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Science Literacy in Elementary Schools: A Comparative Study of Flipped Learning and Hybrid Learning Models

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Abstract

The condition of science literacy in elementary schools continues to transform using various learning technology platforms by following the dynamics of the learning conditions they face. Although previously learning interactions took place normally in the classroom, today's learning also always requires learning interactions in a virtual-based space. This study uses a comparative experimental research design Pretest-Posttest Control Group Design with a sample of 84 students from three grades who were purposively placed in two experimental class groups. Data were collected in the form of a pretest and posttest. The data analysis technique used parametric analysis in the form of the comparative Tukey test. The two models tested were proven to be effective in improving students' science literacy. The results of the comparative analysis prove that the Flipped Learning Model is more positively effective in improving students' science literacy, compared to the application of the Hybrid Learning Model. This technology-based model relies on facilities and infrastructure as a platform to support science literacy in addition to the technological capabilities of teachers and students. This study reveals the implementation of an effective learning model to be used in learning emergencies, including in normal situations after the Covid-19 pandemic.

INTRODUCTION

Background of the Study

The current massive change in education governance requires the need to harmonize access to education and learning in schools. The goal is that all forms of educational services are more adaptive to various developments, both in terms of advances in learning technology and the state of the learning

environment (Komariah, 2021; Siregar, 2019). This massive change will always go hand in hand with technological developments that were felt after the outbreak of the Covid-19 outbreak that occurred in recent years (Salsabila et al., 2020). Since the outbreak of the Covid-19 virus, various government policies in the school education sector have taken place in the form of the implementation of a Limited Face-to-face Learning system that will take effect simultaneously in mid-2021 (Hamna & Ummah BK, 2022). Along with the implementation of the policy, it will also intensify the use of online system-based learning technology (The Cabinet Secretariat of the Republic of Indonesia, 2021).

Even in any situation, the implementation of education and student learning in schools should be ensured to take place well even though the models or learning strategies applied are different. Responding to the learning situation that occurs, educators are always required to be able to design their teaching models by utilizing existing facilities as an effective learning innovation, either by utilizing the surrounding natural environment, social media or internet-based technology facilities, and so on. This is by what is contained in the Circular Letter of the Minister of Education and Culture of the Republic of Indonesia Number 4 of 2020 which offers that the implementation of education policies during the spread of Covid-19 can be integrated with online learning (Indonesian Ministry of Education and Culture, 2020).

Until now, online-based learning has been used as an effective solution for remote teaching and learning activities, as an example seen today. Although the Covid-19 pandemic has shown signs of ending, online learning will still be needed in the present and the future. Novita et al. (2019) said the purpose of implementing online learning is one way of learning that can build interactive relationships between teachers and students without requiring students to be present face to face in their classrooms, but interactive learning activities are mediated by the use of digitalization technology facilities in the form of smartphones or laptops (Mu'ah et al., 2020).

Teaching and learning systems that run online include learning that is packaged virtually with various names such as Blended Learning, Flipped Learning, Hybrid Learning, and the latest Metaverse Learning has functioned with the help of internet-based technology (Kye et al., 2021; Indarta et al., 2022)). Learning activities carried out online, require the accuracy of the material to be taught. Because the accuracy in its use will be the domain of determining the success of learning.

Online learning in elementary schools has also been widely used in supporting student access to learning (Widyaningsih, 2020). Learning with online design is known as distance learning. Access to learning generally uses various heterogeneous learning application media platforms such as WhatsApp, Zoom, Google Form, Google Meet, Google Classroom, and various other learning technology platforms (Chen et al., 2014; Dewi, 2020; Assidiqia & Sumarni, 2020). From these various platforms, the analysis then concentrates this research on the application of the Flipped Model and Hybrid Learning which will be reviewed in a focused manner in the next discussion.

The implementation of this model certainly has an impact on improving the quality of learning activities, especially in terms of students' science literacy skills. Although previously full-day learning interactions were carried out directly in the classroom (full offline learning), at this time they had to interact in a very limited virtual-based room (limited online learning). In this 21st-century learning condition which is known for the massive influence of internetization technology, educators are required to be able to provide maximum lessons in creative, innovative, and adaptive ways using learning media that can stimulate students to develop their science literacy skills (Azimi et al., 2017).

Problem of The Study

Initially, learning that was oriented to increasing science literacy by utilizing online learning facilities from home was seen as a new activity. But now it is seen as commonplace. So that the stigma of perceived learning as mediocre can be transformed into learning that feels new again. Teachers are required to creatively take advantage of existing learning technology platforms with varied teaching

presentation packages and be able to invite active student involvement through online learning that they apply when students study at home (Effendi & Wahidy, 2019).

Not a few students experience failure in their science literacy skills as long as students are charged with learning online from home. Although this fact returns to the internal and external conditions of each student in receiving lessons at school (Verawati & Desprayoga, 2019). Currently, the development of science literacy skills is still very much needed. This is because children's understanding of science as in learning science and numerical abilities will always be needed in their lives. And the state of every human being will always be faced with questions about his life, thus requiring scientific information and scientific ways of thinking to make decisions and personal interests, and the interests of many people in utilizing the potential of living resources such as air, water, and the environment.

Science literacy as scientific knowledge will always be needed by every human being. Everyone needs to use this scientific information in their life. This is why learning that is identified with science literacy needs to be taught from an early age to children at school. At the elementary school education level, learning with an emphasis on the process of science literacy is seen as providing students with more scientific abilities such as making observations, inferences, experimenting, and inquiry is a scientific method as the core of students' science literacy learning. Many ways of teaching can be applied by teachers in teaching science literacy. For example, learning offline or face-to-face in class, teachers can apply cooperative learning models with a scientific method approach, such as by applying the Jigsaw learning model, inquiry, and other models (Ummah BK & Hamna, 2021). Even in online learning, various alternative ways of teaching can be applied by teachers to teach science literacy in elementary schools such as flipped, hybrid, blended, and various other learning platforms.

The application of learning models with an emphasis on scientific methods in teaching science literacy makes it easier for students to describe objects and events, ask questions, build explanations, test their explanations against the latest scientific knowledge, and communicate their ideas to others. Thus, students will be stimulated to identify their assumptions, using critical and logical thinking. In this way, students are expected to be more active in developing their understanding of science literacy by combining their knowledge with their thinking and reasoning skills. Although learning online from home does not mean that students cannot develop their science literacy skills. It depends on how educators can use existing facilities to support student learning, even though they are faced with various possible obstacles such as constraints with poor internet network connections and so on that can potentially reduce students' science literacy skills.

The OECD (2018) released the results of the Program for International Student Assessment (PISA) survey which recorded the learning achievements of 15-year-old students of science literacy in Indonesia with an average score of 396 (ranked 70 out of 78 OECD countries). The condition of the science literacy ability of Indonesian children in this OECD country is still low and very worrying in the current era of digital technology (Fausan et al., 2021). PISA is an indicator for assessing the progress goals of science education in several countries, including Indonesia to date (Sadler & Zeidler, 2009).

The weakness of Indonesian students' science literacy, as noted by the results of the Program for International Student Assessment (PISA) survey, will signal the worst possibility if this condition is not taken seriously. One of the preliminary studies found in the object of this research was that information on science literacy learning outcomes for the students of an Elementary School in Tolitoli Region, Central Sulawesi, Indonesia was getting weaker, during which student learning activities at school were diverted to study from home with a fully online system which showed potential signs of declining literacy skills. student science.

Obtained from the results of student report cards after they were accumulated related to the science literacy ability of 48 students. Initial data was obtained that the three science subjects students in the 2021/2022 academic year were generally classified as low based on the standard setting of 75%

of the Minimum Completeness Criteria (KKM). The results of the achievement of science literacy can be seen in table 1.

Table 1. Accumulative Data on Academic Achievement in Science Literacy for Class IV, V, and VI Students of an elementary school in Central Sulawesi

Subjects	Average Achievement Score	Average Achievement of 75% KKM
Mathematics	56,76%	Not Complete
Natural Science	51,53%	Not Complete
Social Science	56,77%	Not Complete

Source: Data on Report Value of the observed school for the 2021/2022 Academic Year

The condition of the weakening of students' science literacy skills at the observed school cannot be separated from the shift in learning patterns from the face-to-face learning system in schools to changing learning patterns from home based on online and Limited Face-to-face Learning (PTM) which some of the activities are carried out online. learning. The impact of the change in learning patterns requires that every teacher at the observed school switch to optimizing the online learning system as much as possible.

The situational impact of the shift in learning conditions, making the online learning-based teacher learning pattern initially only used as an online learning media platform with the function of ordinary communication tools without utilizing their creativity in combining it with the application of cutting-edge learning strategies that have been widely recognized for their effectiveness by practitioners such as applying the Model Flipped Learning, Hybrid Learning, Blanded Learning and various other effective learning models that can be synchronized with the use of online learning facilities. Various applications of online learning models during the Covid-19 emergency can make a major contribution to student learning (Hamna & Ummah BK, 2022). Mainly contributing to students' science literacy learning in schools as well as answering the challenges of learning in the 21st century which requires integration with digitalization-internetization technology (Alrashed & Bin, 2021).

Research's State of the Art

Learning from home based on online learning is an effective learning pattern applied in times of emergency, especially in studying science literacy (Utamajaya et al., 2020). Learning using Flipped Learning and Hybrid Learning with an online learning base is useful for improving the interaction pattern of students' science literacy learning. These two models can stimulate students' ability to learn science to be better in achieving their learning outcomes, which used to be lethargic when studying online without clear teacher assistance, again making students enjoy the science literacy lessons taught to them (Abroto et al., 2021).

Flipped Learning and Hybrid Learning models are based on different learning implementations, but the learning media platforms used both rely on internet-based information technology media. Flipped Learning is learning that combines classroom meetings with online learning as well as Hybrid Learning which is both based on online learning. According to Herreid & Schiller (2013) in Flipped Learning, things that are usually done in the classroom such as explaining the material, giving assignments, exercises, and homework shifts to online-based learning. The implementation principle in Flipped Learning is synchronous and things that are usually homework including exercises, case studies, problem-solving, and the like are better done in class. While listening to the teacher's

explanation becomes a homework assignment in the form of watching learning video shows. Therefore this learning is called Flipped Learning.

As is the case with Hybrid Learning, learning is also combined with online learning design (Makhin, 2021). Hybrid Learning provides opportunities for students to be able to carry out direct learning such as discussions, and debates, and be able to receive instructions responsively even though it is mediated by an internetization platform (Nurfallah & Pradipta, 2021). The principle of implementing Hybrid Learning is asynchronous learning as a learning model that maximizes direct teaching from the teacher, where in the learning process students learn subject matter through direct virtual interaction with the teacher while still using internet media to support all learning activities such as doing assignments, discussing material, problem-solving includes studying problems that he has not understood while studying online.

The fundamental difference in the focus of this research with the results of scientific studies from several previous researchers who have confirmed the advantages of the Flipped Learning and Hybrid Learning models which were studied separately and carried out by different research subjects, the researchers, in this case, is more focused on revealing the facts of the effectiveness of the two models. which is tested through the results of a comparative study that compares the advantages of the Flipped Learning and Hybrid Learning models which were studied simultaneously by utilizing two different class objects with experimental research methods.

Gap Study & Objective

This study assumes that the implementation of the Flipped Learning and Hybrid Learning system model is seen as effective in improving students' science literacy skills. But of course, its use requires the support of facilities and infrastructure based on the latest technology. The application of the system is also an online learning medium that can bridge the increase in students' science literacy in elementary schools. Therefore, this study focuses on looking at the comparison of the average level of effectiveness of the two models tested on the science literacy abilities of students in elementary schools. This comparative research was conducted because until now there have been no results of research that has carried out comparative tests on the advantages of the two models studied, namely the Flipped Learning Model and Hybrid Learning, especially in measuring students' science literacy skills in elementary schools.

METHOD

Type and Design

This research is comparative-experimental quantitative research. The type of experimental method is a true experiment. Determination of the type of true experiment which is analyzed comparatively is motivated by the selection of the test subject determined by probability sampling so that the results of the sample test can be generalized to a wider population object. The rationale for using this comparative-experimental research is to compare two different experimental class conditions in giving treatment so that the level of comparison of the effectiveness of the two learning models studied can be observed. In addition, the determination of the comparative-experimental method in this research analysis utilizes pretest and posttest instruments to measure students' science literacy learning outcomes by comparing the effectiveness of the Flipped learning model and the Hybrid Learning model.

The design of giving pretest-posttest and comparative-experimental research is almost the same as the type of quasi-experimental research based on the use of pretest-posttest, the difference is only seen from the side of the class group that is formed, namely all classes are used as experimental classes and there is no formation of a control class including the category determination of the sample that is not determined purposively.

Data and Data Sources

The variables used are two independent variables, namely the application of the Flipped learning Model and the application of the Hybrid Learning Model. The two independent variables are then compared with the level of effectiveness of their application to the dependent variable, namely the students' science literacy ability.

The research population came from all students of an elementary school in Central Sulawesi, which was then determined as an experimental class sample from three grade levels, namely grades IV, V, and VI which were determined based on a probability sampling mechanism. The overall sample of students is 84 students who are students for the 2021/2022 academic year. From this whole sample, it was then merged into two experimental class groups according to their class level. Where the experimental class A is given treatment with the application of the Flipped Learning Model and the experimental class B applies the Hybrid Learning Model, as the results of the class formation are shown in table 2.

Table 2. Experiment Class Grouping

Class Samples	Samples	Experiment Class A	Experiment Class B
IV Class	28	14	14
V Class	26	13	13
VI Class	30	15	15
Total	84	42	42

Source: Student Data for Academic Year 2021/2022

The two learning models studied in experimental class A and experimental class B follow the design pattern as shown in Figure 1 (Flipped Learning) and Figure 2 (Hybrid Learning).

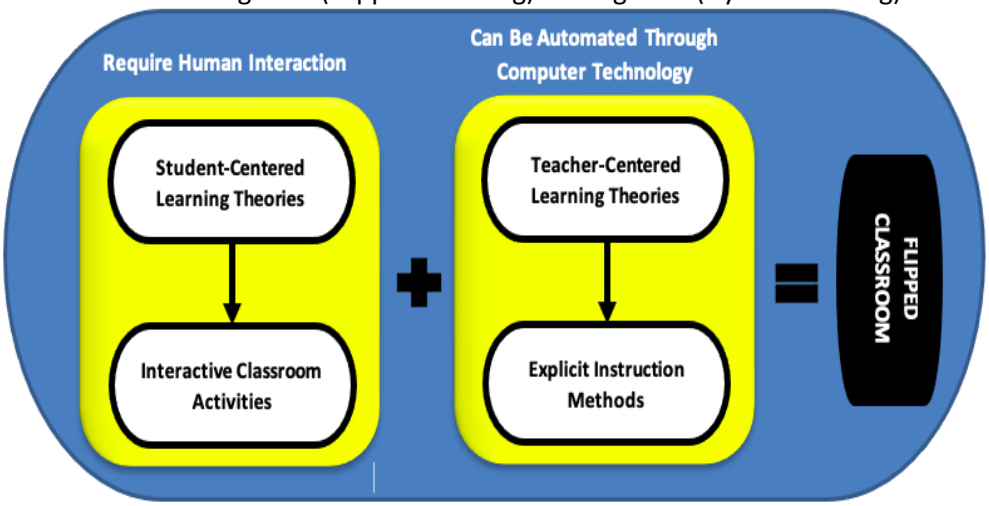

Figure 1: Flipped Learning Model Design (Bishop & Verleger, 2013)

Learning with the Flipped model emphasizes the efficient use of learning time in class into learning activities that are done at online from home and work or assignments that should be done at home, swapping positions to be completed in class (Oakes et al., 2019). In supporting the application of this Flipped Learning Model, at an elementary school in Central Sulawesi, 3-day learning meetings are held for 1 month (12 learning meetings with Flipped Learning activities) by emphasizing two main approaches: 1) using computer/mobile phone devices as access learn directly outside the classroom by watching learning videos that have been shared by the teacher in the form of link access; and 2) continue to carry out interactive learning in the classroom using Limited Face-to-face Learning (PTM)

following the learning policy regulation by the local government in Tolitoli Regency, Central Sulawesi (Tolitoli, 2021).

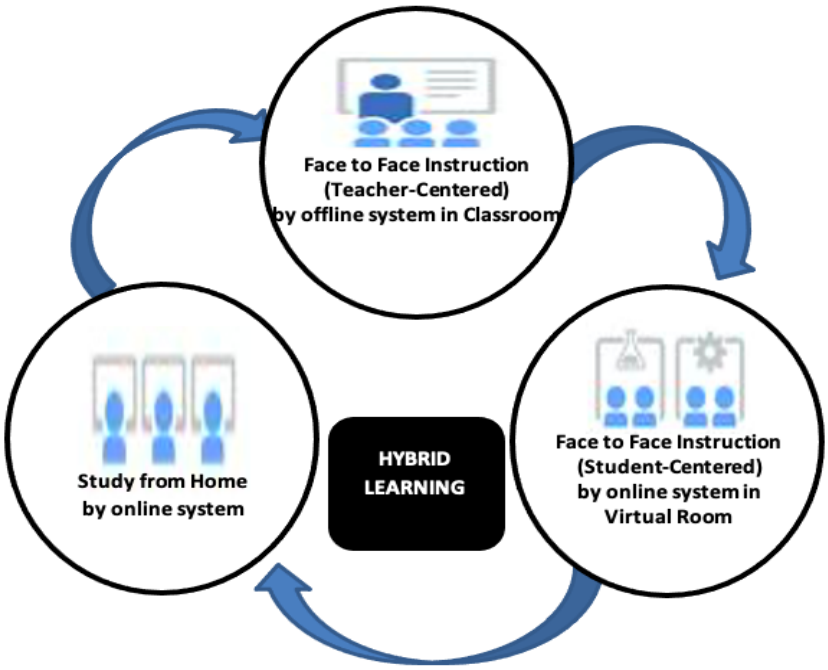

Figure 2: Hybrid Learning Model Design

It is different from the design pattern of the Hybrid Learning Model as can be seen in Figure 2 and then its application is adjusted to the conditions of science literacy learning at the observed school. The design pattern begins with the first stage, where students carry out face-to-face learning about 3 times a week with the teacher in the classroom. Furthermore, for the next 4 weeks (12 meetings as part of the Hybrid Learning activity), students were instructed to undergo web-based/online system-based independent learning activities from home, either synchronously or asynchronously. During the independent study period, all students meet again with the teacher through the online system directly according to a predetermined schedule. In this final stage, students are facilitated to report any learning problems they face in connection with learning tasks related to science literacy given to them. These activities can be done by students directly at school or virtually, depending on the learning situation at hand.

Data collection technique

Data collection techniques in the form of pretest and posttest in this comparative quasi-experimental method use a test instrument in the form of a questionnaire that has been tested for the level of validity and reliability. In order to determine the validity of the scientific literacy questionnaire, it was tested to 28 students. The trial completion of the scientific literacy questionnaire revealed that 18 of its items were valid. The calculation limit above 0.387 is used to determine item validity requirements. Therefore, the number of questionnaire statements used to measure pre- and post-test results for scientific literacy among students is 18. The pretest was given before the learning model studied was applied to the two experimental class groups that had been formed to measure early science literacy skills for all students. The posttest was given after the learning model studied had been applied to the two experimental classes of this study.

Data analysis

The data analysis technique uses parametric statistical analysis in the type of multiple linear regression (F test). This analysis is used to determine the effect of two independent variables on other variables studied. Then the results of comparative data analysis using the Tukey test analysis, which is used to compare the effectiveness of the analysis of each learning model studied. The basis for determining this parametric test analysis departs from the results of the prerequisite tests for data analysis carried out, one of which is that all data are normally distributed. All types of statistical test analysis used were carried out using SPSS 26 software.

RESULTS

As explained in the research methods section, explains the flow of the process of applying two learning models that are believed to be able to streamline students' science literacy learning outcomes. In the following explanation, the comparative test results are explained between the two models studied, namely Flipped Learning and Hybrid Learning. The results of the research in the experimental class were seen based on the results of the pretest-posttest descriptive data analysis as tabulated in table 3 and table 4 below.

Table 3. Descriptive Data of Pretest Results

Experiment A	Science Literacy Subjects	Class IV			Class V			Class VI		
		X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$
Flipped Learning	Mathematics	42	88	65	54	76	65	48	76	62
	Natural Science	67	85	76	58	80	69	65	77	71
	Social Science	64	84	74	62	70	66	59	73	66
The Average Results of the Students' Science Literacy Pretest		58	86	72	58	75	67	57	75	66
Experiment B	**Science Literacy Subjects**	**Class IV**			**Class V**			**Class VI**		
		X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$
Hybrid Learning	Mathematics	56	87	72	50	89	70	55	81	68
	Natural Science	55	89	72	58	85	72	57	90	74
	Social Science	67	87	77	64	82	73	68	78	73
The Average Results of the Students' Science Literacy Pretest		59	88	74	57	85	72	60	83	72

Source: Research Data in 2022

Table 4. Descriptive Data of Posttest Results

Experiment A	Science Literacy Subjects	Class IV			Class V			Class VI		
		X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$
Flipped Learning	Mathematics	79	90	84	84	98	91	81	90	86
	Natural Science	80	95	88	78	92	85	88	96	92
	Social Science	82	94	88	80	95	88	82	96	89
The Average Results of the Students' Science Literacy Posttest		80	93	87	81	95	88	84	94	89
Experiment B	**Science Literacy Subjects**	**Class IV**			**Class V**			**Class VI**		
		X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$	X_{min}	X_{max}	$\bar{X}$
Hybrid Learning	Mathematics	75	83	72	86	94	90	72	82	77
	Natural Science	72	89	81	83	98	91	76	87	82
	Social Science	68	88	77	79	95	87	79	84	82
The Average Results of the Students' Science Literacy Posttest		59	87	77	83	96	90	76	83	80

Source: Research Data in 2022

Tables 3 and 4 show a comparison of the effectiveness of the two learning models based on the results of descriptive data testing, which are cumulatively taken from the overall data from the pretest and posttest test samples (class IV, V, and VI) which are simply seen from the accumulation of comparisons. the minimum value (X min), maximum value (X max), and average value (X) of the learning outcomes of experimental class A (Flipped Learning) and experimental class B (Hybrid Learning). It is also known that the results of measuring the reliability of the test instrument are in table 5 with an r-table of 0.388 for experimental class A based on Cronbach's Alpha value of 0.881 (Highly Reliable). Meanwhile, the results of the instrument reliability test for experimental class B are also very reliable with Cronbach's Alpha value of 0.877.

Table 5. Realibility Statistic

Flipped Learning Model		Hybrid Learning Model	
Cronbach's Alpha	**N of Items**	**Cronbach's Alpha**	**N of Items**
.881	84	.877	84

Source: SPSS Data Processing Results

The results of the normality test show that the data is in a normally distributed state. The results of the normality test of this data become a determining factor for the use of parametric statistical hypothesis testing analysis for the comparative-experimental analysis model of the two class sample states tested, this is as the measurement results are shown in table 6 below.

Table 6. Data Normality Test Results

Test Type		Kolmogorov-Smirnov[a]		
		Statistic	**df**	**Sig.**
Science Literacy	**Flipped Learning**	.134	42	.200*
	Hybrid Learning	.134	42	.186*

Source: SPSS Data Processing Results

After performing the normality test with the results of all data being normally distributed, then the data multicollinearity test was carried out. This multi-collinearity test aims to test whether there is a correlation between the independent (independent) variables in the regression model. Testing for the presence or absence of multi-collinearity data was carried out using the VIF (Variance Inflation Factor) method. The criteria used in testing the VIF method is that if the VIF value is > 10, then there is high multicollinearity between the regressors of one independent variable and the regressors of other independent variables, as shown in the following test results.

Table 7. Data Multi Collinearity Test Results

Variable	*Tolerance*	VIF
Flipped Learning	0.852	1.337
Hybrid Learning	0.756	1.376

Source: SPSS Data Processing Results

Based on the results of the tabulation table 7, the VIF value in all independent variables is < 10, and the tolerance value for the dependent variable is > 10%, so it can be interpreted that in this study there were no symptoms of multicollinearity in the two independent variables. Through the test results of the prerequisite analysis, the statistical hypothesis test was carried out by using parametric statistical calculations with the type of multiple linear regression analysis. Regression analysis is used to determine the indication of the effect of each independent variable on the dependent variable.

Measurement of statistical hypothesis testing using the F test (Simultaneous Test) One Way Anova Test. Simultaneous equation testing can be done by comparing the results of the F-count and F-table measurements provided that if F-count < F-table, Ho is accepted and Ha is rejected (not significant), otherwise if F-count > F-table, then Ho is rejected and Ha is accepted (significant).

Table 8. Test of Between-Subjects Effects

Dependent Variabel: Literasi Sains			
Source	**df**	**F**	**Sign.**
Between Groups	2	7.321	.834
Within Group	82		
Total	84		

Source: SPSS Data Processing Results

The test results in this study simultaneously obtained the results that the F-count (7.321) > F-table (3.429) so it can be interpreted that the hypothesis is accepted, meaning that the Flipped Learning and Hybrid Learning models simultaneously affect students' science literacy skills. As the results of this simultaneous test were then carried out a comparative test analysis was seen through the Tukey test measurement data. Testing with the Tukey test analysis was used to determine the significant difference in the effectiveness of the two learning models studied. The results of the Tukey test can be seen in table 9 below.

Table 9. Comparative Test Results Data Through Tukey's Test Analysis

Dependent Variable	**Class (I)**	**Class (J)**	**Mean Difference (I-J)**	**Std. Error**	**Sign.**	**95% Confidence Interval**	
						Lower Bound	**Upper Bound**
Science Literacy	Flipped Learning	Hybrid Learning	2.71*	3.643	.037	2.41	1.49
	Hybrid Learning	Flipped Learning	-2.52	3.555	.000	-1.49	-2.41

Source: SPSS Data Processing Results

Based on the results of the comparative analysis of the Tukey test, it is proven that the science literacy ability of the experimental class that applies the Flipped Learning Model has a significant difference from that of the experimental class that applies the Hybrid Learning Model. The results of this test indicate that the application of the Flipped Learning Model has a more effective and significant positive effect than the application of the Hybrid Learning Model on students' science literacy skills. Although there are differences in quantum data, these two models both make an effective contribution to improving students' science literacy skills.

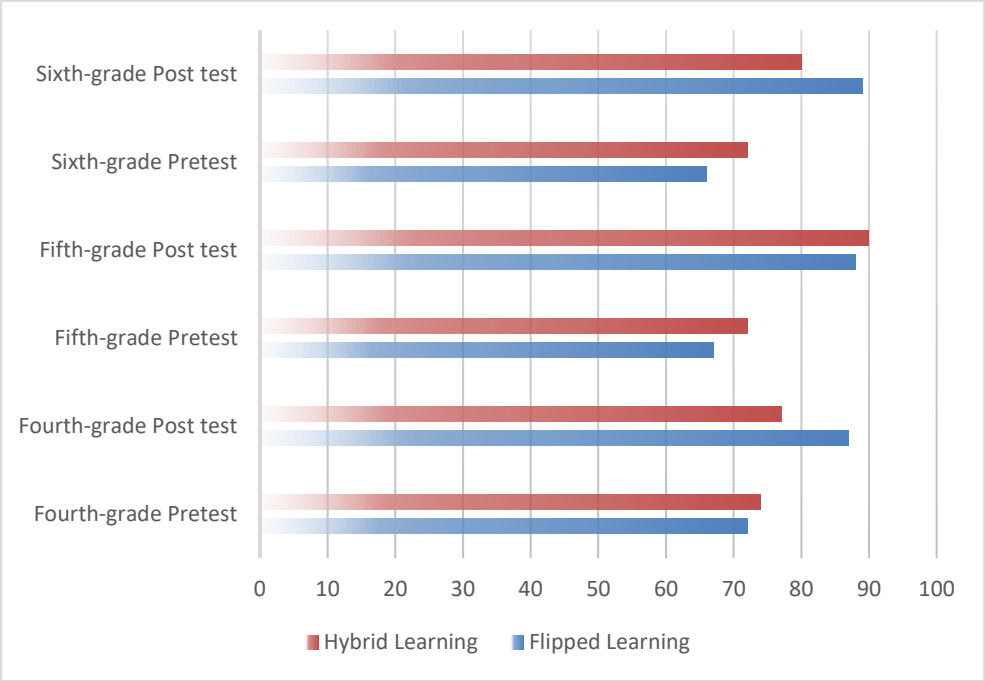

Figure 3: Comparative Differences in the Effectiveness of Flipped Learning and Hybrid Learning Models

Table 10. Accumulated Average ComparisonLevel of Effectiveness of Model Implementation

Model Comparison		Class IV Samples	Class V Samples	Class VI Samples	Total Score
Flipped	Pretest	72	67	66	68,33
Learning	Posttest	87	88	89	88,00
Hybrid	Pretest	74	72	72	72,67
Learning	Posttest	77	90	80	82,33

It is known that the pretest results of the experimental class A that applied the Flipped Learning Model showed students' science literacy results with an average achievement of 68.33 then increased effectively based on the posttest results with an average of 88.00. The results of the pretest experimental class B that applied the Hybrid Learning Model with an average learning achievement of 72.67 also increased effectively from the results of the posttest achievement with an average result of 82.33. As it was proven earlier that the two models studied were proven to be effective in increasing students' science literacy at the observed school, although there was a significant difference in effectiveness that favored one of the models studied.

As the data obtained, the Flipped Learning Model is more effective than the implementation of the Hybrid Learning Model. In fact, from the two experimental class conditions studied for the support of the facilities and infrastructure, including the learning technology used to support the application of the two learning models, it is the same as using a computer/laptop/smartphone device supported by the availability of internet network access.

DISCUSSIONS

Flipped Learning and Hybrid Learning are the two most dominant learning models applied by teachers and students in learning activities that integrate the application of online or offline learning

media technology. The two learning models according to the results of research that have been carried out have proven to be very effective in improving students' science literacy at the observed school.

The effectiveness of the application of the two models studied can be applied especially when facing learning emergencies, such as during the outbreak of the Covid-19 virus which resulted in restrictions on access to face-to-face learning in schools. The research results of Thohir et al. (2021) explain that this model can monitor student learning activities even though they are in a learning emergency, making it easier for teachers to monitor student learning progress through the use of various online media platforms that are easy for students to use and like, such as online quizzes, youtube and so on.

Not only can it be used in an emergency, but these two models can also be applied to all types of subjects at the elementary school level as long as access to learning requires synchronization with internetized technology facilities. Usually the selection of these two learning models in improving students' science literacy in elementary schools because they can harmonize the learning conditions they face. Relevant to the research results of Wendt & Rockinson-Szapkiw (2014), using online learning media can minimize students' scientific misconceptions about what they learn.

The effect of effectiveness of the application of the Flipped Learning Model on increasing students' science literacy at The observed schoolis supported by the learning stages that have been carried out, with the teacher's initial step providing learning videos that have been creatively made by the teacher. The presence of this learning video is very helpful for students in learning, with the advantage that it can be watched repeatedly by students until students understand the material taught by the teacher through the mediation of the learning videos provided.

Awareness of students watching learning videos is also an important weight that underlies the increase in students' understanding of the material being taught so that in the end it makes it easier for students to complete their learning tasks. The presence of videos with Flipped Learning patterns according to Leo and Puzio (2016) is more enthusiastic about students' learning enthusiasm in science learning such as natural science subjects in high grades.

The effectiveness of the Flipped Learning Model has also been mentioned in several previous studies, as concluded through the results of Sezer's research (2016) proving the effectiveness of Flipped Learning can produce good academic achievement and motivate students to be more active in learning. Juniantari et al. (2018) said that the implementation of the Flipped Learning Model on students' conceptual understanding has a positive effect. Shi et al. (2019), Flipped Learning can improve students' cognitive abilities and effectively increase students' individual collaborative and pedagogical activities.

Khofifah et al. (2021) and Gumilar (2021), the application of the Flipped Learning Model has a positive effect on students' understanding of mathematical concepts and problem-solving. Rohmatulloh & Nindiasari (2022) through their research results also revealed an increase in student's conceptual understanding and problem-solving abilities by applying the Flipped Learning model. According to Núñez et al. (2020) that in line with technological advances in environmental sciences-based learning requires innovative and active teacher teaching methods, one of which is by doing Flipped Learning as a good teaching strategy for developing students' learning experiences and learning outcomes (Cheng et al., 2019).

Likewise, the application of the Hybrid Learning model through the data from the research that has been carried out has also been proven to be able to improve the science literacy skills of students at the observed school. This Hybrid Learning Model is an incarnation of the results of the development of the Blanded Learning Model. From a review of the effectiveness of its application to students' science literacy skills, it is done by combining face-to-face learning with learning strategies by utilizing computer/mobile phone facilities online or offline systems. The strengthening of the application of the model is in line with the view that the Hybrid Learning Model can combine face-to-face, synchronous,

and asynchronous learning activities that facilitate the interaction of teachers and students under certain conditions (Hendrayati & Pamungkas, 2016).

Implementation of the Hybrid Learning Model in responding to certain circumstances as stated by (Makhin, 2021) that Hybrid Learning can be useful as a preventive measure to overcome student boredom and rigidity during the implementation of online learning policies during the Covid-19 pandemic which has been carried out fully online so far (Setiawan & Iasha, 2020). The balancing of other learning conditions is mediated by today's technological advances according to Nastiti & 'Abdu (2020), learning in the 4.0 revolution era can apply the Hybrid Learning system. Based on the illustration of the design pattern of its application at the observed school, it shows that the Hybrid Learning Model that is applied is not carried out fully online, but is balanced with other learning activities.

The effectiveness of the implementation of this Hybrid Learning Model in improving students' science literacy at the observed schoolis motivated by the flexibility of learning that can adapt to the learning conditions faced. If the learning collided with emergency conditions such as a ban on learning activities at school during the increasing cases of Covid-19 or other emergency conditions, then this model becomes an effective learning alternative to be applied by teachers in supporting students' science literacy learning.

CONCLUSION

The results of this study prove that the application of the Flipped Learning Model and the Hybrid Learning Model both have a positive and contributive impact on increasing students' science literacy at the observed school. However, the comparative test results prove that the application of the Flipped Learning Model is more effective than the implementation of the Hybrid Learning Model. The limitation of this research is that it only focuses on science literacy in elementary schools which includes learning mathematics, science, and social studies in the sense that it is not applied thoroughly to all subjects taught at school. The limitations of the ability of teachers and students to use the learning model studied and the limitations of some teachers and students in terms of the ability to use technology as well as access disruptions in the form of internet networks are limitations in this study. From this limitation, it can be followed up through the next relevant research. The hope from the results of this study is that these two technology-based learning system models can be used in students' science literacy learning activities. As long as access to student learning is supported by the availability of technological devices and supporting facilities and infrastructure, and is supported by the skills of teachers and students in utilizing this learning technology more meaningfully. Given the learning paradigm in elementary schools, there will be a lot of contact with technological devices as a trend of learning progress in the present and the future.

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