The effect of science technology society (STS) learning model on science literation in physical learning reviewed from cognitive style

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Abstract

The purpose of this study is 1) to analyze differences in scientific literacy of students between groups of students who study learning model STM and learning model of Direct Instruction (DI), 2) to analyze the effect of the inter-action between the learning model STM with cognitive style on scientific literacy of students, 3) Analyzing the difference differences in scientific literacy of students between groups of students who study learning model STM and learning model of Direct Instruction (DI) which have a cognitive style field dependent (FD), and 4) to analyze the differences differences scientific literacy of students between groups of students who study learning model STM and learning model of Direct Instruction (DI) which have a cognitive style field independent (FI). This study is a quasi-experimental design with posttest only control group design. The study population was all students of class XI MIA Denpasar Hope Christian High School in the academic year 2018/2019. Decision-class research group based random sampling technique. Data were analyzed with descriptive statistics and ANOVA two lanes. The results of the analysis states the following. (1) there are differences in the results of scientific literacy scores physics, among students who study learning model Science Technology Society (STM) with students learning with learning model DI (F = 79,32; p <0.05), (2) there are significant interaction between the learning model STM learning model of Direct Instruction (DI) on the scientific literacy of students (F = 76,23; p < 0.05) and. (3) there are differences in students' science literacy among the group of students who studied with STM learning model and learning model of Direct Instruction (DI) students who have the cognitive style of field independent (FI), (F = 20,75; p < 0.05), (4) there differences in students' science literacy among the group of students who studied with STM learning model and learning model of Direct Instruction (DI) students who have the cognitive style of field dependence (FD), (F = 15,60; p < 0.05).

Keywords: Cognitive Learning Style; Scientific Literacy; and Science Technologi Society (STS)

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1. Introduction

Education is needed to support the quality of human resources in accordance with national education goals, namely to develop the potential of students to become human beings who believe and fear God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent and become democratic citizens and responsible [1]. The welfare of a nation is no longer sourced from natural resources and physical capital, but is based on intellectual capital, social capital and trust that leads to the quality of human resources (HR) that are able to compete, and have resilience in thinking and acting. Well-being in the world of education cannot be separated from a curriculum, the curriculum used as a reference in education today is the 2013 curriculum.

The 2013 curriculum is the latest curriculum and is conceptually effective and the public test results are not as good as the concept. This 2013 curriculum is a curriculum that is in accordance with the demands and development of the times, where all forms of shortcomings in the previous curriculum were perfected. Every curriculum, however, has advantages and disadvantages that can be used as a

reference or a basis for future improvement for the realization of the nation's educational goals.

The results of TIMSS and PISA (The Program for International Student Assessment) research developed by several developed countries in the world, every three years which are members of the Organization for Economic Cooperation and Development (OECD) based in Paris (France), where the results learning outcomes of students in each participating country that includes reading literacy (reading literacy), mathematical literacy (mathematic literacy), and scientific literacy (scientific literacy), show that the ranking of science achievements for Indonesia is ranked 60th out of 65 countries participating in the PISA study 2009, with details as follows: reading literacy is at level 57, mathematics literacy is ranked 61, and scientific literacy is ranked 60.

The results of research conducted in the United States by [2] show that the number of students who feel that science is unpleasant and is only memorizing facts increases in higher classes, and vice versa by the National Science Teacher Association, defining that STM as "The teaching and learning of science in the context of human experience".

For the results of the PISA study in Bali on scientific literacy there are several reasons which reveal that this study was conducted according to [3], namely (1) The implementation of education is expected to be integrated with the culture of the place and Bali has a distinctive culture. The prominent characteristics of the culture in Bali are religious, (2) PISA is tested at the age of 15 years. this age students begin to leave their roles as children and try to develop themselves as individuals who are not dependent on their parents. This means that students aged 15 years are the beginning of determining where they will be, because at the age of 15 students have begun trying to develop an attitude of independence, (3) PISA tests the mastery of knowledge and skills that are considered important for adult life, so as to meet real life challenges which is good for personal, community and global life. Likewise, with the hope that the government, through a reasonable nine years, after graduating from school, those who will continue to pursue higher education or those who cannot continue, have gained various skills for their lives in private and community.

The STM learning model is very closely related to scientific literacy which is one of the characteristics of a community citizen or individual who has sufficient knowledge of facts, concepts, and scientific theory and the ability to be able to apply it. The STM learning model is one of the models in science learning in schools [4]. The goal to be achieved through this STM approach is to be able to increase students 'interest in science and shape students' personalities in scientific and technological literacy. Through the STM learning model, students as citizens are expected to be more responsible for the natural environment and the solution. The STM learning model is a learning model that synergizes concepts and principles of science, technology and society. Science learning will be more meaningful if concepts and principles, and scientific theories are packaged in a framework related to the application of technology and science issues that are found in society.

The advantages of the STM learning model in science learning, later on so that students can use scientific knowledge in identifying and solving problems or issues. This means that in dealing with problems or issues of science and technology that are around them, starting from identifying problems, formulating problems, or issues, developing specific questions and developing alternative solutions, students use scientific knowledge and science process skills that they have mastered , and secondly, students become more critical and creative.

Science literacy is the ability to use scientific knowledge to identify problems and draw conclusions based on evidence in order to understand and make decisions about nature and changes made to nature through human activities [5]. According to [6], the advantages of scientific literacy are (1) Establishing actual issues in the student environment related to science and technology, (2) Building and developing, science concepts for students, (3) Establishing student concepts through discussion or re-proof of concepts that have not been accepted or not understood by students, (4) Concepts obtained by students are used to solve problems that arise in the first stage.

Cognitive style is a typical method used by a person in observing and doing mental activities in the cognitive field [7]. This distinctive way is very individual in nature which is often unconscious and once formed, tends to persist. More specifically, cognitive style is said to be part of a learning style that describes behavior that is relatively fixed in a person in accepting, thinking and solving a problem. Therefore, researchers want to study further through an experimental study entitled "The Effect of Community Technology Science Learning Model (STM) on Science Literacy in Physics Learning Viewed from the Cognitive Style of Students".

2. Materials and methods

Location and time of research

This research will be carried out on the second semester XI MIA students in Denpasar Harapan Christian High School 2018/2019 academic year.

Research Material

Materials

The data collected in this study are scientific literacy and cognitive style. The scientific literacy test is in the form of an essay consisting of 12 items with an internal consistency index item (r) moving from 0.340 to 0.810 and the Cronbach Alpha test reliability index of 0.434 with a moderate classification. The aspects measured in scientific literacy tests include (1) having sufficient knowledge of facts, concepts and theories of science and the ability to apply them, (2) making day-to-day decisions, and using scientific concepts, science and value-processing skills value of science, (3) Recognizing the advantages and limitations of science and technology in improving people's welfare, (4) Recognizing and understanding the interrelations and interdependencies between science, technology and society, (5) Identifying reliable scientific and technological sources and using them in making decisions, (6) Understanding and being able to anticipate the negative impacts of science and technology, (7) Being able to distinguish between scientific evidence and personal opinion, (8) Having a broad and deep view of the world of reality thanks to science education he obtained, (9) Having sufficient knowledge and experience about science so that he can appreciate research and respect bangan technology, (10) Considering the political, economic, moral and ethical aspects of science and technology in relation to personal and global issues, (11) Having the ability as decision makers, (12) Having a positive attitude towards science and technology.

Research

The type of research that will be carried out is a quasi experiment because not all variables and experimental conditions can be tightly regulated and controlled [8]. The researcher did not change the class in determining the subject as an experimental or control group. Therefore, randomization can only be done in determining the experimental group and the control group.

Research design

The scoring technique for each item of scientific literacy tests uses a range of 4-0. The students' cognitive style test consisted of 24 items with an internal consistency index item (r) moving from 0.330 to 0.730 and the Cronbach Alpha test reliability index of 0.434 with a moderate classification. Data were analyzed descriptively and 2 Path ANAVA. Descriptive analysis is used to describe the average score and the standard deviation of scientific literacy and cognitive style of students. Testing the research hypothesis used 2 Path ANAVA. Before testing the hypothesis, the data distribution normality test was done using Kolmogorov-Smirnov and Shapiro-Wilk statistics, and the variance homogeneity test between groups using Levene's Test of Equality of Error Variance Test of comparative significance of average scores using Least Significant Difference (LSD) [9]. All hypothesis testing is carried out at the 0.05 significance level.

Research Implementation

The data collected in this study are scientific literacy and cognitive style. The scientific literacy test is in the form of an essay consisting of 12 items with an internal consistency index item (r) moving from 0.340 to 0.810 and the Cronbach Alpha test reliability index of 0.434 with a moderate classification. The aspects measured in scientific literacy tests include (1) having sufficient knowledge of facts, concepts and theories of science and the ability to apply them, (2) making day-to-day decisions, and using scientific concepts, science and value-processing skills value of science, (3) Recognizing the advantages and limitations of science and technology in improving people's welfare, (4) Recognizing and understanding the interrelations and interdependencies between science, technology and society, (5) Identifying reliable scientific and technological resources in making decisions, (6) Understanding and being able to anticipate the negative impacts of science and technology, (7) Being able to distinguish between scientific evidence and personal opinion, (8) Having a broad and deep view of the world of reality thanks to science education he obtained, (9) Having sufficient knowledge and experience about science so that he can appreciate research and respect bangan technology, (10) Considering the political, economic, moral and ethical aspects of science and technology in relation to personal and global issues, (11) Having the ability as decision makers, (12) Having a positive attitude towards science and technology.

Observation Variable

The variables observed for coconut oil include objective observation, namely oil yield analysis, water content, free fatty acid levels, peroxide numbers, impurities, and acid numbers. While subjective observations include the test of flavor, color, taste and overall acceptance.

Data analysis

The variance analysis technique used in this study is 2 Path ANAVA. For the calculation of the 2-way ANOVA program assistance is the SPSS-PC 17 program for Windows. All hypothesis testing is carried out at a significance level of 0.05 ($\alpha = 5\%$).

3. Results and Discussion

The results of this study indicate that the average value of scientific literacy in the STM learning model group is M = 79.32 and SD = 3.93 with high qualifications, while students in the DI model have

an average value of M = 76.23 and SD = 4.16 are in high qualifications, if viewed from the aspect of learning categories, these two models have the same category, still when viewed in terms of numbers or the number of STM learning models obtain higher results than the DI learning model group.

Objective Variables

Based on the type of research, the design used in this study was post-test only control group design. This design chosen because in quasi-experimental research it is not possible to complete randomization of subjects in each class [10]. Post-test only control group design is an experimental research design quasi aims to investigate differences in students' scientific literacy experimental group and control group. This design was also chosen because the research that will be conducted is not to know students' scientific literacy.The general description of the results of the research presented is a description of the scientific literacy tests of the STM and DI groups in Table 1.

Table 1
Data on the Value of Science Literacy on Cognitive Style

Statistik	A₁	A₂	B₁	B₂	A₁B₁	A₁B₂	A₂B₁	A₂ B₂
Mean	79,32	76,23	52,5	42,5	86,46	72,50	78,46	65,00
Median	72,00	70,00	50,1	35,5	84,67	70,33	77,50	63,30
SD	76,00	74,00	8,07	6,50	19,5	7,50	9,02	12,69
Varians	8,43	9,41	7,56	8,56	70,16	82,52	81,53	61,19
Reach	15,52	17,31	12,4	14,3	91,67	95,00	95,00	95,00
Minimum	15,00	16,00	25,0	20,0	60,00	60,00	58,33	43,33
Maximum	30,00	29,00	22,5	37,5	31,67	35,00	36,67	51,67

Based on Table 1 above, the results of students' scientific literacy tests obtained for groups of students who studied using the technology science learning model of society had M = 79.32 and SD = 3.93. This means that the average value of scientific literacy tests of students who use the technology science learning model of highly qualified people. The results of scientific literacy analysis of students for groups of students who study using the direct instruction learning model have M = 76.23 and SD = 4.16. This means that the average value of scientific literacy of students using the direct instruction learning model is also the same as the MPSTM which is highly qualified, but when viewed from the number, the STM model has a big advantage over the DI model.

Conversion of students' scientific literacy values, a table of frequency distribution and a percentage of scientific literacy qualifications is made. The frequency distribution and percentage qualifications of students' scientific literacy abilities for each treatment group are presented in Table 2.

Table 2
Frequency Distribution and Percentage of Science Literacy Values for MPSTM and MPDI Groups

Interval Nilai	Kualifikasi	MPSTM		MPDI	
		fo	Presentase (%)	fo	Presentase (%)
85-100	Sangat Tinggi	5	12,5	0	0
70-84	Tinggi	34	8,50	27	6,70
55-69	Cukup	3	7,5	12	3,0
40-54	Kurang	0	0	3	7,5
0-39	Sangat Kurang	0	0	0	0

Based on Table 2 above, it is seen that students who learn to use the STM learning model are 7.5% in sufficient qualifications, 85% are in high qualifications, and 12.5% are in very high qualifications. Students who learn to use the direct instruction learning model of 7.5% are in less qualifications of 30% in sufficient qualifications 67% are in high qualifications. Data normality test was carried out on all scientific literacy and cognitive style data of students, both from the MPSTM and MPDI groups. The data distribution normality test was carried out using the kolmogorov-smirnov and shapiro-wilk statistics. Then the description of the normality test is shown in table 3.

Table 3
Normality Test Results for Science Literacy and Student Cognitive Style

Unit Analysis		Kolmogorov-Smirnov			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
Literasi Sains	MPSTM	.113	40	.200*	.967	40	.289
	MPDI	.163	40	.009	.931	40	.018
Gaya Kognitif	MPSTM	.185	40	.008	.918	40	.007
	MPDI	.167	40	.006	.932	40	.018

Based on Table 3, it was revealed that the significance value of the data was greater than 0.05 for each study group both for the Kolmogorov-Smirnov and Shapiro-Wilk statistics, so it can be concluded that the data obtained were normally distributed.

Subjective Variables

The type of research that will be carried out is a quasi experiment because not all variables and experimental conditions can be tightly regulated and controlled [8]. The researcher did not change the class in determining the subject as an experimental or control group. Therefore, randomization can only be done in determining the experimental group and the control group. This research will be carried out on the second semester students of class XI MIA in Denpasar Harapan Christian High School 2015/2016 academic year. The population in this study were all students of class XI which numbered four classes distributed into academically homogeneous classes, namely class XI MIA I-XI MIA IV. This class division is not based on rank, so students who have high achievements are scattered in each class. The population in this study was 160 students. Based on the results of the lottery randomly obtained class XI MIA I to apply the STM and XI MIA IV models applying the DI model.

The variance analysis technique used in this study is 2 Path ANAVA. For the calculation of the 2-way ANOVA program assistance is the SPSS-PC 17 program for Windows. All hypothesis testing is carried out at a significance level of 0.05 ($\alpha = 5\%$).

For the dimensions of scientific literacy the MPDI group has weaknesses in variable control capabilities. The STM learning model is one of the models that directs students to develop active learning methods. The STM learning model provides space for students to gain direct learning experience in terms of controlling variables. However, at the secondary education level the implementation of the STM learning model has not been maximized on the students' ability to choose variables which will later be used as the basis for students in carrying out further learning. In the classroom learning, the students' steps to carry out the experiment were hampered by the problem of selecting variables that would be examined by students from the problems given in the I-IV written test

which was carried out after the material ended in each of the 1 subjects. So that the dimensions of scientific literacy are "making daily decisions, and using scientific concepts, science process skills and science values" have the lowest average of the dimensions of "having the ability as other decision makers" in the implementation of STM learning.

4. Conclusion

First, the test results state that there are differences in the scores of physics science literacy results, between students studying with the Science Technology Society (STM) learning model and students learning with DI learning models (F = 79.32; p < 0.05) and LSD = 1.66. Second, the test results There is an interaction effect between the STM learning model and the Direct Instruction learning model (DI) on students' scientific literacy (F = 76.23; p <0.05) and LSD = 4.35. Third, the results of testing there are differences in student scientific literacy between groups of students studying with the STM learning model and Direct Instruction learning models (DI) students who have an independent field cognitive style (F = 20.75; p < 0.05). Fourth, the results of testing there are differences in student scientific literacy between groups of students studying with the STM learning model and Direct Instruction learning models (DI) students who have a field dependent cognitive style (F = 15.60; p < 0.05).

The results of this study indicate that the STM learning model has the opportunity to develop scientific literacy and cognitive style. Therefore, if the teacher wants to develop scientific literacy and cognitive style, it should use the STM learning model as an alternative in the science learning process.

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