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THE EFFECT OF GUIDED INQUIRY ASSISTED BY INTERACTIVE MULTIMEDIA ON SCIENTIFIC LITERACY SKILLS

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Abstract. The research aims to examine differences in scientific literacy abilities in guided inquiry assisted by interactive multimedia and conventional learning; differences in students' learning motivation in the high and low categories in scientific literacy abilities; interaction of student learning motivation and guided inquiry assisted by interactive multimedia on scientific literacy abilities. The experimental method uses a 2X2 (AXB) design. The population of class V students was sampled using purposive sampling, 2 classes as a control group and an experimental group. Data collection techniques use questionnaires and tests and data analysis uses two-way analysis of variance. It can be concluded that there are differences in the scientific literacy abilities of guided inquiry assisted by interactive multimedia and conventional learning; there is no difference in the learning motivation of students in the high and low categories regarding scientific literacy abilities; and there is an interaction effect of student learning motivation and guided inquiry assisted by interactive multimedia on scientific literacy abilities. Students who have high learning motivation have better scientific literacy skills than students with low learning motivation. The results of this research can be used as material for teachers to consider in implementing learning innovations and alternative solutions to improve students' scientific literacy skills.

Keywords: guided inquiry, interactive multimedia, scientific literacy skills, learning motivation

I. INTRODUCTION

The World Economic Forum describes 16 21st-century skills and one of them is scientific literacy as the foundational literacy to solve daily tasks and problems [1]. Scientific literacy is important for students to understand the environment, health, economics, modern society, and technology. Therefore, assessing scientific literacy skills is urgently needed to find out the readiness of Indonesia's human resources to meet the needs and progress of the times.

Scientific literacy will help human beings to sort information and make informed and reasonable decisions. It will help people to realize that science and technology are the source of solutions and problems. Therefore, people need to have the ability to consider the advantages and disadvantages of the use of science and technology either for themselves or the society.

According to the PISA 2018 framework, scientific literacy is the ability to engage with issues related to science [2]. Scientific literacy is an individual's ability to use scientific knowledge to identify and draw conclusions based on evidence so that they can make the right decisions in solving scientific problems in society. Without scientific literacy, an individual will have difficulty solving problems related to education, science, and social problems daily. Scientific literacy is one of the important abilities that need to be assessed as an illustration of the implementation of curriculum in Indonesia.

One of the international assessments to assess scientific literacy is the Programme for International Student Assessment (PISA). PISA is an International assessment program organized by the Organisation for Economic Cooperation and Development (OECD). PISA is designed to measure how well 15-year-old students (1) prepare for future challenges, (2) analyze, express reasons, and communicate effectively, and (3) can continue to learn throughout life. Indonesia has been a member of PISA since 2000, however the results of PISA in 2018 show that the achievement is still below average among countries that follow PISA.

The OECD report shows that in the scientific literacy ranking in 2012 Indonesian students ranked 64 out of 65 countries with a score of 375,12. PISA in 2015 Indonesia was ranked 62nd out of 72 countries with a score of 400.13. Moreover, PISA's score in 2018 shows that the score is getting lower to 396 which means the score is far below the average (457.6). The results show that Indonesian students' scientific literacy skills are still considered low and this is an educational problem that needs to be improved immediately.

The lack of a student's scientific literacy can be caused by many things, such as the application of learning models and methods, media, learning resources, and teaching materials that have not been supported to improve student's scientific literacy. The learning process tends not to provide opportunities for students to understand everyday phenomena. During the learning process, students rarely ask questions and express their opinions, so it is difficult for students to communicate and associate their knowledge with science topics. This is in line with the research results of Negeri et al. [3], factors that cause low scientific literacy are psychological factors (interest in learning and learning motivation), family factors, and school factors (methods, models, and learning approaches).

The interview results in Group I Puspanegara, Citeureup District, Bogor Regency with through class V teachers in July of the 2021-2022 academic year stated that teachers have applied student-centered learning in the form of discussions and conducting experiments or practicums, but

Volume 6, Number 3, October 2023, Page 200-207
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have not yet integrated in a learning model that can improve scientific literacy skills. In addition, students are less trained in solving questions with scientific literacy characteristics as PISA questions. Students also tend not to have the opportunity to make and justify predictions, so learning in schools is focused on teachers as the source of information (teacher-centered). This kind of learning process does not reflect student-centered-based learning and hinders the students from developing their scientific literacy skills.

In addition, other results of interviews with teachers show that the learning process is still not effective due to student's low motivation in the learning process. Most of the students are still in the memorization stage, not until the analyzing stage. Students simply complete the tasks in the student's textbook that are assigned by the teacher.

Moreover, since Covid-19 the learning process has shifted to online learning (Pembelajaran Jarak Jauh/ PJJ) and most of the time the teacher tends to ask the students to do the textbooks repeatedly. Students' motivation and effort to learn is greatly reduced. In addition, students can easily find the answer key by searching for it in the Google search engine.

A teacher must be able to create a learning process that involves students actively and boost student's motivation. Therefore, to solve the problem that has been stated previously, a teacher must be able to apply a learning model based on the scientific method which can develop students' reasoning and scientific skills.

One of the learning models based on the scientific method is the guided inquiry model. Through this learning model students are exposed to scientific activities, such as observing, measuring, classifying, drawing conclusions, and communicating findings, so those scientific activities can improve the students' learning outcomes [4]. The advantages of guided inquiry models are students who are slow learners are still able to follow the learning process and students who are already excellent will not be dominant in the learning process. Students are directed by the teacher so that students who are slow learners are still able to participate in the learning process, and students who already excel and have high thinking skills will not be dominant in the learning process [5].

The pandemic era also made the world of education experience a big disruption in terms of the use of technology and communication tools. All parties involved, both teachers and students, are expected to be able to keep up with the technology. We are faced with an era that requires high-order thinking, and analytical, which means not manual like the habits that have been done previously [6]. During 2 years of online learning, the condition of our students has changed. Even though various technologies have supported the process of online learning, there are still many factors that cause learning at home to be less effective, resulting in learning loss [7]. Therefore, the learning process does not only need innovative learning models but also needs to be supported by the proper use of learning media. One of them is using interactive multimedia in learning.

The use of media in the learning process cannot stand alone, because media is only used as a tool, so learning media must be accompanied by a proper learning model. An interactive multimedia-assisted guided inquiry model will be used in this research.

Several studies on the influence of interactive learning and multimedia model collaboration that have been done by Wahyudin & Isa [8] show that the application of multimedia-assisted guided inquiry learning methods can increase student interest and understanding. Another study by Husein & Herayanti [9] also indicates that interactive multimedia in physics learning affects the mastery of student physics concepts. Moreover, research by Susilawati et al. [10] on the influence of multimedia-assisted problem-based learning models (PBM) and academic abilities on science literacy also shows a positive effect.

Furthermore, research related to the guided inquiry learning model, science literacy, and learning motivation was conducted by Apriliana et al. [11] about the influence of the Guide Inquiry learning model assisted by Mind Mapping on science literacy from a student learning motivation point of view show that the science literacy of students who study with the Guide Inquiry learning model with the help of mind mapping is higher than conventional learning, and students with high learning motivation have higher science literacy skills than students with low learning motivation.

The difference in the research that will be carried out is to examine the influence of interactive multimedia-assisted inquiry learning models on science literacy skills in terms of student learning motivation in Group 1 Puspanegara Citeureup District, Bogor Regency by focusing on science literacy abilities in science lessons in class V. Interactive multimedia that is used by combining several applications such as Canva, Flipbook, and Quizizz.

II. RESEARCH METHOD

This research uses quantitative research because the data from this research is in the form of numbers and analyzed using statistics. This research aims to see the influence of the interactive multimedia-assisted inquiry learning model on scientific literacy skills in terms of student learning motivation that can be known after the interactive multimedia-assisted inquiry learning model is applied in the learning process.

The experimental design used is factorial design. The design focuses on the possibility of variables that affect the treatment in independent variables to the results of dependent variables. In this case factorial design (AXB), the first factor (A) is an interactive multimedia-assisted guided inquiry learning model and a conventional model with textbooks, the second factor (B) is student learning motivation is divided into two categories which are high and low. Therefore, the design of experimental research is presented in the following Table 1.

Table 1. Experimental Research Design

Learning Motivation (B)	Learning Model (A)	
	Guided Inquiry Assisted by Interactive Multimedia (A_1)	Conventional (A_2)

Volume 6, Number 3, October 2023, Page 200-207
e-ISSN: 2623-0232 ; p-ISSN: 2623-0941

High (B_1)	A_1B_1	A_2B_1
Low (B_2)	A_1B_2	A_2B_2

The population in the research is 15 public schools in Gugus I Puspanegara Citeureup District. Sampling technique using purposive sampling. The samples in this study are class V students of SDN Puspanegara 05 totaling 40 and class V students of SDN Muhara 01 students totaling 40 students. From the two classes, one class is used as an experimental class that uses an interactive multimedia-assisted inquiry-assisted inquiry learning model and one class is designated as a control class that uses a conventional learning model.

Based on the needs and types of data that need to be obtained in this research, the instruments used consist of a validation sheet for the feasibility of learning devices, an observation sheet for the implementation of the lesson plan (RPP), a student learning motivation questionnaire, a validation sheet for a student learning motivation questionnaire, and a science literacy test instrument.

1. Learning Tools Analysis

The data from the instrument test follows Syllabus, RPP, LKS, and Interactive Multimedia with an average validity of 3.53 (Very Valid). The reliability of teaching devices using the Percentage of Agreement (PA) with an average result obtained 98.3% which means that the teaching equipment used is very reliable.

2. Learning Motivation Questionnaire Instrument Analysis

The test data of student learning motivation data using a questionnaire with 25 questions. Each question item is calculated using the Likert scale with validity and reliability tests. The questionnaire has been tested in class V SD N Muhara 02 totaling 30 students. With the provisions, the question item is considered valid with a significance level of 5% which is 0.361. The results of the questionnaire reliability test obtained by Cronbach's Alpha are 0.874, so it can be concluded that the level of reliability is high, so the questionnaire is a measuring tool for consistent and reliable learning motivation.

3. Scientific Literacy Ability Test Instrument Analysis

After being calculated with a significance level of 5%, it is known that there are 16 valid questions and 4 invalid questions. Based on the reliability results of the instrument data obtained using Cronbach's Alpha formula of 0.894, the value shows that the test instrument problem is included in the consistent category so that it can be used as a tool for measuring students' scientific literacy skills that are acceptable or reliable.

The results of the analysis with the difficulty criteria of the question item show that there are 16 questions considered as the medium category. After being analyzed with the criteria to distinguish the questions. The results show that 16 questions were obtained in the Good category.

III. RESULTS AND DISCUSSION

Data Description

1. Description of Science Literacy Skills Data

a. Experimental Class (Pretest- Posttest)

The pretest score of scientific literacy skills in the experimental class given the Interactive Multimedia-assisted Guided Inquiry learning model has a range from 13 to 87 with an average score of 46.38, a standard deviation of 19,533 and a variance of 381,522. The posttest value of science literacy ability in the experimental class given the Interactive Multimedia-assisted Guided Inquiry learning model has a range from 47 to 100 with an average value of 81.03, a standard deviation of 12.487 and a variance of 155.922.

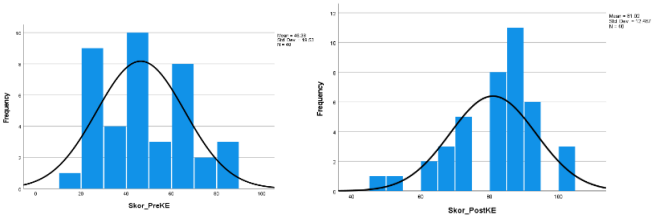

Figure 1. Frequency Histogram of Pretest and Posttest Scores for Experiment Class Students

b. Control Class (Pretest-Posttest)

The pretest score for scientific literacy skills in the control class given the Guided Inquiry learning model assisted by Interactive Multimedia ranged from 20 to 80 with an average score of 46.53, a standard deviation of 15.807 and a variance of 249.846. The posttest score for scientific literacy skills in the control class given the Guided Inquiry learning model assisted by Interactive Multimedia ranged from 40 to 100 with an average score of 67.55, a standard deviation of 13.103 and a variance of 171.690.

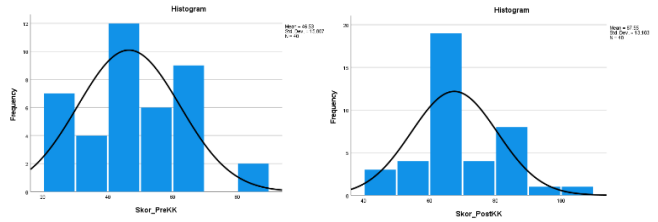

Figure 2. Frequency Histogram of Pretest-Posttest Scores for Control Class Students

2. Description of Student Learning Motivation Data

Based on the questionnaire on the student learning motivation that has been obtained, it is grouped into two class categories which are experimental class and control class. The questionnaire results from each class are divided into two data as follows; pretest and posttest. The description of student learning motivation data can be seen in Table 2 and Table 3 as follows:

Table 2. Pretest Result Data On Learning Motivation For Control Class And Experiment Class

Data Statistic	Control Class	Experiment Class
Lowest Score	73	79
Highest Score	93	96
Average	83,55	89,68
Standard Deviation	4,793	4,041
Variance	22,972	16,328

Table 3. Posttest Results Data On Learning Motivation For Control Class And Experiment Class

Data Statistic	Control Class	Experiment Class
Lowest Score	76	81
Highest Score	98	100
Average	86,90	92,73
Standard Deviation	4,744	5,174
Variance	22,503	26,769

Balance Test

The data used in performing the balance test is pretest data based on the initial data from the two classes tested. The test uses an independent sample t-test with a significance level of 0.05. Based on the initial state data from the Experimental Class, there are 40 students with an average score of 46.38 and Sig. (2-tailed) of 0.123. Moreover, the Control Class with a total of 40 students has an average of 46.53 and Sig. (2-tailed) of 0.123. In a balance test with a two-class t-test with Sig level. (2-tailed) > 0.05 means there is no significant difference between the results of the Experimental Class and the Control Class.

Normality test

The normality test is carried out to determine whether the data sample is normally distributed or not. The data is taken from the N-gain score of pretest and post-test scores in the Experimental Class and the Control Class using the liliefors normality test and can be seen in the Kolmogorov-Smirnov result table. Provisions on normality test decision-making, if the value of Sig. > 0.05, then it can be said to be normally distributed in Table 4 as follows :

Table 4. Normality Test Results

	Class	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
N_Gain_ Score	Experiment	.094	40	.200*
	Control	.136	40	.061

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the results of the table above, it shows that the Sig. value in the Experimental Class is 0,200 > 0.05, while the Control Class is 0.061 > 0.05. In conclusion, Experimental Class and Control Class data are normally distributed.

Homogeneity Test

Homogeneity tests are conducted to find out whether the data samples in the Experimental Class and Control Class come from homogeneous populations or not. The result data is tested using Lavene's test with the condition that if the value of Sig. > 0.05, then the data is homogeneous, that is, it does not have a significant difference between the Experimental Class and the Control Class can be seen in Table 5 as follows:

Table 5. Homogeneity Test Result

Tests of Homogeneity of Variances		Levene Statistic	df1	df2	Sig.
N_Gain Score	Based on Mean	.007	1	78	.932
	Based on Median	.002	1	78	.966
	Based on Median and with adjusted df	.002	1	75.452	.966
	Based on trimmed mean	.000	1	78	.988

Based on the data table above, a Sig. value of 0.932 > 0.05 has been obtained, meaning that there is no difference between the Experimental Class and the Control Class or that the sample is from the same or homogeneous population.

Independent T-test

Hypothesis testing uses two-lane variance analysis, data that has been tested at the requirements test stage and then continued at the hypothesis testing stage of two-lane variance analysis. The results of the analysis of the variance of two paths with cell contents are not the same to the ability of science literacy in the Interactive Multimedia-assisted Guided Inquiry learning model and the conventional model reviewed from student Learning Motivation can be seen in the following Table 6:

Table 6. Two Way Anova Test Results

Variance Value Category	Sig. Value	Criteria	Results
Model	0,000	< 0,05	There is difference
Motivation	0,373	< 0,05	No effect or difference
Model*Motivation	0,002	< 0,05	There is an interaction

Discussion

The research aims to determine the difference in the application of the interactive multimedia-assisted guided inquiry learning model to students' scientific literacy skills in terms of student learning motivation. Based on the results of data analysis in the hypothesis test that has been carried out, the research results are obtained as follows:

1. **There is a difference in the scientific literacy skills of fifth-grade students between the application of an interactive multimedia-assisted guided inquiry learning model and a conventional learning model.**

Based on the results of hypothesis testing using a two-lane variance analysis, the result of a Sig. 0,000 value shows that the Sig. value is less than 0.05, so it can be concluded that there are differences in the application of interactive multimedia-assisted guided inquiry learning models and conventional learning models to scientific literacy skills.

The application of both learning models can be analyzed by looking at the difference in the average value of scientific literacy skills before and after being treated. The following are the average score results using an interactive multimedia-assisted guided inquiry learning model and a conventional learning model that can be seen in the following Table 7

Table 7. Results Of The Average Value Of Scientific Literacy Skills Using The Learning Model

Learning Model	Mean
Conventional	67,55
Guided Inquiry	79,02

From the results of the average score, the value of scientific literacy skills in the conventional learning model 67.55 and the value of science literacy ability in the interactive multimedia-assisted inquiry learning model 79.02. It means

Volume 6, Number 3, October 2023, Page 200-207
e-ISSN: 2623-0232 ; p-ISSN: 2623-0941

that the application of the interactive multimedia-assisted guided inquiry learning model has better scores than the conventional learning model.

After using two-lane variance analysis or two-lane Anava test using N-gain Score after the application of an interactive multimedia-assisted guided inquiry learning model is carried out can be shown in the graph below.

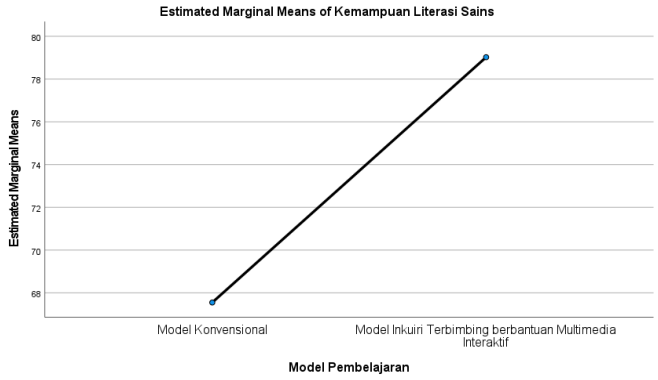

Figure 3. Increase in Average Value of Scientific Literacy Skills (N-gain)

From the picture above, it can be seen that there is an increase in the average value of science literacy skills from 67.55 to 79.02 which shows that the application of interactive multimedia-assisted guided inquiry learning models further improves scientific literacy skills than conventional learning models.

The results of this research are in line with the results of Yulianci & Doyan [12] research which shows that the interactive multimedia-assisted inquiry learning model has an effect on mastery of physics concepts. The research results are also almost similar to the research results of Agustina et al. [13] which states that the interactive multimedia-assisted guided inquiry model has a positive effect on the ability of scientific literacy.

The results of this research are in line with the concept that in the application of a guided inquiry learning model with interactive multimedia assistance, teachers have a role so that the investigation process runs systematically, orderly, logically, critically, and analytically according to the planned learning design. Therefore, the learning process involving student activities tends to reduce the memorization process and students are directed to improve their understanding of concepts [14]. The understanding of concepts in this research is related to students' scientific literacy abilities.

2. There is no difference in learning motivation between students in the high and low categories regarding the scientific literacy skills of fifth-grade students

Based on the results of hypothesis testing using two-way analysis of variance, Sig. 0.373 which shows that the Sig value. more than 0.05, so it can be concluded that there is no significant difference between students' learning motivation in the high category and low category in their scientific literacy skills. The results of hypothesis testing can be known by obtaining motivation questionnaire scores and scientific literacy skills scores which are categorized into high and low categories. The results of categorizing student learning motivation scores are shown in Table 8 and in Figure 4 below:

TABLE 8. AVERAGE RESULTS OF SCIENTIFIC LITERACY SKILLS BASED ON HIGH AND LOW MOTIVATION CATEGORIES

Category	Mean
Low Motivation	72,02
High Motivation	74,54

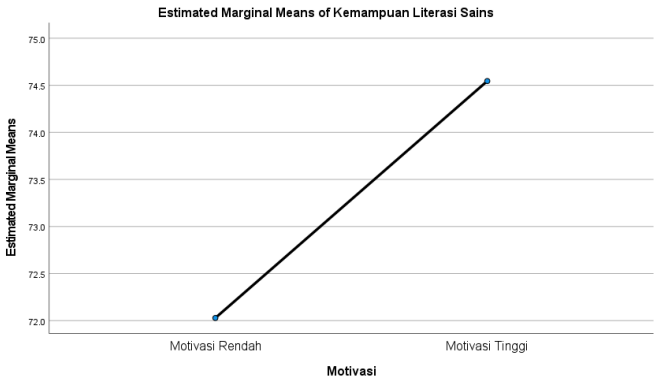

Figure 4. Diagram of Average Literacy Skills Results Based on High and Low Motivation Categories

From the table and diagram above, it is known that the average score of science literacy ability in the low-motivation category is 72.02 and the average score of science literacy ability in the high-motivation category is 74.54 which means that there is no significant difference in the results of science literacy ability between students with high motivation and low motivation categories. However, students who have high learning motivation have better science literacy skills compared to students with low learning motivation.

Hidayah et al. [15] revealed factors that affect students' scientific literacy skills including: (1) interest in science, (2) learning motivation, (3) teacher strategies in learning, and (4) school facilities. The results of this study are not in line with that opinion where the motivation to study in this research is less significant in affecting the ability of science literacy. The results of this research are also slightly different from the results of the research of Syah et al. [16] shows that learning motivation has an influence on the ability of science literacy.

However, the results are in line with the research that has been done by Yanti et al. [17] that states learning motivation does not affect the ability of scientific literacy. Scientific literacy skills are predominantly influenced by reading habits, so students should be trained and get used to doing problems that can boost students' scientific literacy skills. Research conducted by Getman, et.al. [18] also revealed that there were nonlinear results from the relationship between motivation and PISA results of Russian students where students who had high and low motivation both got good grades. However, the results of this research can also be indicated because the learning motivation instrument has not been able to reveal motivation indicators that have an effect on scientific literacy skills.

Volume 6, Number 3, October 2023, Page 200-207
e-ISSN: 2623-0232 ; p-ISSN: 2623-0941

3. There is an interaction effect between student learning motivation and the guided inquiry model assisted by interactive multimedia on the scientific literacy skills of fifth grade students

Based on the results of a hypothesis test using a two-track variance analysis, a Sig. 0.002 results showed that Sig. was less than 0.05, so it could be concluded that there was an interaction between student learning motivation and an interactive multimedia-assisted inquiry model of scientific literacy skills.

The application of a guided inquiry model with interactive multimedia assistance and student learning motivation affects the students' scientific literacy skills. This can be seen from the difference in the value of scientific literacy skills based on the categories of low learning motivation and high motivation after the application of the learning model. The average value of scientific literacy skills based on learning motivations that have been categorized is in Table 9 and Figure 4 below.

TABLE 9. DATA FROM THE INTERACTION RESULTS OF THE GUIDED INQUIRY ASSISTED BY INTERACTIVE MULTIMEDIA AND LEARNING MOTIVATION ON SCIENTIFIC LITERACY SKILLS

Learning Model * Motivation		
Dependent Variable:	Scientific Literacy Skills	
Learning Model	**Motivation**	**Mean**
Conventional	Low Motivation	70.750
	High Motivation	64.350
Guided Inquiry assisted by Interactive Multimedia	Low Motivation	73.308
	High Motivation	84.741

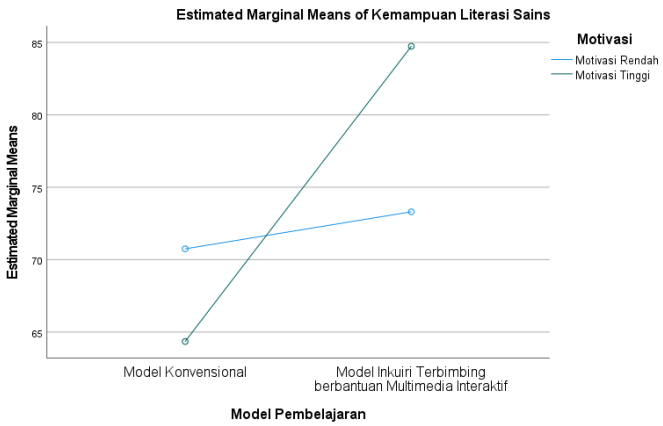

Figure 5. Diagram of the Interaction Results of the Guided Inquiry Learning Model assisted by Interactive Multimedia and Student Learning Motivation towards Scientific Literacy Skills

Based on table 9 and figure 4 above, it shows that by applying an interactive multimedia-assisted guided inquiry learning model, students who fall into the high and low motivation categories have different scientific literacy skills values, where there is an interaction between the interactive multimedia-assisted guided inquiry learning model and learning motivation that affects students' science literacy skills. In the control class, students with low motivational categories have an average score of 70.75 and students with high motivational categories have an average score of 64.35. In the experimental class, students with low motivational grades have an average score of 73.30 and the average scores of students with high motivational categories also increased to 84.74. This shows that there is an increase in scientific literacy skills due to the interaction between the applied learning model and student learning motivation. There is a positive relationship between the interactive multimedia-assisted learning model and student learning motivation towards the ability of science literacy according to the opinion of Hamalik. The five elements related to the learning process are learning motivation, learning materials, learning media, learning atmosphere and study subject conditions [19].

The guided inquiry learning model provides students with the opportunity to discover something new so that students do more self- or group activities to solve problems under the guidance of teachers. The interactive multimedia-assisted guided inquiry learning model can improve student competence and is in line with 21st-century learning. Interactive multimedia is practically used if it is designed according to the preparation of a media, easy to use, attractive, efficient, and has many benefits [20].

The results of Wahyudin & Isa [8] research concluded that the application of guided inquiry learning methods with the help of multimedia can increase student interest and understanding. This is also in line with the results of the Istiqomah & Hariyono [21], [22], [23], [24], [25] research which concluded that the application of a guided inquiry learning model can improve students' scientific literacy skills. Husein & Herayanti [9] also stated that the use of multimedia in physics learning has an influence on mastery of science concepts. Students also have direct insight into understanding the material and are able to apply it in the natural environment.

IV. CONCLUSIONS

Based on the research, it can be concluded as follows:

1. There is a difference in the scientific literacy skills of fifth-grade students between interactive multimedia-assisted guided inquiry and conventional learning. Applying and collaborating on learning models with the help of interactive multimedia can increase student learning motivation and at the same time be able to create more active and interactive learning activities in improving science literacy skills.
2. There is no difference in learning motivation between students in the high and low categories regarding the scientific literacy skills of fifth-grade students. However, students who have high learning motivation have better science literacy skills compared to students with low learning motivation.
3. There is an interaction between student learning motivation and guided inquiry assisted by interactive multimedia on the scientific literacy skills of fifth-grade students, so it can also be seen that students with high learning motivation have better scientific literacy skills than students who have low learning motivation.

The application of the guided inquiry model assisted by interactive multimedia can increase students' learning motivation and at the same time be able to create more active and interactive learning activities in improving scientific literacy skills. Even though there is a less significant difference between the learning motivation of students in the high category and the low category regarding scientific literacy skills, students who have high learning motivation

have better scientific literacy skills than students with low learning motivation. Apart from that, there is an interaction between students' learning motivation and the application of the guided inquiry assisted by interactive multimedia on scientific literacy skills, so that students' scientific literacy skills are better than before.

Further research should be carried out to analyze indicators of learning motivation and factors that influence students' scientific literacy skills so that they can improve scientific literacy skills in the future.

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