$

Information :

H_1 = average student learning outcomes using the media (Ridwan [40])

H_2 = the average percentage of student learning outcomes that do not use the media

H_o = there is no difference in student learning outcomes using media and those who do not use media

Ha = there are differences in student learning outcomes using media and those who do not use media

To test the hypothesis, the two-party test formula is used:

$$t = \frac{\overline{x_1} - \overline{x_2}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$ (Yanasari [41])

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

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

The test criteria are accepted as H_o if $t_{count} > t_{table}$ is obtained from the t distribution list with dk = (n-1) with a significant level of α = 5%, the effective media is used.

3. RESULTS AND DISCUSSION

This research is a type of research and development using the borg and gall development model, so the product resulting from the implementation of this research is Information Systems and digital communication learning media in the form of the Microsoft Team application to improve students' digital information and communication system learning outcomes. The purpose of this development research is to (1) Know the Feasibility of Information Systems learning media and digital communication in the form of Microsoft team applications in improving students' digital information and communication systems learning outcomes. (2) Knowing the effectiveness of Information Systems learning media and digital communication in the form of Microsoft team

applications in improving students' digital information and communication systems learning outcomes.

The development of learning media, especially learning media for information systems and digital communication in the form of Microsoft team applications, in improving student learning outcomes is complementary to existing learning media. Making learning media is expected to be done with careful preparation and planning. Preparation and planning are arranged systematically and developed in accordance with the competence of the syllabus and RPP material for analyzing the manufacture of e-books so that the learning media becomes more effective which has been modified into an even simpler research design.

3.1 Hypothesis testing

Testing the feasibility of the product developed was analyzed from the feasibility validation from experts and the feasibility of testing it on students. The results of the expert feasibility validation trial are in Table 4

Table 4. Expert Feasibility Validation Test Results

No	Expert Assessment	Percentage	Criteria
1.	Learning Material Expert	88 %	Very Good
2.	Learning Media Expert	92,94%	Very Good
3.	Expert Learning model	97,35%	Very Good
Average		92,76%	Very Good

Based on Table 4 above, it can be concluded that learning media products are in the form of applications. The Microsoft team analyzing the creation of the e-book developed includes very good criteria, which means that the product is very feasible to use and can meet the needs of implementing learning to analyze the creation of e-books.

Table 5. Field Trial Results

No	Assessment Aspects	Percentage	Criteria
1.	Appearance	91,74	Very Good
2.	Presentation	92,44	Very Good
3.	language	92,22	Very Good
4.	graphics	93,33	Very Good
Average		92,43%	Very Good

In learning, there are many roles of the media used, including learning that will attract more students' attention so that it can generate motivation to learn and enable students to master learning objectives better. The role of the media in further learning is to make students do more learning activities, and other activities such as observing, doing, demonstrating, and so on.

3.2 Hypothesis Test of Product Effectiveness Developed

The results of the product effectiveness hypothesis test are known through the differences in the post-test results of control class students and experiments and practical results In Tables 4.38 and 4.38 it can be seen the results of the calculation of the hypothesis test.

Table 6. Calculation results of the post-test hypothesis test

Statistics	Class	
	Control	Experiment
N	30	30
Means	68	85
Sd	8,13	4,22
S^2	66,10	17,82
t_{count}	10,691	
t_{table}	1,167	
Status	H_a accepted	

Based on the research conducted, it was found that student learning outcomes in the experimental class that used learning media in the form of Microsoft Applications team analyzed the making of e-books with a fairly good category of 36.67%, while in the control class which did not use media (Control), it was found that the results tended to be learning 26.67% with less good category.

After going through several stages of validation and testing that have been described previously, the learning media in the form of Microsoft Information Systems and digital communication applications is feasible to use. This can be seen from the average rating in almost all stages showing very good results. Based on observations and studies during research, learning media in the form of Microsoft Information Systems and digital communication applications can increase student interest in studying digital information and communication systems subjects. This can be seen from the enthusiasm of students to use learning media in the form of Microsoft team applications and student learning outcomes are getting better than before.

The feasibility test of learning media in the form of Microsoft Information System Team Applications and digital communication can be seen from the validation results of material experts, model experts, and media experts, where the average validation of material experts is from material experts I of 4.41 while from material experts II of 4.88, the average result of model expert validation is from a model I expert of 4.87 while from model II expert is 4.85, and the average result of media expert validation is from media expert I of 4.77 and media expert II of 4.67. Evaluations from material experts, model experts, and media experts show that learning media in the form of Microsoft Information Systems and digital communication applications is in the very good category and is feasible to try out. In trials on students or users, the percentage results for the preliminary field test, main field test, and operational field test were 92.43%, meaning that learning media in the form of Microsoft Information System and digital communication team applications are also in the very good category. . For complete calculations, see the attachment

Furthermore, for the percentage of expert validation test results on learning media in the form of applications, the Microsoft team analyzing the creation of e-books found that the percentage of subject matter aspects was 94.44% in the very good category, the percentage of learning media aspects was 92.94% in the category very good, the average assessment of aspects of the learning model is 97.35% with a very good category. All aspects of the assessment with an average of 94.91% with a very good category.

The results of the feasibility assessment of learning media in the form of an application The Microsoft team analyzed the making of e-books in the overall trial and obtained in the display aspect an average score of 91.74% including the very good category, in the presentation aspect an average of 92.44

including the very category good, and linguistic aspects with an average of 92.22% with a very good category and graphical aspects with an average of 93.33%. The average results of the assessment of learning media in the form of applications The Microsoft team analyzed the creation of e-books at the overall trial stage of 92.43% and included them in the "Very Good" category

In the learning activities carried out by the teacher in the classroom, the most important result is the process, because it is the process that will determine whether the learning objectives will be achieved or not achieved. Achievement in the teaching and learning process is marked by a change in behavior. Changes in behavior both involve changes in knowledge (cognitive), and skills (psychomotor) as well as those involving values and attitudes (affective).

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 [44] says 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.

With the existence of learning media, oral and written traditions in the learning process can be enriched with various learning media. With the availability of learning media, educators can create various classroom situations, determine teaching methods to be used in different situations and create a healthy emotional climate among students. These learning tools/media can then help teachers bring the outside world into the classroom. Thus ideas that are abstract and foreign (remote) in nature become concrete and easily understood by students. If this learning tool/media can function properly and professionally, then the learning process will be able to run effectively.

In line with the Use of Multimedia as a New Educational Technology Tool–A Study. The results of the study suggest that multimedia can provide a better quality learning process, taking into account pedagogical interests, the use of media is the main potential for maximizing the process of achieving learning objectives.

The results of the post-data analysis of the learning outcomes of the control class that did not use learning media in the form of Microsoft application teams analyzing the creation of e-books can be stated that the average score of learning outcomes is 68.00 and the experimental class that uses learning media in the form of application Microsoft team analyzes making an e-book of 85.00 with a classical completeness of 100%.

Sadiman [45] 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 [46] suggest that learning media can fulfill three main functions if the media is used for individuals, groups, or groups that are large in number, 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 [47]) 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 bring psychological influences 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, can create a learning atmosphere

The Use of Media for Effective Instruction its Importance: Some Consideration. The results of the study suggest that the media helps educators to transmit knowledge in an impressive way by diversifying classroom teaching and making learning more effective. Instructional media that provide teachers with powerful tools to make their teaching effective to achieve specific classroom goals.

4. CONCLUSIONS

After carrying out the process or stages of developing digital simulation and communication learning media in the form of a Microsoft team application, the following conclusions can be put forward; (1) Simulation learning media and digital communication in the form of a Microsoft team application developed on material for analyzing e-book creation at SMK Negeri 1 Idi are suitable for use; and (2) Simulation learning media and digital communication in the form of the Microsoft Team application which is used in analyzing material for making e-books at SMK Negeri 1 Idi is defective.

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Development of Android-Based Learning as Interactive Learning Media in Reaction Rate Material on XI Class SMA Student

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Abstract: This aims of this study are to: (1) find out whether android-based interactive learning media that developed have met the feasibility standards based on the android-based integrated BSNP, (2) find out whether student learning outcomes taught using android-based interactive learning media that have been developed higher than the Minimum Completeness Criteria (KKM) score on the reaction rate material. This research is a Research and Development with the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model which was carried out in the odd semester of the 2021/2022 academic year at SMAN 12 Medan. At the implementation stage, a one-group pre-test post-test design was used, with sampling using a cluster random sampling technique consisting of one XI science class at SMAN 12 Medan. The results of the validation of the android-based media obtained for the feasibility of the contents is 3.75; display feasibility is 3.83; language feasibility is 4, and graphic feasibility is 3.83. Overall, android-based learning media obtained a feasibility level of 3.85, with a very feasible category. Furthermore, android-based learning media on the reaction rate material is implemented in the learning process. The KKM scores and the students' average post-test scores were 78 and 85.6, respectively. The data obtained were analyzed using the right-hand t-test. The result of data analysis is that tcount is in the significant area, tcount > ttable = 4.146 > 1.711. So that Ha is accepted and H0 is rejected, it can be concluded that the learning outcomes of students who are taught using Android-based interactive learning media are higher than the KKM value.

Keywords: android-based; learning media; learning outcomes, reaction rate

1. INTRODUCTION

The impact of the COVID-19 pandemic has shifted to the world of education. A total of 577,305,660 students, ranging from pre-primary to high school levels are at risk of the COVID-19 virus. Many affected countries, including Indonesia adopted lockdown or quarantine policies to reduce the spread of this virus. Facing this condition, UNESCO provides distance learning solutions so that the learning process can continue[1]. However, many students and teachers are overwhelmed by this online learning model. During online learning, many students seem to be taking part in learning when in fact they are not. For example, students put up photos or videos that have been recorded beforehand, as if they were taking lessons in class when in fact they are not. This makes teaching and learning activities ineffective and student learning outcomes are low[2].

One of the sciences that develops along with the development of technology is Chemistry. In its application, chemistry is abstract, interrelated with one another and requires high reasoning. chemistry lessons given at Senior High School aim to make students have the ability to understand the concepts, principles, laws, and theories of chemistry as well as their interrelationships and applications to solve problems in everyday life. But the percentage of students who achieve Minimum Completeness Criteria (KKM) in chemistry subjects is still categorized as low. This is because the media used by teachers in learning activities is less varied[3]. One of the teaching materials in Chemistry that seems difficult for students is the rate of reaction. Students have difficulty with chemical concepts because they cannot visualize the processes that occur.

The use of interactive learning media is considered to be able to improve the teaching and learning process. With the interactive device it can support students' kinesthetics intelligence. This interactive learning media involves many senses in the learning process, so that the more senses involved, the more information received and last a long time in students' memories[4]. More interesting teaching can be supported by the use of varied learning media which can ultimately minimize student boredom. Students' motivation to learn chemistry is expected to be increased by the presence of interesting teaching media. Using an electronic module based on scientific literacy can increase student learning outcomes on teaching colloidal system[5]. A media can be said to be efficient if it is easy to use and precise and does not take up much time and space. Therefore, the application of interactive technology is needed to help students understand chemistry, especially in the Reaction Rate material.

2. RESEARCH METHOD

2.1 Location and Time

This research was conducted at SMAN 12 Medan. In this school, the use of learning media in the teaching and learning process is still lacking. The level of motivation of children in learning is also low because the teaching and learning process is only focused on teachers and books. Moreover, in the

current situation of the COVID-19 pandemic, which causes the learning process not to be fully face-to-face. Therefore, research on the development of learning media based on mobile learning is suitable to be carried out at SMAN 12 Medan. The research time carried out in November 2021 until January 2022, the 2021/2022 school year (odd semester).

2.2 Type of Research

The type of research used in this research is the type of development research (R&D) which refers to ADDIE development model developed by Dick and Carry. The stages in the ADDIE development model include: Analysis, Design, Development, Implementation, and Evaluation[6]. Due to the limit of time of researcher, the development carried out in this research up to the implementation stage.

2.3 Population and Sample

The population in this study were all of class XI SMAN 12 Medan in the odd semester of the 2021/2022 school year that divided into six classes, namely Class XI Science 1- XI Science 6. The characteristics of these class are in the same curriculum, the same semester, and the same school year are basically same. The sample studied was one of the class from six class XI Science SMAN 12 Medan, namely class XI Science 2. The sample in this study was assumed to be representative, so the sampling was done by using random sampling technique.

2.4 Research Variable

The variables used in this study are:

1. Independent Variable

The independent variable in this study is android-based interactive learning media on the reaction rate material.

2. Dependent Variable

The dependent variable in this study is the feasibility of learning media by media experts and material experts; student learning outcomes.

2.5 Research Design

The research design that will be carried out in this study uses a one sample t-test which is consist of one-group pre-test post-test design. This design is used because there is only one group (class) that is the sample and there is no control class for comparison.

Table 1. Research Design

Group	Pre-Test	Treatment	Post-Test
Experiment	T_1	X	T_2

Description:
T1 = Pre-Test
T2 = Post-Test
X = Learning using android-based interactive learning media on the reaction rate material

The researcher gave a pre-test first to measure the students' initial ability before treatment. Then proceed with giving treatment, namely learning using android-based interactive learning media on the reaction rate material for a certain period of time and ending with giving a post-test.

2.6 Data Collection Technique

Data collection techniques used in this study are qualitative and quantitative data. Qualitative data were obtained based on suggestions for improvement from expert validators of android-based interactive learning media. Quantitative data were obtained based on tests (evaluation questions) of student learning outcomes using android-based interactive learning media on the reaction rate material and assessments from expert validators of android-based interactive learning media.

2.7 Research Instrument

2.7.1 Test Instrument

The test instrument used in this study was a test in the form of description questions, each of which included the levels C1, C2, C3 and C4. The test instrument questions first examined by an expert validator, to see the cognitive domain of each item from the test instrument. Furthermore, the instrument testing was carried out to determine the extent to which the instrument met the requirements in terms of validity, reliability, difficulty level, and different power of each item.

2.7.1.1 Validity

The instrument validation by students carried out in SMAN 12 Medan. The instrument test was given to one of class XII Science, consisting of 34 students, who had learned Reaction Rate. The researcher gave the test instrument that consist of 40 questions to the students, then the students work on the questions on the instrument. To calculate the validity of the items, biserial point correlation is used. The biserial point correlation coefficient is a statistical measure used to estimate the degree of relationship between data that has a dichotomous scale and those that have an interval/ratio scale. If the correct answer is given a score of 1, while if the wrong answer is given a score of 0. The formula that used:

$$r_{pbis} = \frac{M_p - M_t}{SD_t}\sqrt{\frac{p}{q}}$$

Description:
Rpbis = Coefficient correlation biserial point
Mp = The average total score who answered correctly on the items
Mt = Average total score
SDt = Standard deviation of total score
p = The proportion of students who answered correctly to the items being tested for validity.
q = Proportion of students who answered incorrectly (q = 1- p)

Table 1. Criteria of Question Item Validity

Index	Validity Level
$r_{pbi} \leq 0.19$	Items must be eliminated
$0.20 < r_{pbi} < 0.29$	Items require revision
$0.30 < r_{pbi} < 0.39$	Little or no need of repair
$r_{pbi} \geq 0.40$	Very good item

The calculation result of is compared with the critical table of r biserial, with a significant level of 5% if the value of is valid[6].

2.7.1.2 Reliability

The level of reliability of an instrument is known from the reliability coefficient symbolized by r11. Where the value of r11 ranges from 0.0-1.0. The analysis of the test items carried out to determine the reliability of the test used the Kuder Richardson formula:

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$$q = 1 - p$$

$$r_{11} = \left(\frac{K}{K-1}\right)\left(\frac{S^2 - \sum pq}{S^2}\right)$$

$$. S^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N}$$

To interpret the reliability value of the questions, the value is consulted to the critical value of the product moment table with $\alpha = 0.05$ with the criteria $r_{count} > r_{table}$ for the real level, then the test is declared reliable[7].

2.7.1.3 Problem Difficulty Level

A good question is one that is not too easy or not too difficult. The formula used to measure the level of difficulty:

$$P = \frac{B}{Js}$$

P = Difficulty level
B = Many students answered correctly
Js = The total number of students taking the test

A test item is said to be feasible if the P value is between 0.20 - 0.80. If P < 0.20 means the test item is too difficult and if P > 0.80 means the test item is too easy[7]. The criteria for level of difficulty are conducted in table 3.

Table 2. Criteria of Problem Item Difficulty Level

P Value	Difficulty Level
0.00 – 0.20	Difficult
0.20 – 0.80	Medium
0.80 – 1.00	Easy

2.7.1.4 The Distinguishing Power

The distinguishing power is determined by calculating the power difference index to determine the difference power of each item test, which can be calculated using the formula:

$$D = \frac{BA}{JA} - \frac{BB}{JB}$$

Description:

JA = The number of test takers in the upper group
JB = The number of test takers in the lower group
BA = The number of groups who answered correctly
BB = The number of the lower group who answered correctly

The number that shows the magnitude of the differentiating power of an item, is called the Distinctive Power Index, symbolized by "D". The values of D ranges from -1 to +1. A test item is declared feasible if D ranges between 0.2 - 1.0[7]. The criteria for level of distinguishing power are conducted in table 4.

Table 3. Criteria of Distinguishing Item Power

D Value	Distinguishing Power Level
0.00 - 0.20	Bad
0.21 - 0.40	Sufficient
0.41 - 0.70	Good
0.71 - 1.00	Very Good

2.7.2 Test Instrument

In this study, the non-test instrument was made in the form of a media validation questionnaire based on the BSNP which included aspects of content feasibility, language feasibility, presentation feasibility and graphics.

2.8 Research Procedure

The research flow for the adaptation of the ADDIE model is shown in figure 1. The figure shows the overall and simple stages in this research procedure.

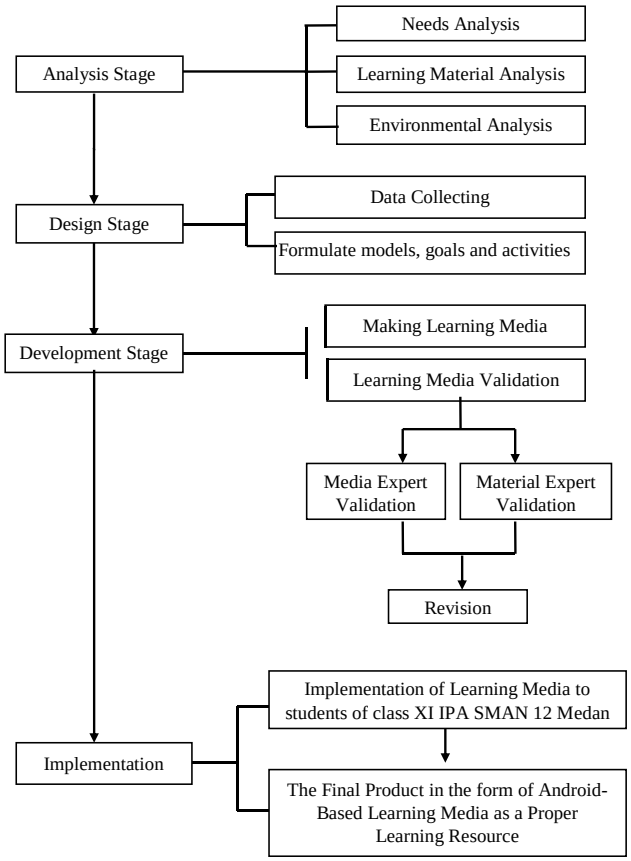

Figure 1. ADDIE Model Adaptation Research Flow

2.8.1 Analysis Stage

The initial steps taken in this research are needs analysis, learning material analysis and environmental analysis.

1. Needs Analysis

Needs analysis aims to identify products that fit the target. As part of the need analysis, the researcher observed the students of class XI science at SMAN 12 Medan through google forms and observed the chemistry teachers in class XI Science at SMAN 12 Medan through interviews. As the result, the product to be developed in this research is an Android-based interactive learning media with advantages consisting of several features, namely material; exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations, and can be used both online and offline.

2. Learning Material Analysis

Analysis of learning materials includes determining learning materials adapted to the curriculum in high school and the needs of students. In this study, the material that will be developed in android-based interactive learning media is the Reaction Rate material. The subtopic of the material consists of Molarity Concept, Definition of Reaction Rate, Collision Theory; Factors Affecting Reaction Rate, Order and Equation of Reaction.

3. Environmental Analysis
Environmental analysis was carried out to identify the learning environment including the KKM value in the Reaction Rate material, the learning method used by the teacher in the chemistry lesson in the Reaction Rate material and how to motivate students.

2.8.2 Design Stage
The design stage is the stage of designing learning media. Researchers conducted discussions with chemistry teachers and chemistry lecturers who are in charge of general chemistry courses to compile forms for all menus that will be converted into the form of learning media.

1. Data collecting.
The purpose of data collecting is to get an overview in making learning media and its framework. Data needs include subject matter in accordance with learning environment that previously analyzed. Data collecting consist of collecting reaction rate material from book, website or other sources; collecting learning video of reaction rate calculation, collecting question that suitable with the competencies and learning objectives to be achieved.

2. Formulate models, goals and activities.
At this stage, the selection of models on learning media that are in accordance with activities that are integrated through interactive learning. After analyzing and collecting data, the learning media design that will be made is planned to consist of 3 main menus, namely home, score and account.

2.8.3 Development Stage
The development stage includes the creation of learning media and validation of learning media.
1. Making learning media
At this stage the researchers compiled an android-based reaction rate learning media in accordance with the BSNP. In the preparation of learning media, researchers also discussed with chemistry lecturers and teachers related to learning media prepared by researchers.

2. Learning media validation
Android-based interactive learning media developed will be validated of two media and two material expert validators who are selected by purposive sampling. Media and material expert validators are represented by 2 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 2 teachers at SMAN 12 Medan with criteria teacher in chemistry lesson. Respondents will assess based on the validation assessment of learning media in accordance with the modified BSNP standard and provide advice on the quality of the learning media developed.

2.8.4 Implementation Stage
Android-based interactive learning media that have been developed and validated are then implemented in learning. Measurement of the implementation of learning media is by using pre-test and post-test instruments.

2.9 Analysis Data Technique

2.9.1 Learning Media Validation
The results of the validation of the feasibility of android-based learning media that have been obtained are then transformed into qualitative sentences. The rating scale used in the android-based integrated BSNP feasibility questionnaire is 1 to 4.1 as the lowest score and 4 as the highest score.

In the research on the development of android-based learning as a medium for learning reaction rate, 4 experts were involved: 1 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 1 teacher of SMAN 12 Medan with criteria teacher in chemistry lesson as media expert; also 1 chemistry lecturers, FMIPA UNIMED with criteria lecturer in basic chemistry course and 1 teacher of SMAN 12 Medan with criteria teacher in chemistry lesson as material experts. As a result, the average formula can be used to obtain the overall percentage, as shown below:

$$\bar{X} = \frac{\sum X}{n}$$

Description:
X = Average value
$\sum X$ = Total of answers to the assessment of the validator/test subject
n = Total of validators/test subjects

The criteria for the validity of the average analysis used are seen in table 5.

Table 4. Criteria for the Average Validity of Learning Media

Average	Validity Criteria
3.26-4.00	Valid and does not need to be revised (very feasible)
2.51-3.25	Sufficiently valid and does not need to be revised (decent)
1.76-2.50	Invalid and some of the contents need to be revised (not feasible)
1.00-1.75	Invalid and need to be totally revised (not feasible)

2.9.2 Learning Outcomes Analysis
Student learning outcomes data at the implementation stage of interactive learning media were analyzed statistically using the right-hand t-test after first testing for normality and homogeneity. Normality and homogeneity test done in class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed.

2.9.2.1 Normality Test
Testing the normality of the data with the Chi Square Test is done by comparing the standard curve (A) in the normal curve formed from the collected data (B). If B is not significantly different from A, it is concluded that B is data that is normally distributed.

First, the pre-test and post-test given to the one of class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed. Then, the data that obtained test for the normality. The formula used to determine the level of normality of the data:

$$x^2 = \sum \frac{(Fo - fh)^2}{fh}$$

Description:

Fo = Frequency/amount of observation data

Fh = Frequency/expected amount of data (percentage of area of each field multiplied by the number of data)

If chi square count chi square table at = 0.05 with db = 5, then the data is normally distributed[7].

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2.9.2.2 Homogeneity Test

The homogeneity test aims to test whether a data group has the same variance among the members of the group. First, the pre-test and post-test given to the one of class XI Science SMAN 12 Medan, consist of 25 students, who have studied Reaction Rate using interactive of android-based learning media that have been developed. Then, the data that obtained test for the homogeneity. The formula used to determine the level of homogeneity of the data:

$$s^2 = \frac{\sum(Xi - \bar{X})^2}{n - 1}$$

$$s = \sqrt{\frac{\sum(Xi - \bar{X})^2}{n - 1}}$$

Description:

s^2 = Varian of sample

s = Deviation standard of sample

2.9.2.3 Hypothesis Test

To test the descriptive hypothesis that has interval or ratio data, a one-sample t-test is used with the following formula:

$$t_{count} = \frac{\bar{X} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Description:

$\bar{X}$ = Average

μ_0 = Hypothesis value

s = Standard deviation

n = Total of sample

t_{count} = t value that counted

If the value of t_{count} is in the critical area ($t \geq t_{\alpha}$) so H_0 rejected or Ha accepted [7].

3. RESULT AND DISCUSSION

3.1 Android-Based Learning Media Development

This research and development resulted in a product in the form of an Android-based chemistry learning media on the reaction rate material with the name LydApps: Reaction Rate Chemistry Learning Application. This research uses the Research & Development (R&D) method and ADDIE development model. The ADDIE development model carried out in this study consisted of four stages including: (1) Analysis stage, (2) design stage, (3) development stage, and (4) implementation stage.

3.1.1 Analysis Stage

The results of the interviews that have been conducted are the use of learning media during the online learning process were still not optimal and active interaction between students and teachers had not been formed. This is because the teacher considers the limitations of students' internet packages during online learning if they empower interactive learning media. In addition, there are many calculations in chemistry lessons. Students sometimes do not understand the lesson and also become bored.

On the other hand, all of the students already have Android and are good enough in using Android. However, even though learning facilities are available, the use of android in learning process as a learning media has not been able to run effectively. Teachers only use a few applications as a place for students to collect assignments. The applications used by teachers in the learning process are WhatsApp groups, google classroom, and zoom meeting (the usage is still minimal). There is no free learning application provided by the school to help the online learning process.

The researcher also gave a questionnaire to the students of class XI Science, totaling 52 students. From a total of 14 questions, 12 questions were given related to needs analysis. From 52 students 90.4% can access learning media with personal android and 9.6% can access learning media with parent's android. The obstacles experienced by students (figure 2) are inadequate internet network (42.3%), limited communication with teachers (67.3%), limited access to smartphones (1.9%), teachers are still not good at using digital technology (13.5%). 88.5% of students agree that the learning media used by teacher did not vary and did not support active interaction between teachers and students during the learning process so that learning still seems monotonous. The lack of student interest in the learning process makes students not focus and causes low student learning outcomes. As many as 76.9% of students choose to use Android-based learning media which is equipped with attractively packaged material, video, animation, quiz/exercise, score ranking features.

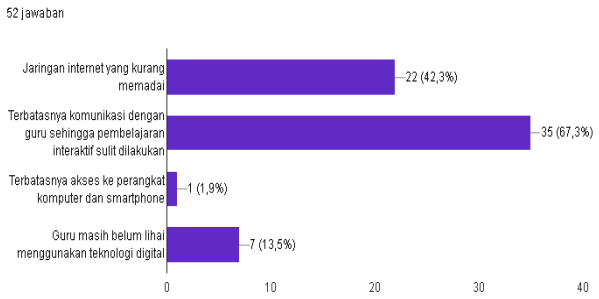

Figure 2. Result of Obstacles Experienced by Students During Online Learning

The curriculum that used in this study is 2013 Curriculum in Reaction Rate material. The analysis used is through the analysis of the Syllabus and Lesson Plan in online learning. Basic Competencies and Competency Achievement Indicators formulated can be seen in table 5.

Table 5. Basic Competencies and Competency Achievement Indicators

Core Competences	Indicators of Competence Achievement
3.1 Understand the theory of collisions (collisions) to explain chemical reactions	3.1.1 Calculating the concentration of a solution (molarity of the solution) 3.1.2 Explain the meaning of collision theory and the rate of reaction
3.2 Analyze the factors that affect the reaction rate and determine the order of the reaction based on experimental data	3.2.1 Determine the order of the reaction and the rate equation for the reaction 3.2.2 Understand the factors that affect the rate of a reaction 3.2.3 Process and

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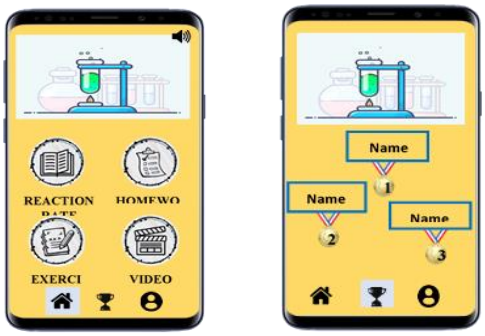
	analyzed data from an experiment on factors that can affect reaction rates

As the result, the product to be developed in this research is an Android-based interactive learning media with advantages consisting of several features, namely material with an attractive appearance so that students not feel bored; interactive exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations. In addition, the learning media should be used both online and offline to avoid network and internet quota problems.

3.1.2 Design Stage

At this stage the researcher collects data and then formulates models, goals and activities to develop a good learning media and in accordance with the needs of teachers and students. The purpose of data collecting is to get an overview in making learning media and its framework. Data needs include subject matter in accordance with learning environment that previously analyzed. The selection of models on learning media that are in accordance with activities that are integrated through interactive learning. After analyzing and collecting data, the learning media design that will be made is planned to consist of three main menus, namely home, score and account.

The design on the home menu consists of material that contains previously collected material, exercise contains 10 multiple choice practice questions, homework contains questions related to learning videos and can be done at home; and a learning video consisting of 3 videos. The design on the score menu consists of students' ranking in doing the exercise. The student with the highest score will rank first at the top, followed by the second, third, and so on. In profile menu consists of feature log in and log out. If the students are entering the application for the first time, they will be directed to fill in their email, student name, class and password. If students already have an account, they only need to enter their email and password when logging in. The design of Android-Based Learning Media can be seen in figure 3.



(a) (b)

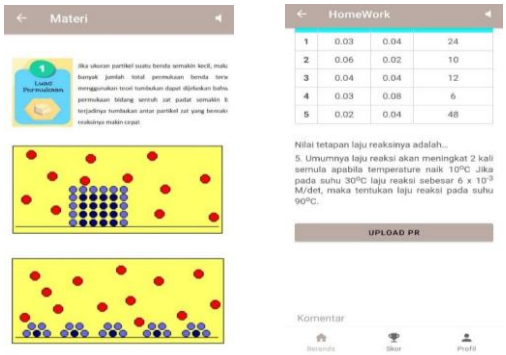
(c)

Figure 3. Design of Android-Based Learning Media. (a) home menu, (b) score menu, (c) profile menu.

3.1.3 Development Stage

Learning media was developed using the android studio application with the java programming language. The data that has been successfully collected at the data collecting stage is then inputted and compiled in the application based on a predetermined design. The output produced is the LydApps: Android-based Reaction Rate Chemistry Learning Applications which can be operated using Android devices and has a storage capacity of 40 MB. The menu contained in this application consists of 3 main menus, namely the home menu, score menu and profile menu.

The home menu consists of the researcher's profile which is located at the top of the page. In this home menu there are also several icons, namely reaction rate material, homework, exercise and video which are located under the profile. Reaction rate material is a page that contains basic competencies, learning objectives, concept maps and reaction rate materials that have been equipped with pictures, animations, examples of questions and solutions, and conclusions. Homework is a page that contains as many as 5 essay questions. This page is also equipped with features uploading comments and files. Exercise is a page that contains 10 multiple choice questions. This page is also equipped with a true or false feature. Video is a page that contains 4 videos that are linked to YouTube. Home menu content can be seen in figure 4.



(a) (b)

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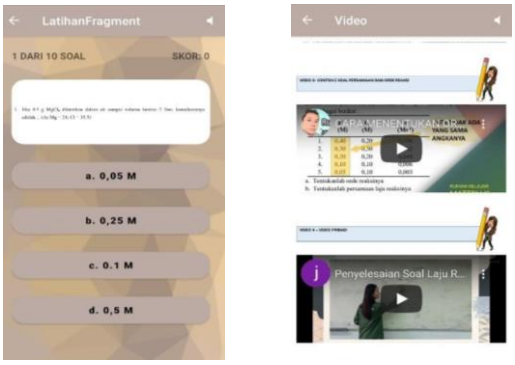

(a) (b)

Figure 4. Home Menu Content. (a) reaction rate material, (b) homework, (c) exercise, (d) video.

Score is a menu that contains the value obtained by students after doing the exercise (figure 5**).** In this menu, students with the highest and fastest scores in doing the exercise will be ranked 1, and so on will be sorted. This rating is visible to all app users.

Figure 5. Display of Score Menu

Profile is a menu that contains the identity of the account owner or user in the form of email and class (figure 6). In this menu there is also a logout feature that allows users to log out of their accounts. If the user wants to log back into the account, then simply enter the registered email and password.

Figure 6. Display of Profile Menu

3.1.4 Implementation Stage

After the media was validated and revised, the learning media in the form of LydApps: Chemistry Learning Applications Reaction Rates were then implemented for class XI students of SMAN 12 Medan. The class that became the sample in this study was class XI Science 2 as many as 25 students.

3.2 Learning Media Feasibility Result Based on Android Integrated BSNP

The feasibility of Android-based learning media is assessed from several aspects in accordance with the BSNP feasibility criteria. Based on the calculation results, the percentages for the aspects of content feasibility, display feasibility, language feasibility and graphic feasibility, respectively are 3.75, 3.83, 4, and 3.83. The final result obtained from the average value of the four aspects is 3.85. Based on this, the android-based learning media developed by the researcher is declared valid (table 6).

Table 6. Learning Media Assessment Results Based on BSNP Integrated Media Android

Assessment Component	Validator		Average	Validity Criteria
	L	T		
Content Feasibility	3.71	3.79	3.75	Valid (doesn't need revision)
Display Feasibility	3.77	3.89	3.83	Valid (doesn't need revision)
Language Feasibility	4	4	4	Valid (doesn't need revision)
Graphic Feasibility	3.85	3.81	3.83	Valid (doesn't need revision)
Average	3.83	3.9	**3.85**	Valid (doesn't need revision)

3.3 Data Analysis of Research Test Instrument

The analysis of the test instrument carried out by the researcher was to provide a test instrument of 40 questions in the form of multiple choice. Data analysis of research test instruments was processed using Microsoft Excel 2019.

3.3.1 Validity Test

The criteria used in the validity test is rcount > rtable, then the question is said to be valid. For N = 34 at the significance level α = 0.05, the rtable is 0.399. Based on the calculation (appendix 12), it's obtained rcount = 0.682. So based on the analysis, 0.682 > 0.399, 26 valid questions were obtained and there were 14 invalid questions. Furthermore, as many as 26 questions that have been declared valid, were further tested to determine the level of reliability, level of difficulty and distinguishing power. Item test validity can be seen in table 7.

Table 7. Item Validity Test

Nu	Criteria	Question Number	Total
1.	Valid	1, 2, 3, 5, 6, 7, 8, 10, 11, 13, 14, 17, 19, 20, 22, 23, 24, 25, 26, 29, 30, 32, 33, 36, 37, 38	26
2.	Invalid	4, 9, 12, 15, 16, 18, 21, 27, 28, 31, 34, 35, 39, 40	14

3.3.2 Reliability Test

For N = 34 at the significance level α = 0.05, the rtable is 0.399. Based on the analysis of the data in the appendix 13 obtained the level of reliability of the test instrument (rcount) = 0.824. By comparing the value that have been obtained, it

can be seen that 0.824 > 0.339 or rcount > rtable. Thus, it can be concluded that the item test is Reliable.

3.3.3 Problem Difficulty Level Test

A good question is one that is not too easy or not too difficult. A test item is said to be feasible if the P value is between 0.20 - 0.80. Based on the analysis of the difficulty level of the test items in the appendix 14, from the 26 valid questions, as many as 24 questions were declared feasible, while two questions are not feasible and categorized as too easy question. Item problem difficulty level test can be seen in table 8.

Table 8. Item Problem Difficulty Level Test

Nu	Criteria	Description	Question Number	Total
1.	Medium	Feasible	1, 2, 3, 5, 6, 7, 8, 10, 11, 13, 14, 17, 19, 20, 23, 24, 26, 29, 30, 32, 33, 36, 37, 38	24
2.	Easy	Not Feasible	22, 25	2

3.3.4 Distinguishing Power Test

A test item is declared feasible if D ranges between 0.2 - 1.0. Based on analysis of distinguishing power of the test item in the appendix 15, from the 26 valid questions, 21 questions were declared feasible with the criteria of 13 sufficient questions and 8 good questions. Meanwhile, there are 5 questions that are not feasible because they are categorized as bad. Item distinguishing power test can be seen in table 9.

Table 9. Item Distinguishing Power Test

Nu	Criteria	Description	Question Number	Total
1.	Bad	Not Feasible	20, 22, 25, 29, 30	5
2.	Sufficient	Feasible	2, 3, 7, 11, 13, 14, 17, 19, 23, 26, 32, 33, 38	13
3.	Good	Feasible	1, 5, 6, 8, 10, 24, 36, 37	8

Based on the validity, reliability, difficulty level and distinguishing power tests, it was concluded that 21 items were suitable for use as a test instrument.

3.4 Analysis of Android-Based Learning Media Implementation

The data from the implementation of android-based learning media in this study were student learning outcomes data in the form of pre-test and post-test which were tested for normality and homogeneity.

3.4.1 Pre-Test and Post-Test Data

Based on the calculation of students learning outcomes, it is obtained that the average value of the pre-test is 59.2 and the average value of the post-test is 85.6. The KKM used in this study was 78, in accordance with the KKM that had been determined at SMAN 12 Medan. Thus, it can be stated that the students' average pre-test scores are lower than the KKM scores, while the students' post-test averages are higher than the KKM scores. Diagram of students learning outcomes can be seen in figure 7.

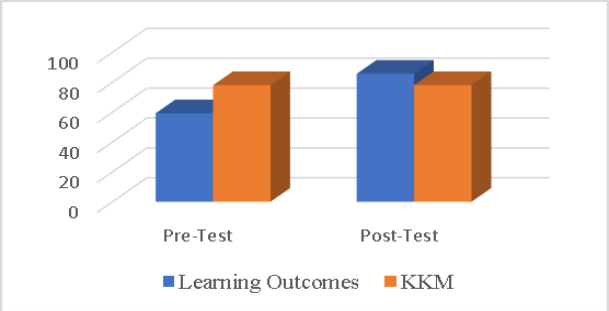

Figure 7. Diagram of Comparison of Student Learning Outcomes with KKM value

3.4.2 Normality Test

The normality test using the Chi Square method was first carried out by dividing the data into six classes and entering them into the auxiliary table. The complete calculation of the normality test for pre-test and post-test data summarized on the table 10.

Table 10. Normality Test Calculation

Data	X^2 count	X^2 table	α	Description
Pre-Test	10.78	11.070	0.05	Normally Distributed
Post-Test	8.78	11.070	0.05	Normally Distributed

As shown in table 10, the Chi Square count (X^2) of pre-test and post-test is 10.78 and 8.78, respectively. Chi Square table at α = 0.05 with db = 5 is 11.070. By comparing the value that have been obtained from pre-test and post-test data, it can be seen that 10.78 < 8.78 or $t_{count} < t_{table}$. Thus, it can be concluded that the pre-test and post-test data is Normally Distributed.

3.4.3 Homogeneity Test

The homogeneity test aims to test whether a data group of pre-test and post-test has the same variance among the members of the group. The homogeneity test carried out in this study was the homogeneity test of one sample group. To calculate the variance and standard deviation of one sample group, a supporting table is needed as attached in the appendix 19. The complete calculation of the homogeneity test of pre-test and post-test data can be seen in the appendix 19 and summarized in table 11.

Table 11. Homogeneity Test Calculation

Data	Squared Deviation $(Xi - X)^2$	Variance (s^2)	Standard Deviation (s)
Pre-Test	4584	191	13.820
Post-Test	2016	84	9.165

Based on table 11, the variance and standard deviation values obtained from the pre-test data are 191 and 13.820, respectively. While the value of variance and standard deviation of the post-test data obtained is lower than the pre-test data, namely 84 and 9.165.

3.4.4 Hypothesis Test

Hypothesis testing is done by using one sample t-test. Prior to testing, the determination of the hypothesis is done first. The hypothesis formulated by the researcher is as follows:

Ha : Student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

H_0 : Student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are lower than KKM value.

Based on the hypothesis calculation on the appendix 20, it is obtained the value of t_{count} is 4.146. The value of t_{table} at α= 0.05, db = 24 is 1.711. By comparing the values that have been obtained, it can be seen that 4.146 > 1.711 or $t_{count} > t_{table}$. Thus, it means that Ha accepted or H_0 rejected. So, the conclusion is student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

3.5 Discussion

The first stage carried out by the researcher was the analysis stage. Based on the results of observations of teachers and students conducted through interviews and questionnaires, the use of learning media, especially android-based learning media in the learning process has not been able to run effectively. The teacher stated that the lack of use of android learning media was due to network barriers and internet packages that often occurred so that the teacher preferred to carry out the learning process by giving assignments to students. Furthermore, this statement is supported by the results of the questionnaire, the biggest obstacles experienced by students are limited communication with teachers (67.3%) continues with inadequate internet network (42.3%), 88.5% of students agree that the learning media used by teacher did not vary and did not support active interaction between teachers and students during the learning process so that learning still seems monotonous.

The challenge that must be faced in implementing electronic learning media in online learning is the availability of internet services and the costs required to buy internet packages are also quite large so that students feel burdened by it[8]. Learning media using the internet also has a disadvantage, namely that it depends on the network. If the network and signal do not support it, then learning media based on Android and computers will be difficult to implement[9]. Learning media must consider the obstacles experienced by students. As the result, the product to be developed in this research is an Android-based interactive learning media with main advantages which has a low capacity for using internet packages and can be used online and offline. In addition, several additional advantages of the Android-based interactive learning media are composed of several features, namely material with an attractive appearance so that students not feel bored; interactive exercises integrated with sound, true or false answers with the discussion and score; homework integrated with comment and upload file feature; learning videos that support chemical calculations.

The second stage is design, the data collected is in the form of teaching materials for chemistry, reaction rates and animations; 4 learning videos consisting of 3 YouTube videos and 1 personal video; 40 questions about the reaction rate which will then be validated, then from 40 questions 15 questions will be taken to be inputted into the learning media. Furthermore, the researchers designed the layout for each menu and icon that will appear on this learning media.

The differences between the media developed in this study and previous research are the media that will be developed in this research is Learning Application Based on Android which can be used both online and offline, the media uses sound that can be turned on or off according to the user's wishes, the material is integrated with moving images and animations, the exercise not only can state a true or false answer but also consist of the discussion of the problem, the homework consists of the comment feature and uploads file, a score ranking feature and a log out feature.

The third stage is development, the researchers compiled an android-based learning media in reaction rate material and in accordance with the BSNP. Learning media was developed using the android studio application with the java programming language. The output produced is the LydApps: Android-based Reaction Rate Chemistry Learning Applications with 40 MB storage capacity. Furthermore, this learning media was validated by material experts and media experts. The results of media validation for the aspects of content feasibility, display feasibility, language feasibility and graphic feasibility are 3.75, 3.83, 4, and 3.83, respectively. The final result obtained from the average value of the four aspects is 3.85 and declared valid with the criteria doesn't need revision. This is in accordance with the BSNP eligibility criteria which is divided into 4 criteria, namely valid and does not need to be revised in the range 3.26-4.00, valid and does not need to be revised in the range 2.51-3.25, invalid and some of the contents need to be revised in the range 1.76-2.50, invalid and need to be totally revised in the range 1.00-1.75[10].

The fourth stage is implementation. At the first meeting, pre-test was conducted to students. After giving the pre-test, students will be taught several subtopics on the reaction rate material using android-based learning media. At the second meeting students will continue the subtopic on the reaction rate material that has not been studied at the first meeting using android-based learning media. After that, students will be given a post-test. The results obtained for the average pre-test score of students were 59.2 with a minimum score of 30 and a maximum score of 80, while the average post-test score of students was 85.6 with a minimum score of 60 and a maximum score of 100. The KKM scores of students in this study is 78.

Based on the data obtained, it can be seen that the average score of the students' pre-test is lower than the KKM score.

This is because the learning media has not been applied to students. Students are still learning online independently and only do the assignments given by the teacher. This makes students not master the material as a whole. Meanwhile, the average post-test score of students is higher than the KKM score. This is because the android-based learning media has been applied in the learning process. This android-based learning media provides an effective learning space for students because it has been equipped with interesting features. Students no longer have difficulty understanding the material because this learning media is also equipped with interesting videos, and is equipped with interactive practice questions that help students find the right solution to the problem.

The learning media used for the learning process has not been varied and has not supported active interaction between teachers and students during the learning process so that learning still seems monotonous. The concept of material that is abstract, difficult to visualize, and the use of learning media has not been maximized, causing a lack of student interest in the learning process so that students do not focus on the online learning process and lead to low student learning outcomes[11].

Furthermore, hypothesis testing is carried out to draw conclusions from this study. Hypothesis testing was carried out using one sample t-test. The data used in hypothesis test in this research is post-test data. If the value of t_{count} is in the critical area ($t \geq t_{\alpha}$) so H_0 rejected or Ha accepted. The value of t_{count} that obtained is 4.146. The value of t_{table} at α= 0.05, db = 24 is 1.711. By comparing the values that have been obtained, it can be seen that 4.146 > 1.711 or $t_{count} > t_{table}$. Thus, it means that **Ha accepted or H_0 rejected.** The conclusion is student learning outcomes who are taught using interactive learning media on the reaction rate material that has been developed are higher than KKM value.

The disadvantages of this research are the limitations in developing the comment feature and uploading files on homework. This limitation is in the form of comments and files sent by users will enter the programming system so that comments and files can only be seen by researchers (media creators) after being extracted from the system and have minimal capacity of file uploaded.

4. CONCLUSION

1. Android-based interactive learning media been developed met the feasibility standards based on the android-based integrated BSNP in value 3.85 with criteria valid and doesn't need revision
2. Student learning outcomes taught using android-based interactive learning media that have been developed higher than the KKM value.

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An Ensemble Learning Model for Predicting Social Engineering Pharming Attacks

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Abstract: Pharming attack has a broad scope as social engineers can masquerade as anyone, particularly during the COVID-19 pandemic from health authorities or even organization executives getting in touch with their personnel. The study aims to develop an ensemble model for predicting social engineering-based pharming attacks from the client-side pharming attack. The target population for the study includes 1781 URLs, which are secondary and readily available on Kaggle having been compiled by Manu Siddhartha. The study focused on identifying URLs that facilitate Pharming attacks, a cybersecurity threat. Malicious URLs miss the protocol segmentation, certificate of authorization, and bait targets into becoming victims of pharming attacks. The research instrument used for data process and building a pharming attack model was CSV and Jupyter notebook. Data was collected from secondary data sources. A model for predictive pharming attacks was built utilizing Logic regression, Random Forest, and gradient boost as the model for boosting algorithms to reduce pharming malware attacks.

Keywords: *Ensemble learning, Pharming attack, Phishing, Social Engineering,*

1. INTRODUCTION

The widespread adoption of internet usage has subsequently led to an increased number of cyber-attack vectors through social engineering [1]. Social engineering attacks are a type of cybercrime where the attacker fools the target through impersonation, pretending to be someone the target knows. Considering cyber security, social engineering accomplishes its malicious goals by captivating human weaknesses. Social engineering is a grim security threat to nations, users, data and its operations and technological infrastructure [2].

Phishing is a type of social engineering whereby social engineers try to deceitfully acquire sensitive information from a target by pretending to be a reliable third party, which entails obtaining access credentials like username, and password [3]. The phishing attack is executed through email spoofing or messaging, and it instructs users to provide personal data on bogus websites. The interface of the bogus website is identical to the genuine website, the only dissimilarity is the URL of the website [4].

Pharming and phishing terms have been used concurrently and these can initiate the capacity for online identity theft. A Pharming attack will redirect the target to the bogus website even though the target is typing the right website address [5]. Pharming encompasses seizing the user's browser settings or running a background process that spontaneously readdresses targets to a bogus site. Most of the time, social engineers aim to access financial data or the authentication of the target credentials, so the redirect prompts when the targets circumnavigate to a financial or banking website [6].

Pharming is a superior kind of phishing attack or DNS poisoning whereby the target is redirected to a bogus website by altering the IP address at the DNS server thus obtaining personal, private, or confidential information or data through technical means [7].This could be an individual or a well-known organization thus gaining access to private data by manipulating the user's email and ads. The highly prevalent pharming aimed websites are online banking and e-commerce websites. As a result of the absence of security administration, desktops are also vulnerable to pharming attacks. An example of pharming is attackers replacing the phone book with a fake one they created [8].

This study aims to build a model to predict pharming malware attacks as a solution, to minimize fraud in cyberspace that is executed through pharming attacks. The develop an Ensemble model for predicting social engineering-based pharming malware attacks. The ensemble is found to be a superior answer to detecting malware pharming attacks. Since it can combine the resemblance in accuracy and several error-detection rate characteristics in picked algorithm[9].

Remarkably, ensemble learning model framework has been utilized globally to detect malwares and improve on prediction accuracy on malware prediction models. Nevertheless, the challenge has occurred in the selection of models that are more suitable for predicting pharming malware on the client side. Thus, a recommendation for further this work to be extended by going into depth of parameters of pharming attacks by finding more suitable features based on URL and website[5].

2. RELATED WORKS

Gajera, Jangid, Mehta, & Mittal, [7] used Artificial Neural Networks ANN for pharming prediction. Elements were picked based on URL parameters and ingested into neural networks for training. The identification amongst genuine websites. The prediction of malicious websites and the addresses were queried to local and global DNS, if they

equally return the same output then the website is genuine otherwise pharming attack was existing.

Ibrahim S. Alfayoumi, [8] presented a client-side approach for predicting pharming malware attacks on the base of the Authorized DNS serve IP Address matching approach. IPS are picked from local and genuine servers and in the subsequent, step their IP addresses are checked. If the IP address is mapped, then it is dispatched as a genuine website. The information collected from the ZONE file is verified and if discrepancies then it is stated that Pharming malware has transpired.

Manhas, Taterh, and Singh, [5] carried a study on the prediction of Pharming attacks on websites using the SVM Classifier. The study entails providing an additional safety Transport Layer Security/Secure Sockets Layer (TLS/SSL) was introduced. By defining a classifier that was able to predict the malicious websites up to great extent. The implementation was set up in MATLAB along with its different modules and libraries for the attribute .

Do Xuan, Nguyen, & Tisenko, [10] study on Malicious URL prediction based on Machine Learning. Machine learning algorithms are applied to classify URLs based on their attributes and behaviour's of URLs. The characters are mined from static and dynamic behaviour's of URLs thus new to the literature. Support vector machine (SVM) and Random Forest (RF) are the two supervised machine learning algorithms used.

Azeez, Oladele and Ologe, [6] conducted a study on Identification of pharming in communication networks using ensemble learning. Analyzed combinations' outcomes and each base learner model's results were compared in order to assess performance. The significance measurements were weighed, and calculated, including Accuracy (Initial Split Assessment), Mean Accuracy (Cross Validation Evaluation), Accuracy, Recall, and Log loss Positive, False Positive, Positive, True F-score, negative, and false negative.

Cohen, Nissim, and Elovici, [11] conducted a study titled Machine learning based solution for the detection of malicious JPEG (images) . In order to distinguish between legitimate and malicious JPEG images, MalJPEG statically extracts 10 straightforward yet discriminative properties from the JPEG file structure. The paper assessed MalJPEG using a real-world sample of 156,818 photos, of which 155,013 (98.85%) are benign and 1,805 (1.15%) are malicious. With an area under the receiver operating characteristic curve (AUC) of 0.997, a true positive rate (TPR) of 0.951, and a very low false positive rate (FPR) of 0.004, the results suggest that MalJPEG, when combined with the LightGBM classifier, exhibits the highest detection capabilities.

A Novel Machine Learning Approach for Malware Detection Malware analysis is the process of finding malware on a system. Static analysis and dynamic analysis make up both halves. A malicious file can be examined using static analysis, and a file can be observed being processed using dynamic analysis. The study presented a methodology for malware analysis that is based on dynamic malware detection and semi-automated malware detection, which is often machine learning. The framework employs the process of classification and displays the quality of experience to preserve efficiency trade-offs. Malware samples demonstrate that a robust detection mechanism was created by the framework.

3. PROPOSED APPROACH

Predictive analytics are techniques that help to make predictions. They analyze current and historical data to answer the question. All predictive analytics are probabilistic. Therefore, they do not indicate what will be the outcome in the future but anticipate what might happen in the future. Predictive analytics doesn't predict one likely future, but rather "multiple futures" based on the outcome actions. The predictive analytical process was utilized which consists of the phases explained briefly below.

Phase 1: Data discovery

Data discovery was achieved at the outset by collecting the data from all of the accessible sources. Understanding the data facilitated in selecting the algorithm. This was achieved by visualizing the data in in Jupyter notebook as shown in Figure 4.2. Understanding the essential information pertaining to the data assisted in making an initial decision on an algorithm.

The size of data some algorithms operate well with big chunks of data than others. The small training datasets, algorithms with low variance and high bias classifiers will run better. Compared to low bias/ high variance classifiers. Thus, for small training dataset, Naïve Bayes will perform well than KNN.

The characteristics of data this indicates how the dataset was formed. The dataset utilized in the study is linear. Thus utilized the logistic regression and random forest model fitted it best, since the data was more complex. The dataset behaviour, the features are sequential thus utilized the random forest.

The dataset from Malicious and Benign Websites | Kaggle set comprises 1781 websites and 21 columns.. These features facilitated predicting the malicious websites that lead to a pharming attack. There are 15 numerical variables, 4 categorical variables, and 2 Date variables. Table 3.1 detailed tabulation of the statistical and classified variables as derived from the Kaggle.

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Table 3.1 Data Understanding

Variable Name	Definitions of the variable
'URLs'	The unidentified URL analysed in the study
'URLs_LENGTH'	The URL length, the number of characters.
'NUMBER_SPECIAL_CHARACTERS'	The tally of the unique characters in the URL, for example (/, %, #, &)
'CHARSET'	The categorical variable - character encoding standard or character set
'SERVER'	The operative system of the server, from the packet response (categorical variable)
'CONTENT_LENGTH'	The content size of the HTTP header
'WHOIS_COUNTRY'	The nations we got from the server reaction, explicitly, our content utilized the API of Who is (categorical variable)
'WHOIS_STATEPRO'	The states we got from the server response, specifically, our script used the API of Who is (categorical variable)
'WHOIS_REGDATE'	Server registration date This variable has date values with format (DD/MM/YYY HH:MM)
'WHOIS_UPDATED_DATE'	The last update date from the analysed server
'TCP_CONVERSATION_EXCHANGE'	The number of TCP packets exchanged between the server and our honeypot client
'DIST_REMOTE_TCP_PORT'	The number of the ports detected and different to TCP
'REMOTE_IPS'	Total number of IPs connected to the honeypot
'APP_BYTES'	Number of transferred bytes
'SOURCE_APP_PACKETS'	Packets sent from the honeypot to server
'REMOTE_APP_PACKETS'	Packets received from server
'SOURCE_APP_BYTES'	The source of the app bytes
'REMOTE_APP_BYTES'	The remote app bytes
'APP_PACKETS'	Complete number of IP created while the correspondence between the honeypot and the server
'DNS_QUERY_TIMES'	DNS packets generated during the communication between the honeypot and the server
'TYPE'	Represent the type of web page analysed (1 is for malicious websites and 0 is for benign websites)

Data discovery involved the following steps

Step 1: Data pre-processing

Data pre-processing was performed once the data set was discovered. The collected datasets underwent dataset processing in order to further tailor them to the needs of the study. Pre-processing involved a number of processes, including

- Data cleaning is the task of smoothening filling missing values, noise, and solving discrepancies.
- Data feature selection
- Data Retrieval ingesting the data into the Jupyter notebook.
- Dataset transformation to modifying data so that can be ready for predictive analytics.
- Data selection identifying suitable data sources, analytics libraries/algorithms, as well as relevant variables data.

This data Kaggle data set comprises 1781 websites and 21 columns. These features facilitated predicting the malicious websites that lead to a pharming attack. There are 15 numerical variables, 4 categorical variables, and 2 Date variables. During the data understanding stage that it was detected the "URL" variable has 1781 unique values. This translated to a unique value for each website in the dataset, thus being the unique identifier for each URL.

The data was stored in the local disk, and later it was ingested into the Jupyter notebook. The data processing and analysis was conducted using Python programming language in the Jupyter notebook. The programme was utilized for data processing, data analysis, data mining and ensemble learning to model the predictive model. The data collected was hence visualized in graphs and charts. Highlighting the quantitative analysis with qualitative data was also stated. The statistical data mining and machine learning tools, like per cent, correlation, classification, and regression was utilized to interpret the study findings. The study utilized three ensemble learning method boosting Algorithm.

Step 2 Feature Selection

The main objective of the study was to develop a model to predict pharming malware attacks via malicious links. Pharming is a subset of phishing attacks even though pharming malware executes the DNS poisoning. However, the study core goal was not to explicitly differentiate pharming attack and phishing attack, but rather build a model that will enable prediction of malicious links which can propagate pharming attack. Thus, by extension enable post process malware analysis that can help to identify specific pharming attack from any other pharming attack. Figure 3.2 indicates the features manual select from the dataset.

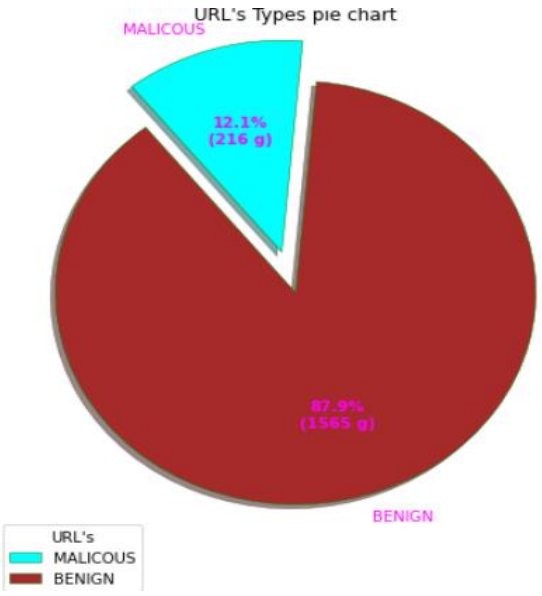


Figure 3. 1 Percentage of Malicious to Benign URLs

The length of the URL - Long URLs could be used to hide the questionable portion from view in the address bar. Even if there is a reliable scientific method for determining whether a website is malicious or benign, there are parameters that must be met. The dataset was used to pick the length of the URL value, which was done by manually comparing the lengths of the longest benign and malicious websites in the dataset.

Step 3 Data Retrieval

The data was then loaded on Jupyter notebook using panda's python library from the local disk where it was initially stored after the download from Kaggle website. The dataset for pre-processing, exploration, and the building of the predictive model. Part 1. Importing the libraries to facilitate dataset loading as indicated below.

```
In [3]: import numpy as np # linear algebra
        import pandas as pd

        from sklearn.feature_extraction.text import CountVectorizer,TfidfVectorizer
        from sklearn.base import TransformerMixin
        from sklearn.pipeline import Pipeline
        import string
        from sklearn import metrics
        import matplotlib.pyplot as plt
        import os
        import seaborn as sns

        import warnings
        warnings.filterwarnings('ignore')
```

```
C:\Users\Injuguna\AppData\Roaming\Python\Python37\site-packages\pandas\compat\_optional.py:138: UserWarning: Pandas requires v
rsion '2.7.0' or newer of 'numexpr' (version '2.6.9' currently installed).
  warnings.warn(msg, UserWarning)
C:\ProgramData\Anaconda3\lib\site-packages\sklearn\feature_extraction\image.py:167: DeprecationWarning: `np.int` is a deprecat
d alias for the builtin `int`. To silence this warning, use `int` by itself. Doing this will not modify any behavior and is sa
e. When replacing `np.int`, you may wish to use e.g. `np.int64` or `np.int32` to specify the precision. If you wish to review
our current use, check the release note link for additional information.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  dtype=np.int):
```

Part 2. Loading of data into the Jupyter notebook

```
In [4]: data = pd.read_csv('C:\pydatafiles\Kaggle_Dataset3.csv')
        data.head()
```

Out[4]:

	URL	URL_LENGTH	NUMBER_SPECIAL_CHARACTERS	CHARSET	SERVER	CONTENT_LENGTH	WHOIS_COUNTRY	WHOIS_STATEPRO
0	M0_109	16	7	iso-8859-1	nginx	263.0	None	None
1	B0_2314	16	6	UTF-8	Apache/2.4.10	15087.0	None	None
2	B0_911	16	6	us-ascii	Microsoft-HTTPAPI/2.0	324.0	None	None
3	B0_113	17	6	ISO-8859-1	nginx	162.0	US	AK
4	B0_403	17	6	UTF-8	None	124140.0	US	TX

5 rows × 21 columns

Step 3 Data cleaning

This entails the task of smoothening noise, filling missing values and resolving inconsistencies in a given dataset. Below are the data cleaning process undertaken to prepare the dataset. The column CONTENT_LENGTH has 50% of the value blank. The variable "APP_PACKETS" has duplication of values with "SOURCE_APP_PACKETS". The variable 'WHOIS_STATEPRO' also had values that were either initials or numbers. To understand the data below is a snippet of the statistical summary

```
In [5]: data.describe(include='all')
```

Out[5]:

	URL	URL_LENGTH	NUMBER_SPECIAL_CHARACTERS	CHARSET	SERVER	CONTENT_L
count	1781	1781.000000	1781.000000	1781	1780	966
unique	1781	NaN	NaN	9	239	
top	M0_109	NaN	NaN	UTF-8	Apache	
freq	1	NaN	NaN	676	386	
mean	NaN	56.961258	11.111735	NaN	NaN	11726
std	NaN	27.555586	4.549896	NaN	NaN	36391
min	NaN	16.000000	5.000000	NaN	NaN	0
25%	NaN	39.000000	8.000000	NaN	NaN	324
50%	NaN	49.000000	10.000000	NaN	NaN	1853
75%	NaN	68.000000	13.000000	NaN	NaN	11323
max	NaN	249.000000	43.000000	NaN	NaN	649263

11 rows × 21 columns

On further understanding the data the variable URL is totally unique. Also, as we preview the first 5 lines, we depicted it as an identifier that is mapping key and does not define the URL Hence the conclusion to drop it from the data set. Identifying if there were any missing values and thus clean up the dataset and fill the empty data points. Below is the result after this process.

```
In [15]: # Interpolate our data to get rid of null values
         data = data.interpolate()
         print(data.isnull().sum())
```

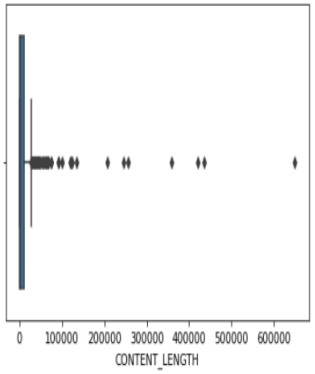
```
URL_LENGTH                 0
NUMBER_SPECIAL_CHARACTERS  0
CHARSET                    0
SERVER                     0
CONTENT_LENGTH             0
WHOIS_COUNTRY              0
WHOIS_STATEPRO             0
WHOIS_REGDATE              0
WHOIS_UPDATED_DATE         0
TCP_CONVERSATION_EXCHANGE  0
DIST_REMOTE_TCP_PORT       0
REMOTE_IPS                 0
APP_BYTES                  0
SOURCE_APP_PACKETS         0
REMOTE_APP_PACKETS         0
SOURCE_APP_BYTES           0
REMOTE_APP_BYTES           0
APP_PACKETS                0
DNS_QUERY_TIMES            0
Type                       0
dtype: int64
```

Step 4 Data integration

The next step was to drop outliers from the column content length using the linear method to facilitate model creation.

```
In [11]: # Handling missing values and outliers for CONTENT_LENGTH feature
         sns.boxplot(data.CONTENT_LENGTH)
         data.CONTENT_LENGTH.describe()
```

```
Out[11]: count       967.000000
         mean      11733.697001
         std       36429.131522
         min           0.000000
         25%         324.000000
         50%        1853.000000
         75%       11324.500000
         max      649263.000000
         Name: CONTENT_LENGTH, dtype: float64
```



```
In [12]: # dropping the outliers

         data = data.drop(data[data['CONTENT_LENGTH']>300000].index.values)
         data.CONTENT_LENGTH = data.CONTENT_LENGTH.interpolate(method ='linear')
         print(data.shape)
         data.isnull().sum()

         (1775, 21)

Out[12]: URL                         0
         URL_LENGTH                  0
         NUMBER_SPECIAL_CHARACTERS   0
         CHARSET                     0
         SERVER                      0
         CONTENT_LENGTH              0
         WHOIS_COUNTRY               0
         WHOIS_STATEPRO              0
         WHOIS_REGDATE               0
         WHOIS_UPDATED_DATE          0
         TCP_CONVERSATION_EXCHANGE   0
         DIST_REMOTE_TCP_PORT        0
         REMOTE_IPS                  0
         APP_BYTES                   0
         SOURCE_APP_PACKETS          0
         REMOTE_APP_PACKETS          0
         SOURCE_APP_BYTES            0
         REMOTE_APP_BYTES            0
         APP_PACKETS                 0
         DNS_QUERY_TIMES             0
         Type                        0
         dtype: int64
```

Step 5 Data Selection

The dataset was split into two datasets consist of the testing sets for evaluating the performance of the assembled model and training set for model assembling. The research implemented the train test procedure which entails having separate data for training and testing the performance of the predictive model. The classification was based on the variable 'TYPE' thus separating it into two different data frames.

```
In [23]: from sklearn.model_selection import train_test_split
         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.20, r
         om_state = 10)
```

Separating training and test data

The dataset was split on a ratio of 70:30 where 70 percent of the data was utilized for training functions while else the 30 percent was utilized for testing. the random state was to ensure that this can be recreated test/training split and reinvent the results.

```
In [24]: X_train.shape, X_test.shape, y_train.shape, y_test.shape

Out[24]: ((1420, 16), (355, 16), (1420,), (355,))
```

Phase 2. Model Development

This phase is the task of building a model that was utilized to predict the pharming malware attack. Data Mining Task which was built and train using the training data set. This entailed defining the model object which refers to specifying the components of the model and their interconnections. Compile the defined model object converting the model into an executable model. Training the model which is performing machine learning to train the model by calling the model. fit () method and passing input attributes (X) sample and output attributes (Y) sample.

Ensemble learning was the selected algorithm utilized to building the pharming malware prediction model. This entails merging the strengths drawn from simpler base models. There are several techniques that form the basis of ensemble learning in this study we will utilize boosting ensemble mechanism with base model Random Forest, Logistic regression, and Gradient boosting. Random forests the method depend on multiple decision trees for training purposes. The predictions from the trees are assembled simultaneously in making a final prediction. This was achieved by using the mean prediction for regression based random forest. This technique of combining multiple trees is the basis for reference for an ensemble technique. Random Forests are extensively used to solve real world machine learning challenges that would require classification or regression-based solutions.

The baseline models were varied, and 10-fold cross-validation was used to determine which baseline models will be used at level 0 of the ensemble learning approach and which ones will have the best performance. The same datasets as the baseline models were used for a variety of machine learning algorithms. The best machine learning classifiers for detecting fraud were found to be Random Forest, Logistic Regression, MLP, and Gradient Boosting classifiers [9].

The study utilizes the random forests is used into working together with random feature selection. Every new training set was drawn, with replacement, from the initial training set. Then a tree was developed on the new training set applying random feature selection. The reason for selecting boosting is it enhance accuracy when random features are utilized. Also boosting can be used to give continuing estimates of the generalization error (PE∗) of the merged ensemble of trees and estimates for the strength and correlation.

The output is numerical in character with the hypothesis of an independently drawn training set from the distribution of random vector Y, X (BREIMAN, 2001).

$E_{xr}(Y\text{-}h(X))^2$

The predictor of a random forest is achieved by attaining the average over k of the trees.

$(h\ (x, O_k))$

The proposed predictive framework of this research encompassed of boosting based ensemble learning algorithms the method inclined towards prediction pharming malware. The first step involved training three ensemble learning algorithms with their default parameters on the training dataset. Three models were created from this specific step by training the three algorithms on our training dataset.

Post-processing task preparing the model for deployment which is visualising the model by calling the plot model () method that creates a plot of the network model. Followed by testing which refers to assessing whether the model has achieved the expected functional requirement such as predicting or describing. Then model was validated by checking what it had achieved the non-functional requirement of accuracy. The model was saved after validation results were satisfactory.

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Phase 3. Model Evaluation

Classification techniques have been applied to many applications in several fields of sciences. The training data are utilized for building a classification model to predict the class label for a new dataset. The outputs of classification models could be discrete as in the decision tree classifier. Though, the outputs of learning algorithms need to be evaluated and analysed meticulously and this analysis interpreted correctly, so as to evaluate different learning algorithms. The confusion matrix was used to assess the trained models as a method of solving a classification challenge. An observation's actual value is listed on the rows of a confusion matrix, while the observation's projected values are listed on the columns. A classification issue known as the binary classification has only two viable solutions (Tharwat, 2018).

Below are defined main lingo and metrics associated with a confusion matrix according to (Tharwat, 2018)

- ✓ True Positive: This indicates whether the observations are true. They are located in the matrix's bottom right cell.
- ✓ True Negative: This designates the observations "NO" that are found in the matrix's top-left cell.
- ✓ False Positive / Type I errors in a model are observations that were expected to be "YES" but were really "NO." They are found in the matrix's top right cell.
- ✓ False Negative/Type II Error: These observations were predicted as "NO" but ended up being "YES," according to the model. They are found in the matrix's bottom left cell.

- ✓ Recall: This shows how many of the dataset's actual positive observations we were successful in correctly predicting. Additionally, known as "Sensitivity of a model.

$$Recall = \frac{TruePositive}{TruePositive + FalsePositive}$$

- ✓ Precision: This tells us how many of the observations that we have predicted to be positive are actual positives.

$$Precision = \frac{TruePositive}{TruePositive + FalsePositive}$$

- ✓ Specificity: This indicates how many of the actual negative observations in our dataset we were able to predict correctly.

$$Specificity = \frac{TrueNegative}{TrueNegative + FalsePositive}$$

- ✓ Accuracy: This indicates how many observations we predicted correctly regardless of whether they are negative or positive.

$$Accuracy = \frac{\text{TruePositive} + \text{TrueNegative}}{\text{TruePositive} + \text{TrueNegative} + \text{FalsePositive} + \text{FalseNegati}}$$

- ✓ The F1-Score evaluates a model's simultaneous recall and precision balance. Since it might be difficult to compare models with high recall and low precision to those with high recall and low precision, it is an important metric. F1 Score was used in the study to assess the trained models.

$$F1 = \frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}}$$

Phase 4: Model Deployment

This phase entailed using the model to predict real produce reports for supporting the decision-making process.

Loading the model - the model structure and weight data was loaded from the saved Jason files. Compile the loaded model was essential before it was used so that predictions made using the model can use the suitable efficient computation from the Keras backend. The model to predict classes of new data cases was used by selecting new data that is not classified and requires new classes to be predicted.

Phase 5: Model Monitoring

This phase entailed validating the deployed model to ensure it has attained non-functional requirements such as accuracy. Using the following

- Select a new data file with input attributes without known classes
- Utilize the deployed model to predict the unknown classes
- Select a file with a list of known classes for the new dataset
- Utilize the list of established classes to validate the performance of the model

Data was sourced from the online data science platform Kaggle. The downloaded URL file was stored on the local disk. The file is retrieved later into the Jupyter notebook platform using various python libraries. The URLs was analysed using the Jupyter notebook, first by pre-processing the ingested data and performing some feature extraction and labelling. The data was visualized using the necessary visualization libraries. The building of a model to predict pharming malware attacks, the model was evaluated, and results tabulated.

4. RESULTS AND DISCUSSION

Factors that lead to pharming malware attack

The relationship between the variables that lead to pharming malware attack was visualized as visualised in Figure 4.1 According to this view, as URL length increases, the likelihood that a website is harmful decreases until the URL length significantly increases. The likelihood that the webpage is dangerous then rises once more.

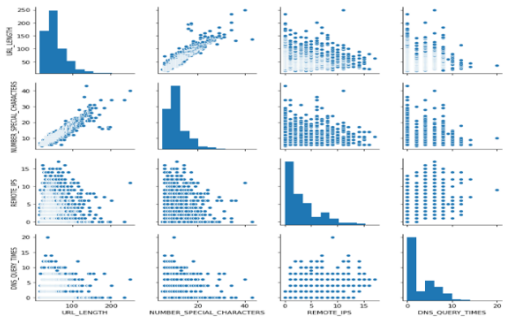

Figure 4.1 Variable Visualization

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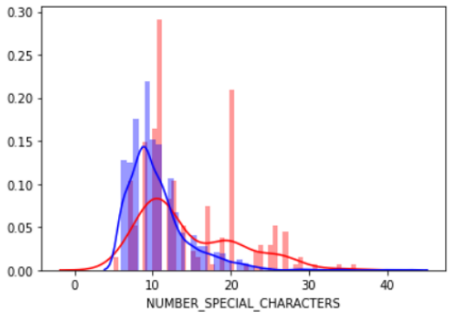
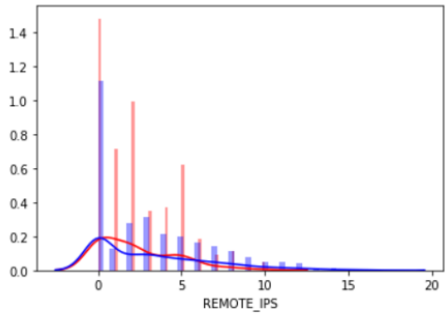
The attributes demonstrated a meaningful link with the target variable, according to the visualizations we performed in the Exploratory data analysis portion. how many special characters are on a URL, the more special characters, the more harmful the website is. The red bars represent the malicious websites, there are some positive peculiar spikes.



The REMOTE_IPS implies that 'this variable has the total number of IPs connected to the honeypot'. Thus malicious websites have a somewhat lesser grouping of remote IPs connected than benign websites.



The average URL_LENGTH of benign url denoted with 1 is higher than of malicious URLs denoted by O. The average CONTENT_LENGTH of benign URL at 17432 is higher than of malicious URLs at 12954. The shorter the URL length the high chances of it being malicious.

Pharming malware predictive model by use of ensemble learning

Logic Regression

A machine learning algorithm called logic regression is used to train classifiers. It is essentially a linear regression model with the logistic/sigmoid function on top. The following is how it is modelled mathematically:

$z = wx + b$

$y = sigmoid(z)$

$$sigmoid(z) = \frac{1}{1 + e^{-t}}$$

This model assumes that all predictors are linearly associated with the log probabilities of the result, which in this case includes evidence of malice. Convergence problems for logistic regression were caused by the predictor variables' multicollinearity. Lasso regression, which only chooses one feature for highly correlated data and minimizes it to zero coefficient, was used to address the convergence concerns. Figure 4.2 shows the Logic Regression ROC Curve

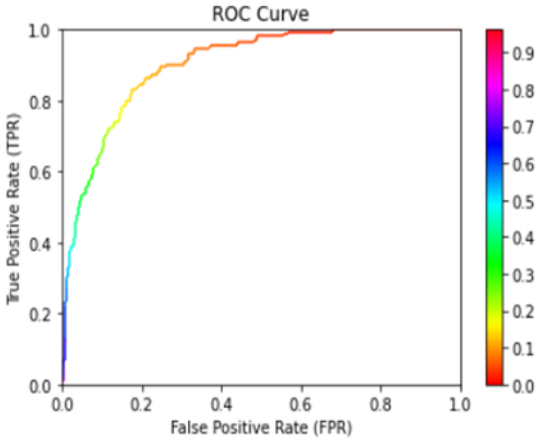


Figure 4. 2 Logic Regression ROC Curve

The Logistic Regression model has a recall of 98 percent overall, an AUC of 0.985, and an accuracy of 91 percent after being trained on the entire train dataset containing labelled malicious and benign traffic. The high recall demonstrates that the model could reliably categorize the majority of malicious traffic. A requirement for the prediction of pharming malware is the strong recall.

RANDOM FOREST

A combination of matplotlib and seaborn was utilized to offer customized themes and give additional plot types. Matplotlib is hence a superset of seaborn make the two important for visualization.

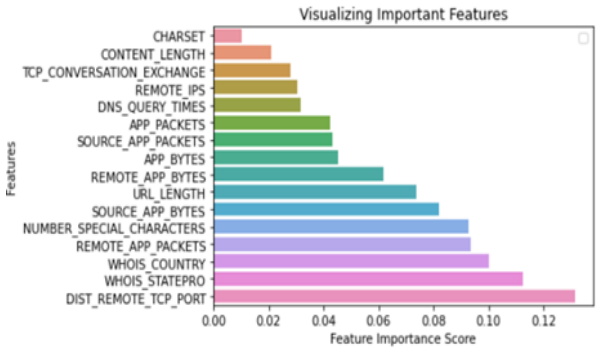


Figure 4.5 Visualizing Important Features

The study generated the model training set features perform predictions on the selected test set features and compare actual and predicted values. The modelling leveraged on

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obtaining the best combination of hyperparameters tunning translating to improved performance. This process showed improved performance of Random Forest from training accuracy at 92% to 99% the testing accuracy at 91% to 94%.

Gradient Boosting

Each predictor aims on improving on its predecessor by reduction of errors, by fitting the new predictor to the residual errors created by the preceding predictor. The log odds conversion formula.

$$e * \log(odds) / (1 + e * \log(odds))$$

The modelling leveraged on obtaining the best combination of hyper parameters tuning translating to improved performance. This process showed improved performance of Random Forest from training accuracy at 97% to 99% the testing accuracy at 93% to 96%. The gradient boosting model had a 91 percent accuracy rate and a 98 percent total recall after being trained on the entire train dataset containing labelled malicious and benign traffic. An AUC of 0.985 was achieved for the area under the curve.

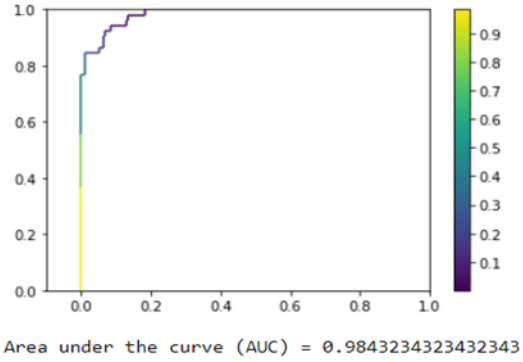

Table 4. 1 Testing Algorithm

Testing Algorithm	**Precision**	**Recall**	**F1-Score**	**Accuracy**
Logic regression	89%	90%	89%	90%
Random Forest	92%	91%	90%	91%
Gradient Boosting	90%	90%	90%	94%

The three models' training set performances were compared. shows that all models have excellent logical accuracy, but the Random Forest model had the highest final score. With the exception of logic. After the hyperparameter tuning the AUC was at 0.984

Below is the comparison of the outcome of three ensemble learning techniques.

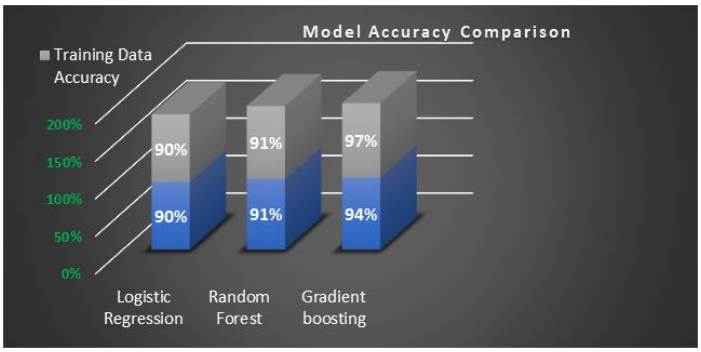

Figure 4. 7 Accuracy Bar graph

The Model Comparison

The three models' test set performances were compared. shows that all models have good rational accuracy, but the gradient boosting model has the greatest final score. With the exception of logic regression, all models have good scores when ranked according to the F1- score.

Training Algorithm	Precision	Recall	F1-Score	Accuracy
Logic regression	90%	91%	90%	90%
Random Forest	90%	91%	96%	91%
Gradient Boosting	90%	90%	90%	97%

Table 4. 2 Training Algorithm

The finding is that, among the trained models, the Gradient Boosting model had the highest accuracy. Given that logistic regression is a linear model and is extremely sensitive to the distributions of predictor variables, the following arguments support the study's findings. It is possible that there exist non-linear relationships between the predictors and the objective. (Kenneth, 2021). Random forests are ensemble methods that have demonstrated incredibly resilient performance in a wide range of classification issues. Hyperparameters were used to boost performance, which also increased accuracy.

Test and validate the model for predicting pharming malware

To facilitate the validation and evaluation of the predictive model built. The study utilized the performance of recommended methodology confusion matrix. This is a table that gives the performance of the classifier on the basis of some parameters on test data containing 1781 URLs. It indicates how the classification model gets confused as their make predictions. The step to follow

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when using a confusion matrix is first the dataset validation or test with probable outcome results. Next Predict each row in the test dataset in this study the URLs dataset.

The expected outcomes and expected predictions provide the number of precise predictions for each class and the number of imprecise predictions for each class, requested by the class that was predicted. The values are structured in matrix comprising of Predicted class and Actual class, as shown below assigned to following terms.

True Positive (TP) = 303

False Negative (FN) = 14

False Positive (FN) = 0

True Negative (TN) = 38

The following confusion matrix derived by Gradient boost model shows values of both predicted and actual class.

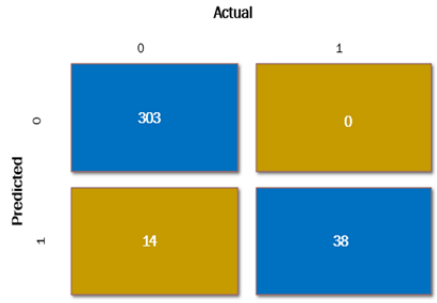

Figure 4. 9 Confusion Matrix

Performance Evaluation

Below are defined main lingo and metrics associated with a confusion matrix according to (Tharwat, 2018).

$$Recall = \frac{TruePositive}{TruePositive + FalsePositive} = 95\%$$

✓ Precision: This reveals the proportion of observations that are actually positive that we projected to be positive.

$$Precision = \frac{TruePositive}{TruePositive + FalsePositive} = 100\%$$

✓ Specificity: This shows what percentage of our predicted positive observations are actually positive.

$$Specificity = \frac{TrueNegative}{TrueNegative + FalsePositive} = 100\%$$

✓ Accuracy: This shows how many observations, whether they are favourable or negative, that we accurately predicted.

$$Accuracy = \frac{\text{TruePositive} + \text{TrueNegative}}{\text{TruePositive} + \text{TrueNegative} + \text{FalsePositive} + \text{FalseNegative}} = 96\%$$

✓ F1-Score is a measures the balance amongst recall and precision of a model simultaneously. It is a significant measure as it can be challenging to compare models with high recall and low precision to models with low recall and high precision. The study utilized F1 Score to evaluate the models trained.

$$F1 = \frac{2 * \text{Precision} * \text{Recall}}{\text{Precision} + \text{Recall}} = 96\%$$

On the test set, the study's highest F1-score was equivalent to 0.96. As a result, the ensemble is effective and trustworthy and can anticipate Pharming attempts.

Variables are essential in predicting pharming malware, the study utilized three ensemble models. In all three model it was observed several variables that were considered essential. Thus, the variable was well-thought-out to be vital by each model, the REMOTE_IPS. This is consistent with the existing literature which show that the IP address check is a vital pointer of to check the legitimacy of a visited website. Hence, it's essential to note the ultimate ensemble learning model using the Gradient Boost technique had the best performance highlighting the necessity to adopt the method in pharming malware prediction on the client side.

5. CONCLUSIONS AND FUTURE RESEARCH

There have been rigorous efforts to predict and hence eradicate the pharming malware attacks, a critical contributor to social engineering in the cyber security threats globally. As an effort to contribute to the cyber security threats, an objective determination of URL features to before building a predictive model for pharming attack. These significant features were utilized as variables to the base model logic regression random forest and gradient boost for the modelling using the Boosting algorithm. However, because typical network usage is so unpredictable, more reliable models will always be essential for keeping track of different networks. A dataset with a distribution of harmful and benign traffic was used by the model. Previous studies have utilized single classifier in predicting the pharming attacks that various users can utilize in malware detection process.

The comparison and combination was undertaken for logic regression, Random Forest and Gradient boost model features. The contribution to computing is in the combination the several models utilizing the URLS features as variables. Thus, the results generated by models providing an insightful way of assembling more details that may not have been captured by initial modelling. This has been helpful in improving the model performance even further.

Future testing of the model will be required on actual network traffic, where the proportion of malicious and benign traffic is far from balanced. The imbalance class may prove to be difficult for conventional ensemble learning methods, requiring the development of unique loss functions. By applying sample strategies to address the class imbalance and more complicated models, the study's findings can be further improved. The limitation of the study was identifying URLs that facilitate pharming attacks and any other malware attack thus a need for further work. Further work can be extended to focus on differentiating pharming attacks from other phishing attacks.

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Application Interactive Thematic Learning Media i-Spring to Improve Student Learning Outcomes

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Abstract: The purpose of this study was to determine the level of feasibility of using interactive thematic learning media for the application of i-spring to elementary school students. Development research methods (Development & Research). Development research is a model in research that is used to produce certain products and to test the feasibility of media and the effectiveness of a product. The subjects in this study were students of class III A at Tembung 101767 Elementary School. The location of this research was carried out at elementary school IT Nurul 'Ilmi in the odd semester of the 2022/2023 academic year. This development research focused on thematic learning, namely theme 3 "Things Around Me", sub-theme 2 "Objects Being" and Learning 5 and 6 in class III elementary school. The final product will be evaluated based on the specified product quality aspects. The results of the study show that the Thematic Interactive Learning media in the thematic learning developed has been validated and meets the criteria for good and appropriate learning media to be used in thematic learning on the theme 6 sub-themes 3 in class III elementary school with an average media percentage of 88% and material of 90% with a very feasible category as a learning medium.

Keywords: learning Media; thematic; interactive; i-springs; improve learning outcomes

1. INTRODUCTION

Learning outcomes are needed to see the development of students. Learning outcomes are a collection of information in the form of data that can be used to modify the teaching and learning strategies and techniques that have been carried out. Rasyid Harun and Mansur [1], student learning progress can be known through the learning outcomes obtained before and after participating in the teaching and learning process. Every educator today needs the innovation that can provide the key to success in teaching for students. This is of course in accordance with the provisions in Law no. 14 of 2005 article 20 B [2] namely, "Teachers are obliged to improve and develop academic qualifications and competencies in a sustainable manner in line with science, technology, and art".

Learning media designed according to student's learning needs can lead to positive attitudes students towards the learning process. Prawiradilaga [3], the application of learning media can also be designed specifically to achieve learning objectives by taking into account the nature and characteristics of the material to be delivered. In this case, the learning activities that have been carried out are said to be successful if students have good learning outcomes, namely having limits on being able to achieve KKM (Minimum Completeness Criteria).

With the existence of technology-based learning media that combines interesting picture, sound, video, and animation effects, plays a role in stimulating interest in learning and can improve learning outcomes. For this reason, there is a need for more innovative learning transitions by utilizing technology in learning. Accompanied by the teacher's role in designing learning, developing, managing, and carrying out reflections on each lesson, to see student learning needs. Determining solutions to overcome these problems is by developing interactive thematic learning media based on technology in learning.

Interactive thematic learning media is a means for teachers to be creative and increase innovation in thematic learning. Thematic learning means a learning process that is interrelated in each of the themes studied. The 2013 curriculum provides a theme-based learning concept that provides a blend of 3 to 4 subjects in each meeting. While interactive can provide interrelated meanings, the presence of action or subsequent treatment provides feedback as a reaction that arises.

Interactive in this scope relates to the use of the media used, including one of the technology-based learning media using the help of i-Spring software incorporated in Microsoft PowerPoint and/or multimedia programs used in the form of innovative simulations with additional evaluation facilities at the end. The result of the media can be obtained via interactive media in HTML, flash, MP4 video, and powerpoint formats and can be used as one of the features of mobile phone applications.

The use of i-Spring interactive learning media can make it easier for teachers to teach abstract material to be more concrete and can attract students' interest in learning. This is proven based on the results of previous studies which stated that (1) "Data on student responses to interactive learning media Powerpoint i-Spring suite 8, there are 15 statements consisting of positive responses and negative responses of students after using learning media Powerpoint i -Spring suite 8, shows that student's responses to the use of interactive learning media have received positive responses from students. Putriyani and Haryono [4], the media developed can help increase student motivation in studying chemical equilibrium material and improve student learning outcomes. Fibriani, et al. [5], the resulting interactive media development products were able to improve cognitive,

affective, and psychomotor learning outcomes with learning outcomes that exceeded the achievement target of the student response questionnaire to learning was very good [6].

1.1 Learning and Learning Outcomes

Learning occurs especially when a person responds and receives stimulation from his external environment which is in line with Gagne's thought [7] "The purpose of instructional is to help people learn". In this case, the stimulus is very important and is useful as a driving force for changes in a comprehensive manner that comes from the external environment of students. From the explanation of learning above, it can be concluded that the definition of learning is a person's continuous experience in acquiring development from within that originates from stimulation and a willingness to make changes based on experience with the new things that have been obtained. Thus becoming a better person than before by achieving the ability to think rationally, creatively, and morally.

Learning outcomes are the product of an information system input process that issues (output) in the form of behavior/performance. Schunk [8], the acquisition of learning outcomes is known after the occurrence of human performance, but the process of learning is much less obvious. Driscoll [9], the final results of learning activities contribute to (1) intellectual skills, (2) cognitive strategies, (3) verbal information, (4) attitude, and (5) motor skills. [10].

1.2 Interactive Learning Media

Media is an intermediary for teachers and students in providing good and fun communication and can increase student learning enthusiasm when the application of learning media is given interestingly and innovatively in the learning process [11]. Learning media is considered important when carrying out learning for teachers so that learning objectives can be achieved and learning activities can be more easily understood and conveyed with the help of learning media. According to Arsyad [12], the word media comes from the Latin Medius which literally means 'middle', 'intermediary', or 'introduction'. Another opinion regarding the media is the carrier of information/messages from information sources to recipients, and the message is intended to change the recipient's behavior [13].

Media are all forms and channels of conveying messages/information from message sources to intermediaries that can stimulate the mind, and arouse enthusiasm, attention, and willingness of students so that students can acquire knowledge, skills, or attitudes in accordance with the objectives of the information conveyed [14]. In the learning process, the important thing is to motivate learning which is useful as students' skills in mastering learning material and learning success. This is in line with Rusman's opinion [15], which states that the media is a tool that allows students to understand and understand something easily, to remember it for a long time compared to the delivery of subject matter, by face-to-face and lecturing without tools or tools. learning Media.

Learning media is an important component during the learning process in achieving learning goals. According to Rusman [16] the use of learning media will be very helpful in conveying messages and lesson content, as well as giving more meaning to the learning process, thus motivating students to improve their learning process. This is in line with Susilana's opinion [17] that the benefits of learning media contain value: (1) concrete abstract concepts, that is, they can provide concrete forms through elaboration and descriptions that were previously difficult to convey to students, (2) can present objects that are too dangerous or difficult to get into the learning environment, (3) can be interactive learning media for objects that are too big or small, (4) show movements that are too fast or slow.

Furthermore, Suryani [18] the benefits of learning media for students are: (a) stimulate curiosity to learn, (b) motivate students to study both in class and independently, (c) make it easier for students to understand the subject matter presented systematically through media, (d) providing a fun and not boring atmosphere so that it focuses more on learning, and (e) giving students awareness of choosing the best learning media for learning through the variety of media presented.

Interactive learning media is a learning program that contains a combination of text, images, graphics, sounds, videos, animations, *and* simulations in an integrated and synergistic manner with the help of computer devices or the like to achieve certain learning goals where users can actively interact [19].

The use of interactive learning media must be able to control and interact dynamically. This is the characteristic of interactive learning media in which there is the word "interactive". In contrast to the interactive term that is applied between two people where each can influence *the* other to interact. Because in interactive learning media involves humans and computers (non-human), the interaction is always preceded by humans as users who provide action and computers react. Users press the button, move the cursor, shift objects, do *drag-and-drops*, write through the keyboard, talk via *a* mic, *and* move limbs in front of the camera are some examples of actions from users who can start to interact with the media.

According to Surjono, [20] Interactive media has a mandatory element in the form of text, images, sounds, animations, and video in an integrated and synergistic manner through a computer or electronic *by* the purpose. In addition, learning media *to* be included in the interactive category of emotion have feedback, branching, assessment, monitoring, instructions, and interesting interactive learning *media*.

1.3 I-Spring Learning Media

I-Spring is a tool that provides several features on the *powerpoint* which includes a realistic dialog simulation character with additional assessment evaluation features. The results of the creation of interactive thematic learning media can be converted in the form of flash formats, power points, HTML5, and MP4 videos, or can even be used as *mobile-based* media. I-Spring is one of the tools that *convert* presentation files into Flash and Scorm / AICC forms, which are forms commonly used in learning with E-Learning LMS (Learning Management System). I-Spring software is available in free and paid versions.

According to Hermawati [21], I-Spring is one of the tools that converts presentation files into flash form, *and* can easily be integrated *into* Microsoft PowerPoint so that its use does not require complicated expertise. The use of this application can create various forms of *the* quiz, *and* enter audio, video, and YouTube.

The I-Spring application can make the presentation file into flash easily and make the entered video run smoothly. Utilization of I-Spring applications can make it easier for teachers to teach abstract material to be concrete precisely on the material of the human digestive system. Learning using this media can help students to more easily understand the material and make learning more interesting.

I-Spring can easily be integrated into Microsoft Power Point so that its use does not require complicated expertise. Some features of the I-Spring Presenter are: (1) Media I-Spring Presenter works as PowerPoint add-ins, to make the PowerPoint file more attractive and interactive-based-based and can be opened at Hamedia Interactive Learning for each computer or platform; (2) developed to support e-learning learning methods. I-Spring can insert various forms of media, so that the resulting learning media will be more interesting, including being able to record and synchronize the video presenter, add Flash and Youtube videos, import or record audio, add information makers and company logos, and create navigation and Unique design; (3) easily distributed in flash format, which can be used anywhere and optimized for the web; and (4) making quizzes with various types of questions/questions, namely: True/False, Multiple Choice, Multiple Response, Type in, Matching, Sequence, Numeric, Fill in the Blank, Multiple Choice Text.

1.4 Thematic Learning

Susanto [22], states that several characteristics are contained in the application of integrated thematic learning models, namely: (1) Student-centered learning (Student Centered), (2) Learning can provide direct experience to students (Direct experience). (3) In learning the separation between subjects becomes not so clear. (4) Learning presents concepts from various subjects in a learning process. (5) Learning is flexible (flexible). (6) Learning outcomes can develop according to the interests and needs of students.

Meanwhile, Prastowo [23], concluded that the characteristics of thematic learning are basically, namely: (1) Student-centered learning. (2) emphasizing the formation of understanding and meaningfulness. (3) learn through experience or provide direct experience. (4) pay more attention to the process rather than the result. (5) loaded with linkages. (6) the separation of aspects is not very clear. (7) presents concepts from various aspects. (8) is flexible. (9) learning outcomes according to the interests and needs of students. (10) using the principle of learning while playing and having fun.

Thematic learning provides advantages compared to conventional learning. According to Prastowo [24] the advantages of thematic learning consist of: (1) Being able to shape learning experiences and activities that are relevant to the development of children in elementary school. (2) the activities selected in the implementation of learning are more meaningful and memorable for students. (3) learning activities will be more meaningful and memorable for students so that learning outcomes last longer. (4) help develop students' thinking skills. (5) present pragmatic learning activities by the problems students often encounter in their environment. (6) develop students' social skills such as cooperation, tolerance, and responsiveness to other people's ideas.

By the teacher's handbook for class III theme 3 Sub-theme 3 Learning 1 and 2 of the 2013 revision of the 2018 curriculum. The limitations of the material on thematic learning that will be discussed include several subjects, namely mathematics, SBDP, and Indonesian, the following is the scope of basic competencies to be developed;

The formulation of the problem in this research is how is the development of interactive thematic learning media in learning theme 3 sub-theme 3 appropriate for use in learning.

2. METHODS

This research is a type of research and development (R & D). Development research (Development & Research) is a model in research that is used to produce certain products as well as test the feasibility of the media and the effectiveness of a product. In this research what will be developed is learning media using PowerPoint and i-Spring. This development research focused on thematic learning, namely theme 3 "Things Around Me", sub-theme 2 "Object Being" and Learning 5 and 6 in class III SD IT Nurul 'Ilmi. The final product will be evaluated based on the specified product quality aspects. Thus, the product of this research is an appropriate and effective media for third-grade students at Tembung 101767 Elementary School.

The development model that will be planned in this study follows the path of Thiagrajan, Dorothy S. Semmel, and Melvyn I Semmel's siiiiasailam [25]. According to Thiagarajan, and Semmel in Sugiono [26], namely the 4-D model (four D models) consists of 4 stages, namely: (1) the definition stage (define), (2) the planning stage (design), (3) stage of development (develop) and (4) stage of deployment (disseminate). Here's the main flow of the Thiagarajan, Semmel & Semmel development model.

Valid products will be applied to learning to see the level of effectiveness in improving student learning outcomes. In addition to being feasible and effective, the media developed must also have practical value, by what is needed when learning takes place, teachers who play a role in learning know what students need, and vice versa the responses given by students must be by what needed, the conditions for the media to be feasible to develop must pay attention to feasibility and effectiveness.

According to Thiagarajan, et al [27], states that "initial design is presenting of the essential instruction through appropriate media and in a suitable sequence". The initial design is the design of all learning media that must be developed before the trial is carried out.

Activities in this phase are designing patterns, and plots based on the flowchart of the trial model, Rusman [28] revealed that the computer as a tutor is oriented towards efforts to build student behavior through the use of computers. In simple terms, the operating pattern is as follows: (1) The computer prepares material (2) students respond (3) student responses will be evaluated by the computer orientated toward the student's direction in pursuing the next achievement, and (4) continue or repeat the next stage.

This learning media was tested in class III elementary schools, to see the effectiveness of the learning media that had been designed and to increase student learning independence. In the context of developing learning media, the following steps will be carried out: (1) Validation of learning material experts; (2) Validation of learning design experts; (3) Validation of learning media design experts; (4) Revision of learning media based on input from experts during the validation of i-Spring learning media in thematic learning; (5) Trial I (individual) of 2 class III students; (6) Revision of learning media based on

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the results of trial I; (7) Distribution of practical questionnaires to teachers and distribution of student response questionnaires; (8) Trial II 25 students in class III learning; (8) Revision of the media and further trials if they have not met the set effectiveness standards and stop the trials if they have met the set effectiveness standards; (9) Student assessment of product attractiveness; and (10) Analysis of interactive learning e-media.

The trial design in this study used a one-group pretest-posttest design. The first step is to take measurements as an initial test (Pretest), then subject to treatment within a certain period, then a final test (posttest) is carried out. The pre-test and post-test research design is the pattern in the table as follows:

Table 1. Trial Design

Test	Treatment	Test
T1	X	T2

Information:
T1 is a test of learning outcomes before learning.
T2 is a test of learning outcomes after learning.
X is learning using i-Spring-based learning media.

Feasibility Analysis of Interactive Thematic Learning Media
Expert validation questionnaire data were analyzed using the percentage of developed learning media scores. The formula used to calculate the percentage of expert validation questionnaires, namely:

$$P = \frac{f}{N} \times 100\%$$

Information:
Q: Score Percentage
f: Total score obtained
N: Total maximum score

Table 2. Classification of Feasibility of Learning Media

Achievement Level	Validity Classification
81,26% < P ≤ 100%	Very Valid
62, 26% < P ≤ 81,25%	Valid
43,76 % < P ≤ 62,25%	Less Valid
25% < P ≤ 43,75 %	Not Valid

Data Analysis of the Effectiveness of Interactive Thematic Learning Media

The data obtained from the trial results were analyzed to see student learning outcomes. This analysis will show the percentage of students who can achieve a minimum KKM score in the B- category (complete).

Based on Permendikbud number 104 of 2014, the competency mastery value of skills knowledge is expressed in the form of numbers and letters, namely 4.00-1.00 for numbers that are equivalent to the letters A to D. Individual learning mastery is set with an average score of 2.67. The value of student's knowledge and skills is determined by the following formula:

$$\text{Student value} = \frac{Skor\ yang\ diperoleh}{Skor\ maksimum} \times 4$$

While the learning completeness per class or the percentage of classical completeness (PKK) is obtained by calculating the percentage of the number of students who complete individually. A class is said to have completed learning if the PKK is 85% (Ministry of Education in Trianto, 2011). The percentage can be calculated by the formula:

$$PKK = \frac{Jumlah\ siswa\ yang\ telah\ tuntas\ belajar}{Jumlah\ seluruh\ siswa} \times 100\ \%$$

3. RESULT AND DISCUSSION

3.1 Results

Table 3. Material Expert Analysis Calculations

No	Aspect	Total Score	Percentage score	Classification
1	Learning	92,85 %	90%	Very Valid
2	Material	83,33%		
3	Display Quality on the monitor	92,85 %		

To see more clearly the validation results can be seen in the following diagram:

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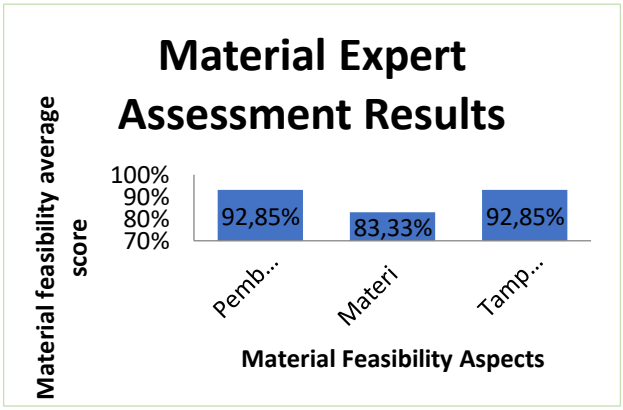

Figure 1. Graph of Material Expert Assessment Results

Based on the percentage of assessment of each aspect that has been assessed by the validator, it can be seen, which is composed of 92.85% learning aspect assessment, 83.33% material aspect assessment, and 92.85% display aspect assessment on the monitor. The results of the validation value on the media have an average feasibility level of 90% and are included in the very feasible category.

Based on the review of learning material experts, notes were obtained about the shortcomings of the Thematic Interactive media in thematic learning. Among them are video media that are displayed less effectively, material for each subject that needs to be added, additions to media titles, and additions to questions at the end of learning.

After the assessment was given, the researcher revised the product deficiencies that had been given by the validator.

Table 4. Calculation of Learning Media Expert Analysis

No.	Aspect	Total Score	Percentage score	Classificati-on
1	Conformity	85,71 %	88%	Very Valid
2	Convenience	83,33%		
3	Attractiveness	88,89 %		
4.	Benefits	92,85 %		

In Table 4.4 above, it can be seen the results of the validator's assessment of each media aspect, namely the assessment of the suitability aspect of 85.71%, the convenience aspect of 83.33%, the attractiveness aspect of 88.89%, and the usability aspect of 92.85%. The following is a diagrammatic form of the results of media expert validation.

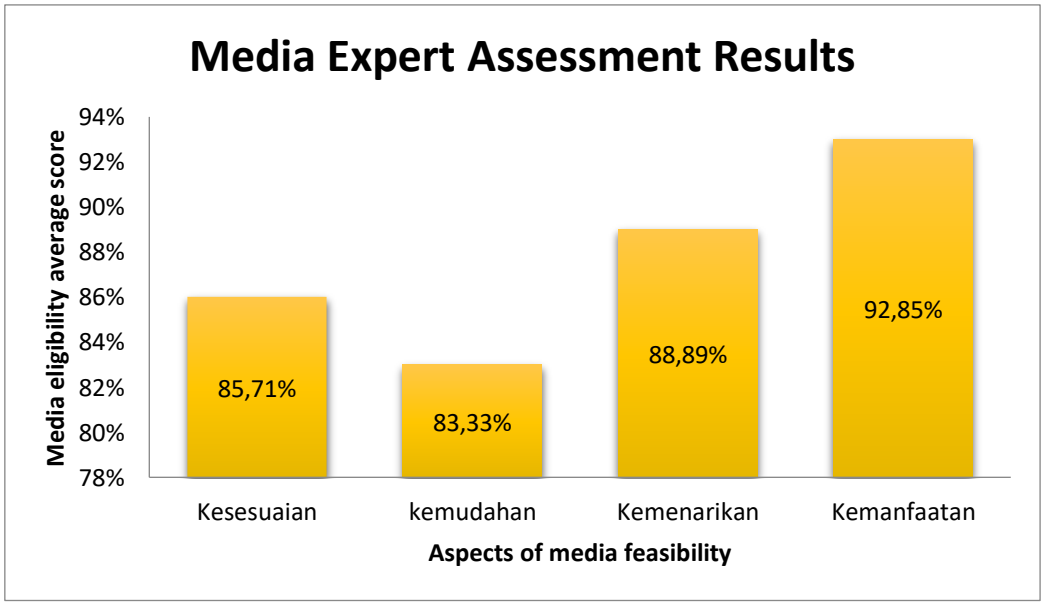

Figure 2. Graph of Media Expert Assessment Results

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Based on the validation of media experts, there are many notes containing improvements to learning media, namely: (1) Improvements to hyperlinks for each slide, (2) Adding recorded narrations to important material, (3) When the video tutorial media is played, turn down the music, (4) There are some not needs to be displayed on the slide like a back button. After providing a note of deficiencies to be corrected, then the media will be repaired and declared its eligibility.

3.2 Description of Student Response Test Result Data

The trial was carried out in the environment around the children of SD N 101767 Tembung with 15 third-grade students consisting of 2 groups, namely 4 individuals and 8 small groups. The purpose of this response questionnaire is to see student interest in the student learning process in class and is useful to see the relationship between the media and student learning processes. The analysis of the results of the trial of I-Spring learning media in thematic learning applied to class III at SD N 101767 Tembung, is as follows:

Table 5. Calculation of Student Response Questionnaire Analysis

No	Aspect	Score Average	Percentage score	Classification
1	Content Quality	89%	89,86 %	Practical
2	Pleasure	89,37%		
3	Evaluation	89%		
4	Grammar	85,65%		
5	Use of Illustration	95.25%		

To make it easier to see the results of the student response questionnaire analysis can be seen in the following diagram:

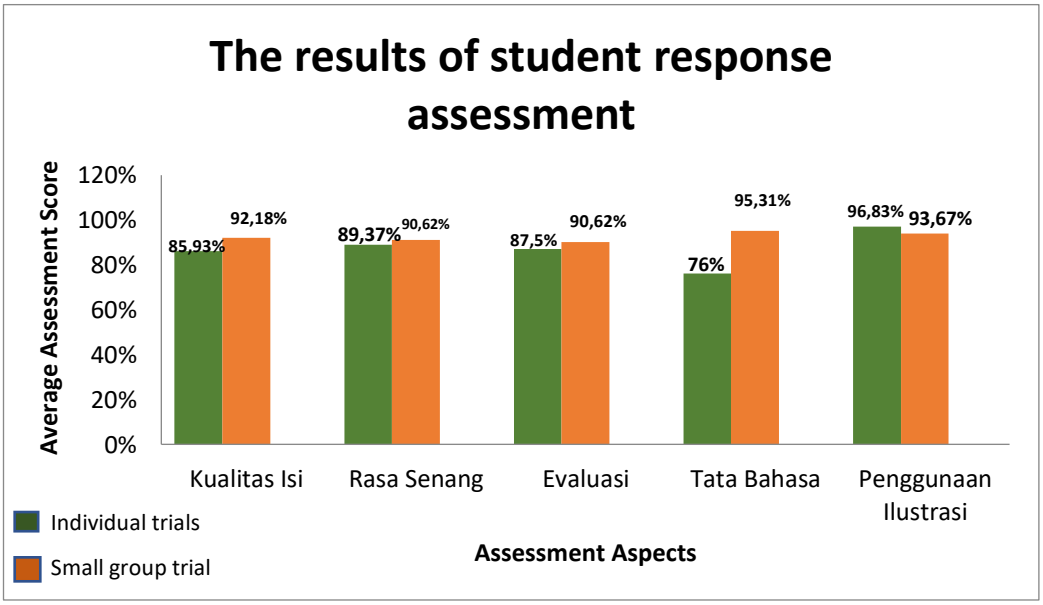

Figure 3. Graph of Student Response Assessment Results

From table 4.6 the assessment obtained consists of 89% content quality, 89.37% enjoyment, 89% evaluation, 85.65% grammar, and 95.25% use of illustrations. The results of the analysis of student responses can be concluded that the score obtained from the student response questionnaire is worth 89.86%, with the predicate of good media value according to students, for this reason, it can be concluded that the i-Spring learning media has been effectively used without having to revise it.

3.2 Discussion

The discussion of the results of this study aims to explicitly describe the findings of the research results that have been stated previously which discuss the analysis of the needs and feasibility of learning media. The feasibility of i-Spring learning media refers to product quality. Media or products that are said to be suitable for use if they have validity.

The stage that has been passed and is mandatory in development research before testing the product in the field is conducting product validation by expert validators. The validators consist of material experts and learning media experts. The product is feasible to be tested in the field if the team of experts has validated the product with a valid category without revision. Material experts classify learning media as valid categories accompanied by notes on revisions from various aspects. The revised notes contain video media that is shown to be less effective, for each subject needs to be added, additions to media titles, and additions to questions at the end of learning. After knowing and understanding the shortcomings of the research media, the making improvements and the validator has been revised the researcher.

The next step is validation by learning media experts. At this stage, media experts classify learning media as valid categories, but there are several revisions from the assessment aspect. These revisions include (1) Improvements to the hyperlinks for each slide, (2) Adding recorded narration to important material, (3) When the video tutorial media is playing the music is turned down, (4) some things don't need to be displayed on slides such as a back button. After knowing

the weaknesses of the media that need to be corrected, the next step is for the researcher to make revisions according to the notes of the expert team. The validation results of learning media validation are declared valid according to the percentage score obtained.

Meanwhile, in terms of the practicality of the media, the i-Spring learning media in learning has the characteristics of a high-quality product that is practical. This was measured through student response questionnaires through individual trials and small group trials which were given after using the i-Spring learning media. The results of the analysis of student responses at the trial stage were that the media had been categorized as practical with an average response rate of 89.86%.

When viewed from previous research conducted by Kusuma [29] entitled "Development of Ispring Suite 8 PowerPoint Interactive Learning Media on the Excretion System Concept in High Schools", it was concluded that the use of iSpring learning media has fulfilled the valid category by showing an average the results of student responses obtained were "4.57" with a percentage of 91.40% with a very strong category (above 80%). This shows that students' responses to the use of interactive learning media PowerPoint Ispring Suite 8 obtained positive responses from students.

In addition, the development research conducted by Wijayanto and Rafiq [30] on the development of PowerPoint & Ispring Suite learning media at SMP Negeri 1 Jambi City stated that these media could be used by students independently at home and anywhere. Learning media developed according to students' views are very good to attract students' interest and motivation in the process of learning activities. The results showed that the use of Ispring Suite 8 learning media increased student motivation and learning outcomes and contributed to interactive and dynamic learning. So, based on research that has been conducted at 101767 Tanjung Selamat, it can be said that i-Spring learning media in thematic learning can improve student learning outcomes in class III.

4. CONCLUSION

The success of a media in the form of learning products can be a reference in every selection of learning media. This is supported by the rapid development of information technology and the alignment and attachment of students to each technology that develops according to student learning needs. Besides that, the application of learning media can support efforts to improve student achievement in today's technology-based educational ecosystem. Based on the results of the analysis and discussion in this study, several conclusions were put forward as follows: (1) Interactive Thematic Learning Media in the thematic learning that has been developed meets the validity criteria and can be used properly by teachers and students; (2) Interactive Thematic Learning Media in thematic learning that has been developed has been validated and meets the criteria for good and appropriate learning media to be used in thematic learning on theme 6 sub-theme; dan (3) I-Spring media in learning that has been developed on reaction rate material, has met the eligibility standards based on validation by material and media experts, with an average media percentage of 88% and material of 90% with a very feasible category as learning media

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Number Recognition Techniques to Automate Revenue Collection at Dodoma Mini Bus Terminals in Tanzania

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Abstract: The manual revenue collection process currently operating in Tanzania, has deprived the Local Government Authority (LGA) of its potential income. Meanwhile, The Number Recognition (NR), is a modern technique that uses optical character recognition on images to obtain desired characters. The technique involves Image acquisition, pre-processing, character segmentation and Character recognition. This technique has been used in activities like license plate detection as Automatic Number Plate Recognition (ANPR). This research attempts to solve the problem by automating the current revenue collection process at the mini bus terminals in Tanzania taking a case of Dodoma Municipal using Number recognition techniques and Optical Character Recognition (OCR).

The research adopted a case study research design and simulation. In addition, the study used key informant interviews and observations to acquire a good understanding of the current operations at the mini bus terminals and the necessary requirements to achieve the main goal of the study. Simulation of the Number Recognition System (NRS) was achieved by using Matlab R2017a as a simulation tool on a Dell computer running windows 7 professional, Hard Disk Drive (HDD) 500 Gigabyte (GB), Random Access Memory (RAM) 4 Gigabyte.

The research, achieved a simulation for NRS with an accuracy of 0.988 for the character recognition of the captured Surface on mini buses. The researcher recommends a further study on the image acquisition process and messaging alert system, to completely automate the process.

Keywords: Image Processing and Recognition, Number Recognition, Revenue Collection

1. INTRODUCTION

Local Government Authorities (LGA) in Tanzania, are responsible for providing socio- economic services to its people. To manage this task Tanzania has embarked on decentralization with the aim of making the system of governance more accountable, more open and transparent, and more democratic [1].

Although the decentralization aimed at enabling local governments to support themselves, many local government authorities failed to support their activities and depended on the central government due to unstable and poor planned sources of revenue [2]. Local governments have many sources of revenue which include hotels, shops, restaurants, fish licensing fees and bus stand fees to mention a few. Owing to this inability to support themselves, the local government authorities adopted an outsourcing revenue collection as a means to solve the revenue collection problem[3]. [4] explains the potential of Private Public Partnership (PPP) as a way to solve the revenue collection problem. However, this did not entirely solve the problem as some councils reported loss of revenue due to outsourcing revenue collection.

Furthermore [5],reported the existence of corruption and fraud activities in the entire process of outsourcing and mismanagement of the whole

process. The report revealed that private collectors submitted less than what was collected and agreed in the contract. As reported by [6], collection of market due dropped by average of 47.6%. This reveals the presence of fraud activities in the outsourcing of revenue collection to private collectors.

To prevent fraudulent activities, revenue collection in bus terminals is done with an agent using an Electronic Fiscal Device (EFD). The fee is collected as the mini bus leaves the station and a receipt is handed to the driver or the conductor. This situation gives room for corrupt collectors to benefit by cheating and not actually using the device. These problems necessitate to automate the process at bus terminals to easy and maximize revenue collection.

2. LITERATURE REVIEW

2.1 Introduction

The presence of a diverse nature of number plate format and languages, has hindered the development of a single application that would be deployed worldwide for license plate recognition. This has led to the development of different system for different countries [7]–[10]. Several approaches have been used to overcome these problems across countries, Argentina used Intelligent Template Matching (ITM), Australia approached the problem by using both fixed and mobile systems and Egypt, approached the problem by the creation of an organized database to be used for the number plate recognition system [11]. Most of the research conducted is based on License plate recognition [12],[13].

Many researchers, have ventured in the development of effective and efficient character recognition algorithms. Number Recognition Systems date back as far as 1976 where they were first studied in the scientific development branch Police in UK [14],[15];[16]. The technique has been used in several areas such as the road, boarders and toll gates. License plate recognition, has assisted in solving several queries which include traffic monitoring, stolen vehicle monitoring and managing parking toll [17].

There have been many attempts to develop an efficient algorithm for character recognition part of the process. Some of these detection algorithms are Mathematical morphology, structuring element, media filtering and edge detection [18]. The License Plate Recognition process involves three steps which include Image license positioning, character segmentation and character recognition [19].

2.2 Number plate recognition systems world wide

Introduced in the year 1976, Number Plates Recognition (NPR) has since found a wide commercial application, making its research prospects demanding and scientifically interesting [20]. Countries like China, Europe, India and Malaysia have had a fair share of application from toll collection, intelligent traffic surveillance systems, law enforcement to car theft tracking [18]; [21].[22], [23]designed an algorithm that serve the private and commercial plates, for Tanzania mainland plates which are yellow and white. The aim was to exclude diplomatic plates which have different color and format. Some of the difficulties that the other encountered were the variation of Tanzania plates shape, size and color which pose challenges in the detection process Fig 1.

Figure 1. Tanzania Number Plates

This research has used minibus identification number assigned by Surface and Marine Transport Regulatory Authority (SUMATRA) for the detection process. A few challenges existed since some of numbers may be clear while others are not as shown in Fig 2.

Figure 2. SUMATRA Bus Identification Number (Source: Own Processing**)**

2.3 Payment techniques

Payment mechanisms differ from one payment process to another. The choice of the payment method depends on the ease of access and time required to complete the process. For a busy area like a bus terminal, time is a critical factor to consider. Putting this in mind, several toll collecting booths in the world deployed different methods with accordance to the nature of activities. Payment methods may include cash, pass cards or credit card [21]. When the user is paying the toll in cash, it requires much time which causes a delay at the toll booth. Korea Expressway Corporation (KEC) employed an electronic payment system that enables the driver to use the prepaid card to directly pay the toll fee. This reduced the delay at toll booth to about 3 seconds from 11 seconds. Figure 3 show an automated payment process that is adopted in many countries and areas like the airports and shopping malls.

Figure 3. Flow Chart on E-Payment (Source:[24]

3. METHOD

3.1 Research design

The study adopted a case study research design and design science. The design science approach was used in creating an artifact that mimics the operation of image acquisition and automatic revenue payment. The artifact was created with the focus on a modified four step frame work that was designed by Kopparapu as shown in Fig 4.

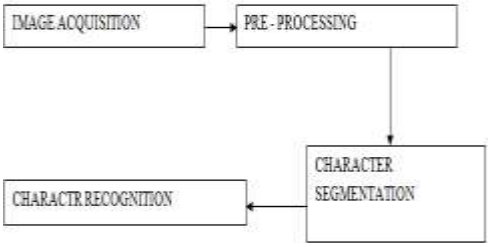

Figure 4. Flow Diagram (Source: Modified from [22]).

3.2 Image acquisition

The researcher used a mobile phone TECNO Y4 to capture image in the Red Green Blue (RGB) format for the study figure 3.1. Images were saved in a Joint Photographic Expert Group (JPEG also abbreviated as JPG) file format. The image acquisition process, involved the retrieval of images from a file in the computer system. These images were designed to meet the requirements for the image acquisition process.

3.3 Pre-processing

After capturing the image, it is then processed to convert it from the RGB to Gray scale. Since machine best understands grey images which are defined as a two-dimension function f(xy) where x and y are spatial coordinates and f is the light intensity at the region. A Gray scale image is a black and white representation of the converted true color image. Gray scale conversion was achieved through binarization. Detect MSER features function which was then applied to the gray scale image to obtain Region of Interest (RoI) through thresholding

3.4 Character segmentation

After obtaining the ROI, areas with the same color threshold were detected and considered as character segments. A mask is created to compare the region detected with the regions in the original image. The create Mask method returns a binary

image the same size as the input image, containing 1s inside the ROI and 0s everywhere else (MATLAB documentation, R2013)[25], [26]. This mask enables us to easily perform Optical Character Recognition (OCR) from the captured image.

3.5 Character recognition

Involved identification of the recognized numerals and matching them to the pre-existing database and checking if the number exist. The numbers were recognised and extracted from the image using the OCR function of MATLAB. Only numbers were checked because the SUMATRA mini bus identification number contains numbers and some short code representing the region.

3.6 Sample

The researcher has used a purposive sampling technique to achieve the targeted sample. Forty (40) plate numbers were used. Sampled mini buses were chosen based on the clarity/ visibility of their SUMATRA number Fig 5. This sampling technique was appropriate for the research as it saved time and enabled the researcher to get the right minibus with correct clearly visible SUMATRA numbers.

Figure 5. Captured SUMATRA Number (Source: Own Processing)

3.7 Data collection

To collect images of plate numbers to be used in model development, the researcher used a digital camera for capturing images of the side bus numbers (SUMATRA number) based on the number of samples required for the study.

3.8 Simulation tool

MATLAB as a simulation tool was used for this study. The software choice was influenced by the presence of a rich literature of image recognition systems developed and the presence of required libraries, for the image processing to demonstrate a complete simulation of the revenue collection process, database to represent the electronic payment process was designed by using Microsoft access database and linked to MATLAB by using Open Database Connectivity (ODBC) drivers.

4. RESULTS

4.1 Image acquisition

Image was acquired from a set of pre-designed images. Images are custom designed to meet the system specifications which are font style (Arial Unicode MS), font size (36) and character spacing (Normal). To acquire the image from a file in the computer, the imread() function of MATLAB was used. The image should reside in the same location or a path has to be defined.

```
>> image=imread('num6.jpg'); # Read image for processing

>> inshow(image); # Displays true color image Fig 6
```

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Figure 6.Acquired Image

Figure7.Gray Scale Image Character Segmentation

4.2 Pre-processing

The acquired true color image Red Green Blue (RGB) is converted to the grayscale intensity image by the rgb2gray () function that converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance. This is achieved by forming a weighted sum of the R, G, and B components Fig 7:

0.2989 * R + 0.5870 * G + 0.1140 * B

>> grayimage=rgb2gray(image); # Converts the true color image to a gray scale image

>> imshow(grayimage); # Displays the grayscale image

The detectMSERFeature extraction method with the gray image and a threshold value of 5 is used to segment the character part from the rest of the image thus obtaining the Region of Interest Fig 8.

>>imgRegions=detectMSERFeatures(grayimage,'ThresholdDelta',0.5); #threshold conversion

smtRegionsPixels=vertcat(cell2mat(imgRegions.PixelList))

imshow(image); hold on; # image display

plot(imgRegions,'showPixelList',true,'showEllipses',false); plotting the threshold results on the image figure 8.

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Figure 8.Threshold Image

4.3 Character recognition

After the characters are segmented through the threshold and Maximally Stable Extremal Regions (MSER) feature detection, OCR function is applied to recognize and capture the characters which are then stored in the ocrtext object. By using the ocrtext.Word ( ) function, the required text can be displayed or used by other function in the developed system model. The "OCRTXT" object captures all text on the image. To obtain the required text, the ". Word" property is used. >> text=ocrtxt.Word ( ). In order to obtain the desired character, the object OCRTXT.Word(2:3,1) was used to specify the character from the row two and three of the first column in the OCRTXT object Fig 9.

Figure 9.Detected Character

Table 1.OCR results for recognition Accuracy

Sumatra Number Image	Recognised Characters	Ocr Word Confidences
	400 DOM	0.8908 (Sumatra number) 0.8978 (region)
	500 DOM	0.8908 (Sumatra number) 0.8978 (region)
	490 DOM	0.9111 (Sumatra number) 0.8776 (region)
	7000 DOM	0.9278 (Sumatra number) 0.8706 (Region)
	900 DOM	0.8912 (Sumatra number) 0.8741 (region)

The table 1 displays the probability of returning the accurate reading from the captured SUMATRA number. The word confidences ranging from 0 to 1, shows the probability of the captured number being correct. The findings show that, the designed model has a recognition accuracy of 0.90234 which is an average of the five attempts, to recognize different SUMATRA numbers. Finding the average of recognition show the extent to which the obtained results are accurate. The sum of the overall Word Confidences is obtained and divided

by the number of images captured and processed to obtain the degree of accuracy of the recognition process equation (1).

$$ARWC = \frac{Sum\ of\ Word\ Confidence}{Number\ of\ processed\ images} \quad (1)$$

Where ARWC is Average Recognition Word Confidences

4.4 Results recommendation

This research main objective was to simulate the automation of the revenue collection process at the Dodoma Municipal mini bus terminals. Due to limitations encountered, the research used own processed images and proposed a Microsoft publisher template, for the creation of the SUMATRA numbers that will be similar for all the mini busses, operating at the Municipal. The template will eliminate variation among SUMATRA numbers on mini busses. The research also recommends a standard or guide from SUMATRA for both number and position of the number, on the side of the mini bus. The guide will create conducive environment for the development and implementation of the simulated revenue collection process.

5. CONCLUSION

Number recognition and character recognition are growing technologies with a number of applications from the health sector, engineering, education to business. The potential to solve these problems has seen these technologies being applied in our daily lives, including a face recognition for security, object identification and number plate recognition for traffic purposes.

This study has employed number recognition technique and OCR to obtain SUMATRA numbers on the side of mini buses, at the Dodoma Municipal bus terminals for the automation of revenue collection. The developed simulation has the potential to solve revenue collection problems facing LGA's. Deployment of such processes at the desired terminals would increase the revenue collection and eliminate if not reduce, fraud activities which the current manual system is prone to.

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Intelligent Computing: A Technological Revolution

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Abstract: A key factor in the advancement of human evolution is computing. With novel computing theories, architectures, methodologies, systems, and applications, intelligent computing is changing traditional computing and accelerating the digital revolution in the age of big data, artificial intelligence, and the internet of things. With the advent of increasingly diversified computing paradigms including perceptual intelligence, cognitive intelligence, sovereign intelligence, and human-computer fusion intelligence, intelligent computing has significantly expanded the scope of computing. The evolution and development of intelligence and computing have long followed different routes, but they have recently grown more intertwined; intelligent computing is not just intelligence-oriented, but also intelligence-driven. Intelligent computing is now successfully used in many fields, including environmental monitoring, transportation, healthcare, home, education, to make cities smart etc. This paper focuses on the review of intelligent computing; its technological foundation, properties, characteristics and application of intelligent system, advantages and disadvantages of intelligent computing and suggested the future solution for intelligent computing.

Keywords: Intelligent Computing, cognitive intelligence, artificial intelligence, intelligence-oriented, intelligent driven.

1. INTRODUCTION

The recent technological advancement, in which computing has emerged as a crucial component in creating and fostering societal progress, human civilization is transitioning into an intelligent society from information society. Traditional computing on data is far from being able to meet the growing demand for a higher level of intelligence by humans in the new era of digital civilization with the internet of all things. With the advancement of computing science, intelligent observation of the physical world, and comprehension of the cognitive mechanism of human consciousness, the growing interest in intelligent computing has raised the level of computing intelligence and sped up knowledge generation.

Due to the new technology evolution, remarkable popularity and effectiveness of machine learning, artificial intelligence (AI) and deep learning it has emerged as the next frontier in human research of machine intelligence. As a result this has led to the development of a number of ground-breaking research findings, including the convolutional neural network (CNN) suggested by Yann LeCun and advances made in the field of causal inference in deep learning made by Yoshua Bengio [1] [2] [3]. One of the pioneers of AI, Georey Hinton, proposed the backward propagation optimization algorithm and the deep belief network model in 2006. Another artificial intelligence researcher Jurgen Schmidhuber proposed Long Short-Term Memory (LSTM), which is one of the most popular recurrent neural networks (RNNs) [2].

The term "intelligent computing" describes the use of technologies like artificial intelligence, big data analytics, and computer networks to automatically sense, analyze, evaluate, and forecast environmental parameters in the real world and to provide corresponding strategies for various requirements [3]. Distributed intelligent network devices having the ability to sense, communicate, and process information are installed by intelligent computing systems at the appropriate locations in the environment. By utilizing the communication network, these devices cooperate with one another and exchange data and resources. Pervasive computing, which is focused on people, is the foundation of intelligent computing. Pervasive computing aims to effectively combine information space and physical space, making computing tools and services available everywhere [12]. Intelligent computing creates an intelligent environment where the system carried out the information gathering, analysis, processing, and assessment automatically.

In the new age of digital civilization that promotes global connection, intelligent computing can be defined as an integration of human society, the physical world and the information space that incorporates new computing theoretical techniques, architecture systems, and technical capabilities. High computing capability, energy efficiency, intelligence, and security are the goals of intelligent computing, which is also human-oriented. Intelligent computing employs the best and the appropriate algorithm that matches sufficient computational capacity to the specific actual needs, and targets computational activities with the lowest possible cost in order to produce the best results [1].

The general theoretical framework of intelligent computing, which incorporates a wide range of computer paradigms in support of the integration of human, physics, and information as shown in Figure 1 [1]. Humans will be using different methodologies such as imitation, learning, logic and self-examination and will be performing different activities such as group-environmental interaction, knowledge creation and task decomposition. The methodologies and the architecture that is

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used by the physics paradigm includes, in-memory computing, distributed computing, heterogeneous computing and performs various tasks such as clustering, hierarchical while the information paradigm includes different models generated by turning machine, DFA and neural networks. Intelligent computing has the ability to have data intelligence, cognitive intelligence and perpetual intelligence and have the wide area collaboration using heterogeneous integration. Figure 1 shows the overview of intelligent computing using the combination of human, physics and information.

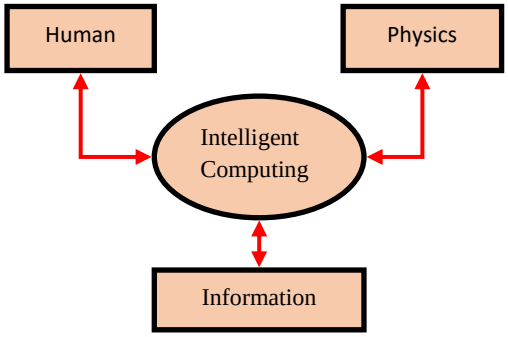

Figure 1: Overview of intelligent computing in combination with human, physics and information.

2. PROPERTIES OF INTELLIGENT SYSTEM

Intelligent systems typically use IP (Internet Protocol) technology and sensors to gather data from a particular environment and distribute it among its various components in order to accomplish a shared objective. Intelligent systems can vary greatly depending on the industry, despite the fact that they share many fundamental traits. Following are the few important properties of intelligent systems.

1. **Sensors**: The technology gathers environmental data and sends it to the intelligent core for naming and analyzing.
2. **Actuators**: They carry out the tasks that the intelligence core decides upon after real-time environment analysis.
3. **Specific environment**: The intelligent system evaluates and adapts the context. They can be considered as deterministic, episodic, static, and discrete.
4. **Intelligence Core**: The foundation of an intelligent system is made up of two important developing technologies artificial intelligence and machine learning.
5. **User Interface (UI):** An outside agent interacts with the system and modifies how they relate to one another in the manner.
6. **External Agents**: The individuals who are involved or in charge of the intelligent system's or even other artificial intelligence's processes.

Following figure 2 shows the intelligent system functionality.

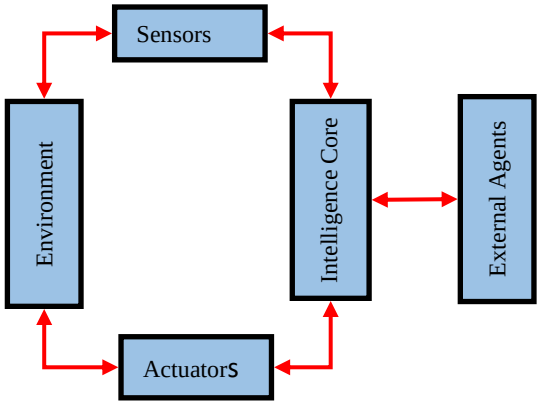

Figure 2 Intelligent System Functionality

3. CHARACTERISTIC OF INTELLIGENT SYSTEM

The main characteristic of an intelligent system are shown in the following figure 3.

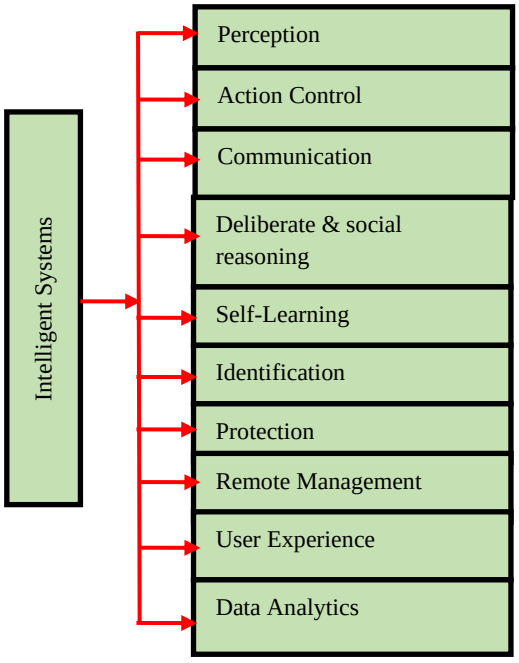

Figure 3: Characteristics of Intelligent System

1. **Perception:** In order to interact with a particular environment and carry out tasks, an intelligent system builds a representation of the world.
2. **Action Control:** To accomplish a task, an intelligent system can take action or stop action.
3. **Communication or connectivity:** An intelligent system can use a common language to put its components into communication.
4. **Deliberate and social reasoning**: The machine decides on its own to accomplish a goal and takes into account the human condition.

5. **Self-Learning:** By using their own experiences as learning opportunities, intelligent systems can minimize errors and improve performance.
6. **Identification:** Intelligent systems have the ability to automatically distinguish specific information and deliver it via a variety of networks.
7. **Protection:** For an intelligent system to work correctly, its networks and communications must be protected.
8. **Remote Management:** People can communicate with an intelligent system from everywhere.
9. **User Experience (UX):** Intelligent systems need user-friendly interfaces that can be altered in order to communicate with users.
10. **Data Analytics:** One of the important characteristic of an intelligent system is that they must have the capacity to process enormous amounts of data.

4. APPLICATIONS OF INTELLIGENT SYSTEM

Intelligent systems are equipped to handle an expanding number of tasks in current culture, such as:

a) **Factory automation**: Sophisticated robotics and automation applications in industries demand technologies that can carry out challenging yet vaguely defined tasks. These activities, which are often carried out by people, are undefined in the sense that they are goal-oriented but lack specific procedures or algorithms. A combination of intelligence, a highly developed sensory system, training, and years of expertise are used by humans to perform these functions. Additionally, additional applications such as those in space, the ocean, or building will be interested in the answer to these problems.

b) **Field and service robotics**: Field robotics are non-factory machines that are often dynamic and work in challenging conditions. These environments can be on the surface of the Earth or other planets, underground, under water, in the air, or in space. Service robots are those that assist humans in their daily lives by collaborating directly with them.

c) **Assistive robotics:** An assistive robot is a machine that can recognize, analyze sensory data, and carry out tasks that aid the elderly and individuals with impairments in their daily lives. Robots with physical assistance help people whose injuries or medical ailments restrict their ability to move their upper or lower bodies. Additionally, these robots are employed in rehabilitation facilities to assist recuperating victims of spinal cord and neurological damage.

d) **Military applications:** Drones and AI can be used together to patrol territories, spot risks, and share warning alerts with the appropriate response teams. Thus, the deployment of intelligent systems enhances the battle efficiency of military personnel.

e) **Medical care**: AI in healthcare can improve patient outcomes overall, improve preventative care and quality of life, and create more precise diagnosis and treatment strategies. By examining data from the public sector, the healthcare industry, and other sources, AI can help forecast and monitor the development of contagious diseases.

f) **Education**: An intelligent tutoring system (ITS) is a computer program that tries to give students quick, personalized education or feedback, typically without the need for a teacher's intervention. By utilizing a variety of computing technologies, ITSs aim to enable meaningful and effective learning.

g) **Entertainment**: Automation of sound production processes will increase with the use of AI in the entertainment industry. AI can provide a platform that can automate tasks like script splitting, short list creation, storyboarding, schedule creation, and resource management for movies. Additionally, AI software can automatically synchronize the group-filmed video.

h) **Visual inspection**: Global clients can get reliable monitoring technology from Intelligent Monitoring Systems.

i) **Character recognition**: Modern optical character recognition (OCR) technology called intelligent character recognition (ICR) is simply described, as a technology that enables a computer to distinguish handwritten letters and translate them into text that can be read by a computer. ICR services enhance OCR systems' effectiveness by converting different handwriting slants into data that can be extracted from both structured and unstructured texts. Every time when an additional evidence is introduced to ICR, it strengthens and updates its knowledge acquisition process through artificial neural networks and adds characters to the authenticate the database with each new handwriting thereby improving the accuracy of analyzes of recognition over time.

j) **Human identification using various biometric modalities (e.g. face, fingerprint, iris, and palm):** Depending on the kind of human attribute, it accepts as input, and the biometric paradigm falls under the umbrella of a biometric system. The following biometric technologies are available: voice, handwriting recognition, iris, face, fingerprint, and hand geometry. The majority of biometrics is quantifiable, and there is no one biometric technique that is excellent while deploying of biometric system. Considering many factors, such as location, security risks, task (identification or verification), anticipated user count, user situations, previous data, etc., must be measured when incorporating a biometric device. Increasing the availability of data sample the system becomes distinctive and trustworthy. It can operate on a variety of paradigms related to behavioral patterns, measurements of a person's physique and features. Biological characteristics of the person are used to categorize the paradigms [12].

k) **Visual monitoring**: Intelligent monitoring systems (IMS) can be used as an alternative of conventional monitoring systems. In IMSs, anomalous behaviors in videos are recognized by using computer vision, pattern recognition, and artificial intelligence technologies. They discuss the advancement of real-time, intelligent surveillance technologies that are behavior-based [11].

l) **Intelligent transportation:** Modern wireless, electronic, and automated technologies are a part of intelligent transportation systems (ITS). These technologies have the ability to combine users, infrastructure, and vehicles (such as transit, trucks, and personal automobiles) (roads and transit). Computerized guideways, collision avoidance systems and precise bus docking are just a few examples of computerized and in-vehicle innovations [13].

5. ADVANTAGES OF INTELLIGENT SYSTEM

An intelligent system has the capacity to explain its activities, has sophisticated decision-making processes, and is knowledgeable in a certain field. The ability of an intelligent system to communicate with humans to instruct or support

sophisticated information processing is its most crucial feature [7].

1. An intelligent system functions in a setting where there are other agents,
2. Comprises cognitive skills such language usage, analytical reasoning, action control, and observation.
3. Respects behavioral guidelines based on reason and traditional conventions and
4. Has the ability to learn and adapt.

6. DISADVANTAGES OF INTELLIGENT SYSTEM AND ITS SOLUTION

Following are disadvantages of intelligent system and its solution.

1. **Mapping:** A significant amount of information is lost when switching from the 3-Dimensional to the 2-Dimensional environment. Clustering objects with intra- and inter-class variation, adjustments in viewpoint, illumination, and scale, complex background, and animation are difficulties for computer vision [11].
   Solution: Integrated device management system can be deployed using the artificial intelligence applications irrespective of the device type and its framework. New artificial intelligence algorithms and models can be developed to scale to computer vision issues.
2. **Computing Power**: Since developing the algorithms and models, consume more power. Since machine learning and deep learning are the cornerstones of contemporary AI, and in order for them to perform well, they both require a growing number of cores and GPUs.
   Solution: Deep learning frameworks can be applied to a wide range of tasks, including as tracking celestial bodies, providing healthcare, and monitoring asteroids.
3. Time-consuming computation: To identify the most efficient path to a destination, it takes a significant amount of effort and resource to search within an extremely large state space. The drawback of excess time spent on computing is that if the world changes during that period, the computed approach will become obsolete.
   Solution: To overcome the time consumption computation method, an intelligent real time scheduling can be introduced which is based on the artificial intelligence methods such as Artificial Neural Networks (ANN), Reinforcement learning, Fuzzy logic, Artificial Immune system, Swarm intelligence etc.
4. **Trust Deficit:** One of the most important issues that worries artificial intelligence is the uncertain nature of how deep learning models forecast the output. It can be difficult for the typical person to understand how a certain set of inputs might offer a solution to a variety of problems. Many people around the world have no idea what artificial intelligence is, what it can do, and how it has been implemented into devices they use every day like smartphones, smart TVs, banking systems, and even cars (at some level of automation).
   Solution: The gap can be addressed through the utilization of good data, the key competencies such as right expertise, leadership support, and productive collaboration between data scientists and end users. Proper models, coupled with experimental methods, guides the choice of the best modelling approach that satisfies the following requirements:
   a) Transparent: The system may describe how the system will operates and the necessity why specific predictions are made.
   b) Reliable: The system can manage various real-world circumstances an requires no ongoing supervision.
   c) Self-Explanatory: The system should communicate the required details about its central workings system, the correlations it discovers, and the outcomes it produces.
5. **Limited Knowledge:** Although there are multiple areas in the industry where artificial intelligence can be used as a superior replacement for conventional technologies. The knowledge of artificial intelligence is the true issue. Only a small percentage of individuals, excluding computer enthusiasts, college students, and researchers, are aware of the possibilities of AI.
   Solution: The developed system should be transparent and self-explanatory, explaining the central working of the system, the outcomes and why the particular decisions or predictions are made.
6. **Human-level:** One of the biggest challenges in artificial intelligence is to enhance artificial intelligence services for enterprises and start-ups. Humans are still superior in every situation. Humans are capable of learning and using broad knowledge to address issues in a wide range of areas. The ability to switch effortlessly through one learning assignment to the next when necessary to enable problem solving is a function of general intelligence.
   Solution: In the recent years, artificial intelligence has gained a huge importance and progress tremendously. By using machine, learning and deep learning, which are the branches of artificial intelligence, can act as the catalyst for quick learning activity. Different algorithms and models can be developed in machine learning and deep learning for quick learning process. For a deep learning system to behave effectively, with extremely fine customization, hyper-parameter enhancement, a huge sample, an accurate and well-defined procedure, as well as substantial computational resources, continuous training on train data, and evaluation on test data.
7. **Data Privacy and Security:** The main factor on which all deep and machine learning models are based is the access to data and resources to train these models. There is tremendous amount of data, which is generated by heterogeneous users around the world, and there is a high possibility that it could be mishandled. Internet activity, corporate behavior, and governmental decisions all prioritize privacy issues. This is primarily a reaction towards the controversies, hacks, and disclosures of confidential communications that already have damaged public trust in technology and information systems. Three important data privacy principles data accuracy, data protection and data control needs to be focused.
   For example: A medical service provider who is serving a city, different categories of people and maintains a huge database which includes the wide range of details of all the users which includes the details about their illness, health problems, medical histories etc. A cyberattack on this database may result in the leakage of all the private data's of everyone and which will land in the hands of dark web.
   Solution: Data privacy can be obtained by;
   a) Sanitization of good data: Only the necessary data types required to build the artificial intelligent system should be gathered, and those should be adequately protected and preserved to achieve the goal.
   b) Use of good statistical data: Developers of artificial intelligence should utilize reliable, impartial and

comprehensive data sources. Programmers should create artificial intelligence algorithms that checks similar algorithms quality, reliability and effectiveness.

c) Giving users the control: Individuals should to be aware of how personal data is being utilized, whether artificial intelligence is being used to draw conclusion regarding them, or whether their information is being utilized to build AI. Additionally, they should be offered the option to agree to the usage of their data.

d) Reduce algorithm bias: When training artificial intelligence, make sure that the data source are extensive and diverse. Technological prejudice presents issues most frequently for populations who make up a small part of technology workforce, such as women, minorities and the senior individuals. Proper artificial intelligence and machine learning models can be developed to control cybercrimes and other data security issues. Some of the areas where the artificial intelligence and machine learning models are beneficial.

a) Detecting and Responses
b) Online Rackets
c) Advanced Certification and Endorsement
d) Individual screening
e) Surveillance of larger scale for individuals

8. **The Bias Problem:** An AI system's quality is largely determined by the volume of data it has been trained on. Therefore, the capacity to gather high-quality data will be essential for creating future AI systems that work effectively. The real data that the businesses collect on a regular basis, however, is poor and has no inherent value. They are prejudiced and only serve to characterise the traits of a select few people who, in terms of race, religion, ethnicity, gender, and other variables, have comparable interests. Real change won't happen until certain algorithms are developed that can track these problems with accuracy.
9. **Data Scarcity:** Many global businesses are being accused of utilizing user data collected unethically; many growing nations are implementing tough information technology regulations to limit the flow. These businesses are now faced with the challenge of designing applications for the global market utilizing local data, which would be biased. Since data is a crucial component of artificial intelligence, and labelled data is used to teach computers how to comprehend and forecast the future. Despite the lack of data, several businesses are working to develop novel approaches and artificial intelligence models that can produce reliable findings. The system may become problematic if the data were skewed.

Solutions: If the proper data privacy and security are maintained for the individual's data then, the trust deficit from the individuals mind will be removed and they will be shared data and thus the data scarcity can be controlled. Algorithms are developed that can track these problems with accuracy.

10. **Data Scarcity:** Many global businesses are being accused of utilizing user data collected unethically; many growing nations are implementing tough information technology regulations to limit the flow. These businesses are now faced with the challenge of designing applications for the global market utilizing local data, which would be biased. Since data is a crucial component of artificial intelligence, and labelled data is used to teach computers how to comprehend and forecast the future. Despite the lack of data, several businesses are working to develop novel approaches and artificial intelligence models that can produce reliable findings. The system may become problematic if the data were skewed.

Solutions: If the proper data privacy and security is maintained for the individual's data then, the trust deficit from the individuals mind will be removed and they will be shared data and thus the data scarcity can be controlled.

7. CONCLUSION

Present development in the human growth is making the crucial switch from the information society to the intelligent society, which integrates human-physics-information. Computing technologies are undergoing revolution and potentially devastating, improvements have taken place during this changeover. The prospects of computing is thought to rest in intelligent computing, including both intelligently directed and intelligently enabled computing. In this well-equipped smart society, it will offer universal, affordable, private, independent, dependable, and accessible computational services to facilitate large-scale and complicated computational operations. Unfortunately, computational intelligence technologies are neither extremely portable nor economical due to their sheer complexity and abundance of sensors. Future advancements in intelligent computing' architecture and multi-mode hybrid classification technologies might lower costs and enhance mobility, adaptability, and dependability. Additional growth strategy would involve fusing sophisticated computation with other cutting-edge technologies to further progress.

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Machine Learning Algorithms and Its Applications: A Survey

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Abstract: In today's world, many microcomputers are being developed in every field. The data we receive contains valuable information for predicting the future. Due to its enormous size, physical forecasting presents a complex task for humans. To overcome this problem, a data model is developed to predict the future by scenario with the help of training data and test datasets. There are many types of machine learning algorithms and tools to train a machine or data model. This paper will emphasize a comprehensive review of some machine learning algorithms (ML) and methods used in several applications and domains.

Keywords: Microcomputers, Predicting, Machine Learning, Data Model, Machine-Learning Algorithms

1. INTRODUCTION

Machine learning (ML) is a subset of artificial intelligence (AI). Machine learning (ML) can be used to derive applications from human-like experience. As data is fed into these applications, they learn to grow and adapt to experience. This is done by using CRAM algorithms from the data in an iterative process. Applications that use ML use pattern recognition to respond to various data that is fed as input to the application. Machine learning is an applications ability to react to new data we provide as input using iteration. Machine learning algorithms help the computer learn how to predict outputs based on the previous examples we have given it and the correlation between the data we feed as input data and output data called the training data set. The relationship between inputs and outputs of any model is improved incrementally by testing its predictions and correcting it when incorrect output is obtained. Machine learning (ML) is a set of computerized methods for learning about various outliers in data.

The ability for a machine to automatically learn from data, enhance performance based on prior experiences, and make predictions is known as machine learning. Collections of algorithms used in machine learning operate on vast amounts of data. These algorithms are fed data to train them, and after training, they develop a model and carry out a certain task. These ML techniques support the resolution of numerous business issues, including clustering, associations, forecasting, classification, regression, and others.

Based on the methods and way of learning, machine learning is divided into mainly four types.

1.1 Types of Machine Learning

Following are the various types of machine learning;

1. Supervised Machine Learning
2. Unsupervised Machine Learning
3. Semi-Supervised Machine Learning
4. Reinforcement Learning

Following figure 1 shows the types of machine learning.

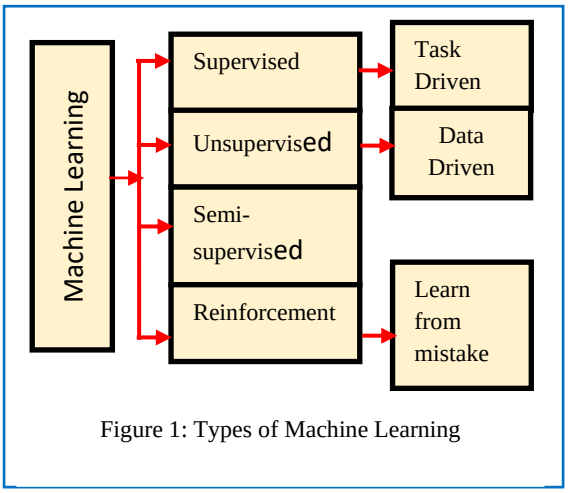

Figure 1: Types of Machine Learning

1.1.1 Supervised Machine Learning

As its name suggests, supervised machine learning is based on supervision. It means in the supervised learning technique, we train the machines using the "labelled" dataset, and based on the training, the machine predicts the output. Here, the labelled data specifies that some of the inputs are already mapped to the output. More preciously, we can say; first, we train the machine with the input and corresponding output, and then we ask the machine to predict the output using the test dataset.

1.1.2 Unsupervised Machine Learning

Unsupervised learning is different from the supervised learning technique; as its name suggests, there is no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabeled dataset, and the machine predicts the output without any supervision.

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1.1.3 Semi-Supervised Machine Learning

Semi-Supervised learning is a type of Machine Learning algorithm that lies between Supervised and Unsupervised machine learning. It represents the intermediate ground between Supervised (With Labelled training data) and Unsupervised learning (with no labelled training data) algorithms and uses the combination of labelled and unlabeled datasets during the training period.

1.1.4 Reinforcement Learning

Reinforcement learning works on a feedback-based process, in which an AI agent (A software component) automatically explore its surrounding by hitting & trail, taking action, learning from experiences, and improving its performance. Agent gets rewarded for each good action and get punished for each bad action; hence the goal of reinforcement learning agent is to maximize the rewards.

2. LITERATURE REVIEW

Pinky Gupta (2022) has designed a survey form to gather data from all respondents in order to understand how people use machine learning in their daily lives. People are aware of machine learning technologies, according to her survey. so that it is possible to claim that humans are utilizing cutting-edge technology. According to the survey response she received, machine learning is the process of trying to teach a computer what to perform using the code. Artificial intelligence (AI) systems are used to carry out complicated tasks in a manner akin to how people solve issues.

Meherwar Fatima et al.(2017) presents an overview of various machine learning methods for diagnosing diseases like hepatitis, dengue, and the disorders of the heart, liver, and diabetes. Numerous algorithms have produced positive outcomes because they correctly detect the feature. The survey outlines the benefits and drawbacks of various algorithms. Improvement graphs of machine learning algorithms for prediction of diseases are presented in detail. From analysis, it can be clearly observed that these algorithms provide enhanced accuracy on different diseases. This survey paper also provides a suite of tools that are developed in community of AI. These tools are very useful for the analysis of such problems and provide opportunity for the improved decision making process.

Raja Irfan Ahmad Mir describes an overview of machine learning, including its fundamental model, applications in a variety of industries, as well as advantages and disadvantages. Additionally, it looks at a variety of machine learning techniques and tools, including classification and prediction methods, as well as their goals, methods of operation, advantages, disadvantages, real-world applications, and implementation tools. Emerging advances in artificial intelligence and machine learning call for the strong foundations of the aforementioned approaches, and they will be helpful in cross-disciplinary domains as well.

3. APPLICATIONS OF MACHINE LEARNING

Machine learning is about how we develop and design our program to automatically improve their performance through its effects in the world of technology. [1]

Following figure 2 shows various machine learning applications.

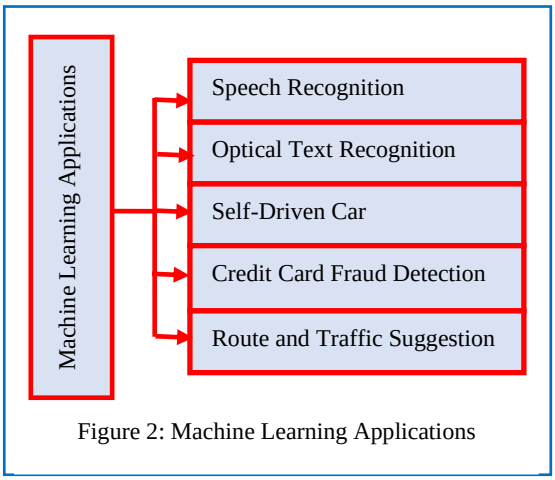

Figure 2: Machine Learning Applications

3.1 Speech Recognition

The automatic speech recognition (ASR) and machine learning (ML) groups have increasingly influenced one another in recent years. This is demonstrated by the recent occurrence of a number of dedicated workshops by both communities as well as by the fact that significant ML-centric conferences include sessions on voice processing and vice versa. community to establish assumptions on an issue, create exact mathematical theories and methods to solve the problem in light of those assumptions, but then evaluate on data sets that are generally small and occasionally fabricated [2].

3.2 Optical Text Recognition

The process of turning scanned images of printed, handwritten, or typewritten text into machine-encoded text is known as optical character recognition (OCR). Through an optical system, this technology makes it possible to recognize characters automatically. In the case of humans, our eyes are an optical system. Eyes provide the brain with an image to process. OCR is a technology that mimics human reading ability and it cannot match a human reader's ability to read. With the use of OCR technology, you can turn a variety of documents into editable and searchable data, including scanned paper documents, PDF files, and digital camera photographs [3].

3.3 Self-Driving Cars

Without the need for human intervention, an autonomous car can recognize its surroundings and drive itself. A driverless or self-driving car is another name for an autonomous vehicle. Without a human operator, it executes software and travels between locations using a combination of sensors, actuators, machine learning systems, and powerful algorithms. The sensors collect information about the environment in real-time, such as geographic coordinates, the vehicle's acceleration, speed, and potential impediments [4].

3.4 Credit Card Fraud Detection

Most people throughout the world are most aware of frauds because they have been in the news frequently over the past few years, particularly credit card thefts. Because there will be more valid transactions than fraudulent ones, the credit card dataset is rather unbalanced.EMV cards, which are smart cards that save their data on integrated circuits rather than magnetic stripes as technology advances, have made some on-

card payments safer, although card-not-present fraud rates are still higher. As chip card security has improved, the US Payments Forum study, thieves' attention has switched to crimes involving CNP transactions [5].

3.5 Route and Traffic Suggestions

Internet Map Applications like Google Maps recommend the noteworthy path to follow in order to go to our destination. These cues are delivered at the idea of carefully constructed computations. From outside data on speed, locations of cars, etc. It will store all the data on the appropriate server. Our ability to analyze congestion and nice directions is aided by machine learning methods [1].

4. ADVANTAGE AND DISADVANTAGES OF MACHINE LEARNING ALGORITHMS

There are several distinctive kinds of algorithms, each with a particular goal and working method. For instance, methodologies influenced by neural networks and tree-based algorithms. The methodology we'll employ in this case is considered to be the most beneficial for cluster processes. Even though these are not ideal, this grouping strategy is appropriate. Additionally, some algorithms can easily fit into a variety of categories.

Following are some of the machine learning algorithms;

a) Decision Tree Based Classification: A decision tree algorithm is a kind of categorization that is mainly used to create a model in the form of a structure that resembles a tree like having (root, branch, and leaf), that is based on previous knowledge to categorize or estimate class or identify factors of future (new data) that we can get with the aid of decision rules or decision trees. Decision trees are mostly used with numerical and categorical data. The algorithm uses a greedy search technique, starting at the top and working its way down. **Advantages**: It is easy to implement, less data processing, it can be used to classify and predict the categorical and numerical data. **Disadvantage**: Low predications accuracy, calculation difficulty if the data set is large, additional drawing is required for each data set, high probability of over-fitting.

b) Support Vector Machines: It can be classified into two different types i) Linear support vector machine ii) Non-linear support vector machine. The main goal of is to determine the hyper-plane that can be used for dividing the classes in two major types. Based upon the values received the data sets are place into the data set with the similarities. **Advantages**: Its memory efficient and suitable for multi-dimensional data space. It can easily classify the predication problem. **Disadvantage:** Memory usage is very high and it is not suitable for large and noise data sets.it is slow in the test phases.

c) K- nearest algorithm: Based on the k-values this type of algorithm it is used to calculate the distance of the data set with the predefined data set. **Advantage**: it supports multi class data. **Disadvantage**: It needs huge data set to calculate the distance with accuracy, larger storage space is required, its difficult to calculate the appropriate k-value.

d) Linear Regression: It is used to find the relationship between the dependent and independent variables. It cannot be applied to the non-linear data set and it only predicts the numerical output.

5. CONCLUSION

Machine learning is a subset of AI, which enables the machine to automatically learn from data, improve performance from experiences, and make predictions. Machine learning contains a set of algorithms that work on a huge amount of data. Data is fed to these algorithms to train them, and based on training; they build the model & perform a specific task. The recent development shows that people are aware of all the applications of machine learning that can be used in our day-to-day life. Numerous algorithms can been generated successfully to identify the characteristic and the requirements appropriately.

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