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ARCS Learning Model in Improving Students's Mathematical Connection Ability

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Abstract.
This research is quasi-experimental research conducted to improve students's mathematical connection skills, one of which is through the use of attention, relevance, confidence, and satisfaction (ARCS) models. The purpose of this study was to determine (a) the description of the process of students and teachers in learning mathematics using the ARCS learning model, (b) differences in the improvement of mathematical connection skills between students using the ARCS learning model and students using conventional learning, (c) student responses to mathematics learning using the ARCS learning model. The data were obtained using a test research instrument in the form of mathematical connection skills and nontest questions, namely student response questionnaires to learning using the ARCS learning model. This research was conducted at SMPN 3 Bandung City with a sample of class VIII-6 as a control class and class VIII-7 as an experimental class on statistical material. Based on the results of research and processing of n-gain data, obtained: (a) the description of the learning process of teachers and students on statistical material using the ARCS learning model is in the very good category; (b) there are differences in the improvement of mathematical connection skills between students who use the ARCS learning model and students who use conventional learning; (c) most of the students who received learning using the ARCS learning model responded positively to learning mathematics using the ARCS learning model.

Keywords: ARCS learning model, mathematical connection

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1. INTRODUCTION

Mathematics is a material that must be mastered by students at every level of education and has an important role in various sciences. Mathematics can provide assistance to other fields and has a role in every field or discipline so that mathematics is called the queen of science [1]. Positive views about mathematics are still rarely found, mathematics is still considered a subject that is not easy to master and the discussion only about formulas and numbers that are not easy, besides that there are many assumptions that mathematics is far from daily activities. In fact, mathematics is often used in daily activities, traders unconsciously use mathematical knowledge in the process, such

as the total amount of money that must be paid to buy some goods, how much money is changed, price multiples and divisions[2]. Based on the National Council of Teachers of Mathematics (NCTM) (2000) determines the standard of student abilities that must be mastered there are five, namely problem solving skills (problem solving), communication skills (communication), connection skills (connection), reasoning skills (reasoning), and representational abilities [3]. According to Sumarmo, students will master every mathematical material better and deeper if they can make connections between several mathematical ideas [4].

The study conducted by Nafa Meinitasari in 2019 in class IX of SMP Rancaekek obtained results that only 10% of students in one class completed the questions given completely, while the remaining 90% of students still could not solve the questions and felt difficult in working on the questions that had been given. After analyzing the results of student answers using Newman's Theory, it was found that the problem of students' difficulties in working on questions was in linking between mathematical topics with Cartesian coordinates [5]. The low ability of students can be caused by many factors, according to Sugilar [5] many factors cause failure in learning mathematics, including the skill factor carried out by the teacher in choosing the method used in learning, students are slightly involved in learning so that students tend to be passive, or the use of strategies used in learning is not appropriate. Of the many learning models that are able to provide students with an active role and improve student learning outcomes, namely using the Attention Relevance Confidence Satisfaction (ARCS) model, this learning model can provide opportunities for students to learn better by understanding the concept, it is associated with four concepts namely attention (attention), relevance (relevance), confidence (self-confidence), satisfaction (satisfaction). The ARCS model is a learning model developed by Keller (2010), this learning model was developed in order to provide solutions to learning that can affect student motivation and student learning outcomes [6].

When learning is done virtually, you can use many platforms that can help continue learning, one of the platforms that teachers can use in teaching is Google Classroom. Hamimi (in Silaen 2019:258) the platform from Google Classroom itself is very supportive in terms of task activities, sending assignments and teachers can assess student work that has been directly collected and accepted by students.

2. RESEARCH METHOD

The approach used in this research is a quantitative approach. The research method applied in this study is a quasi experimental method. The purpose of the quasi-experimental method is to see the impact and cause-effect (cause-and-effect relationship) by comparing it with the experimental class group that is receiving treatment, with the control class group that does not receive treatment. The study used a quasi-experimental study to examine the effect of using the ARCS learning model on students' mathematical connection abilities by comparing students who received conventional learning using the lecture method in class VIII of SMPN 3 Bandung City for the 2020-2021 school year. The research design applied in this research is Quasi Experimental Nonequivalent Control Group Design shown Table 1, [7].

TABLE 1: Desain penelitian nonequivalent control grup design.

Class	Pretest	Perlakuan	Posttest
Experiment	O	X	O
Control	O		O

Information:
X: There is treatment, using the ARCS learning model
O: Mathematical Connection Ability Test (Pretes-Posttes)

The data used in this study is quantitative data collected from the acquisition of students' mathematical connection ability tests, besides that qualitative data obtained from student attitude scale questionnaires and teacher and student observation sheets are also used. The data source consists of the population and the sample, which uses the population, namely all students of class VIII SMPN 3 Bandung City in the even semester of the 2020/2021 school year. In addition, using a sampling technique, namely random sampling technique, the data sources that will be used as subjects in this study are students of class VIII-6 and class VIII-7. As for the experimental class, namely class VIII-7 there are 30 students and selected for class VIII-6 as the control class there are 30 students. The class selection is seen from the grades of students in the class and the mean, median and mode values are searched and the class is homogeneous.

The instruments used in this study were test and non-test instruments. The test instrument is in the form of pretest and posttest questions for students' mathematical connection abilities which includes five questions with indicators of students' mathematical connection abilities, while non-test instruments are in the form of observation sheets that contain descriptions of the learning process of students and teachers in accordance with the syntax of the ARCS learning model and student attitude scale sheets. which contains students' attitudes towards learning using the ARCS model.

This research was conducted for four meetings in the control and experimental classes. The following Table 2. of research activities.

Table 2: Schedule of research implementation activities.

Class	Date and Time	Activity
VIII-6 Control	23 March 2021 (13.00-14.20)	Pretest
	24 Maret 2021 (08.00-09.30)	Meeting 1: Data analysis and data concentration measures
	31 March 2021 (08.00-09.30)	Meeting 2: Size of data spread
	07 April 2021 (08.00-09.30)	Posttest
VIII-7 Experiment	23 March 2021 (13.00-14.20)	Pretest
	24 March 2021 (09.30-11.00)	Meeting 1: Data analysis and data concentration measures
	31 March 2021 (09.30-11.00)	Meeting 2: Size of data spread
	07 April 2021 (09.30-11.00)	Posttest

3. RESULT AND DISCUSSION

The results and discussion contain the results of the analysis of phenomena in the research area that are relevant to the study theme. Research results should be compared with relevant theory and research findings. Based on the results of the observation sheet, the description of student learning activities during the two lessons is as follows Table 3.

Table 3: Percentage of description of teacher and student learning process using ARCS model meeting I.

Activity	Presentase(%)	Category
Teacher	80	Good
Students	79	Good

At the first meeting the students still had difficulty in applying the learning model that involved students actively in learning. The results of the description of ARCS learning activities at the second meeting are as follows at Table 4.

Table 4: Percentage of description of teacher and student learning process using ARCS model meeting II.

Activity	Presentase(%)	Category
Teacher	92	Very good
Students	87	Very good

At the second meeting the students were getting used to the learning model in which students were active in every learning process, as well as the teacher's activities which had improved from the previous meeting.

The description of the process of teaching mathematics subject teachers on statistical material by applying the ARCS learning model can be concluded in the very good category. The situation is based on the increase in the percentage of teacher activities achieved at each meeting with an average percentage of teacher activity achievement that is 86%, the achievement of the teacher's activities in teaching is such as repeating material, giving material to students, making students active by asking questions and appreciation is given to students. according to the learning syntax using the ARCS learning model. While the description of the student learning process using the ARCS learning model such as answering teacher questions and doing exercises is in a very good category as well [8]. This situation is seen from the percentage of student activity achievement which increases each meeting with an average percentage of 83%. Based on the data processing of pretest, posttest, and normalized gain of mathematical connection ability, the data obtained are as follows Table 5.

Table 5: Pretest results of class students' mathematical connection ability using ARCS model and conventional class.

Class	N	Ideal Value	Pretest		
			Minimum	Maximum	Average (Mean)
ARCS Learning Model	30	100	3.33	36.66	20.27
Conventional	30	100	8.33	38.33	19.71

Based on the table above, it can be seen that the average (mean) pretest score of students' mathematical connection abilities in the experimental class who received learning using the ARCS model and the control class using conventional learning had differences. The average (mean) pretest score of students' mathematical connection abilities in classes using the ARCS learning model is 20.27 while the average (mean)

pretest score of students' mathematical connection abilities with conventional learning is 19.71. Judging from the acquisition of the average value of the two classes, it can be seen that the class pretest score with the ARCS learning model is superior to the conventional class. The results of the posttest data are as follows Table 6.

Table 6: Posttest results of class students' mathematical connection ability using ARCS model and conventional class.

Class	N	Ideal Value	Posttest		
			Minimum	Maximum	Average (Mean)
ARCS Learning Model	30	100	30	76.66	57.88
Conventional	30	100	28.33	71.66	50.99

In accordance with table 6, it can be observed that the average (mean) posttest score of students' mathematical connection abilities in the experimental class who received learning using the ARCS learning model and the control class which during the learning process used conventional learning was different. The average (mean) posttest score of students' mathematical connection abilities in classes that use the ARCS learning model is 57.88 with the smallest value of 30 and the largest value of 76.66 while in the conventional class it is 50.99 and the smallest value is 28.33 while the largest value 71.66. Because based on the average value of the two classes, it can be seen that the posttest average score of the class using the ARCS learning model is higher than the conventional class, although the difference is not too far away, it is still said to be different. By looking at the values already mentioned, it can be concluded that both of them have different levels in students' mathematical connection abilities. N-gain statistical data on students' mathematical connection abilities can be observed in the Table 7.

Table 7: Descriptive statistics of N-gain students' mathematical connection ability.

Class	N	Minimum	Maximum	Mean	Std. Deviation	N-Gain Criteria
ARCS Learning Model	30	0.24	0.71	0.47	0.11	Currently
Conventional	30	0.08	0.62	0.38	0.13	Currently

The table above shows that the average (mean) N-gain of students' mathematical connection abilities in the experimental class who received ARCS learning model learning and the control class that received conventional learning was different. The average (mean) N-gain of students' mathematical connection abilities in the ARCS learning model class is 0.47, which is different from the conventional class, which is 0.38. The average

value of the two classes shows that the N-gain of the ARCS learning model class is better than the conventional class.

Furthermore, to find out whether there is an increase between the class that received ARCS model learning and the class that received conventional learning, calculations were carried out through an independent t-test. Prior to the test of the difference between the two averages in order to get the results of whether there is a different increase in the mathematical connection ability of students who use the ARCS model and students who receive conventional learning, the conditions that must be met by N-gain data are data that is normally distributed and has a high variance. homogeneous. To fulfill the first requirement, a normality test was carried out using the Kolmogorov Smirnov (K-S) with the help of SPSS. Guidelines for decision making using SPSS are:

If the value of Sig. > 0.05, then the N-Gain data is normally distributed.

If the value of Sig. 0.05, then the N-Gain data is not normally distributed.

TABLE 8: normality test for n-gain data using SPSS.

Class	Table Value KS		
	Statistic	Df	Sig.
ARCS Learning Model	0.128	30	0.200
Conventional	0.121	30	0.200

In table 8, information is obtained for the sig value in the experimental class using the ARCS model, namely 0.200> 0.005, then the N-Gain data is normally distributed. Furthermore, other information obtained from table 4.8 is the value of sig. in the conventional class is 0.200 > 0.005, so the N-Gain data is normally distributed. After testing the normality of the N-Gain data using SPSS, it was concluded that the N-gain data from the experimental class that received the ARCS model and the control class that received conventional learning were normally distributed.

Then in order to test the average difference, the N-gain data used must have the same variance, the next step is to perform a homogeneity test using the SPSS-assisted f test. The following are the homogeneity test criteria using SPSS:

If the value of Sig. > 0.05, then the variance of the N-Gain data is the same.

If the value of Sig. 0.05, then the variance of the N-Gain data is not the same.

TABLE 9: Test of homogeneity variance of N-gain data using SPSS.

Levene Statistic	df_1	df_2	Sig.
0.065	1	58	0.799

In table 9 it can be observed that the value of Sig. N-Gain data is 0.799 > 0.05, meaning that the variance of the N-Gain data is the same (homogeneous). Based on the homogeneity test of the N-Gain data carried out with the help of SPSS as shown in table 4.9, it can be concluded that the N-Gain data from the class that received the ARCS learning model and the class that received the conventional model had a homogeneous variance [9]. In accordance with the results of the normality test and the homogeneity test of variance of the N-Gain data, it can be seen that both conditions have been met, namely the data has a normal distribution and has a homogeneous variance. After that proceed to the calculation through the independent t test. The formulation of the hypothesis is as follows:

H_0: There is no difference in increasing mathematical connection skills between students who use the ARCS learning model and conventional learning.

H_1: There is a difference in the improvement of mathematical connection skills between students using the ARCS learning model and conventional learning.

Similar to the normality and homogeneity tests, the data-free t-test of N-Gain was carried out manually and using SPSS. Independent t-test is carried out using SPSS based on the following conditions:

If the value of Sig. 0.05, then H_0 is accepted.

If the value of Sig. <0.05, then H_0 is rejected.

The results of the t test through the SPSS version can be seen in the following Table 10.

Table 10: T-independent test of N-gain data using SPSS.

t-test For Equality of Means			
T	dF	Sig. (2-tailed)	Mean Difference
2.630	58	0.011	0.086

Through the table above, information on the value of Sig. (2-tailed) is 0.011 < 0.05, thus H_0 is rejected, it can be concluded that there is a difference in increasing mathematical connection skills between students who use the ARCS model and students who use conventional learning. Based on the calculation results, it can be seen that all students, both those who received the ARCS model and students who during the learning process received conventional learning experienced an increase in their mathematical connection abilities from the pretest and posttest.

In the previous table, it can be seen that the average N-Gain test of students' mathematical connection abilities who received the ARCS model was better than students who

received conventional learning [3]. Likewise, after the independent t-test was carried out, which accepted the hypothesis that there was a difference in the improvement of students' mathematical connection abilities using the ARCS model and students receiving conventional learning [6]. So it can be concluded that students who in their learning process use the ARCS model have differences in increasing mathematical connection abilities with students who use conventional learning in their learning. This can be observed through the results of the analysis of the average N-Gain data on the mathematical connection ability test of students who receive learning through the ARCS learning model, which is 0.47 better than conventional student learning, which is 0.38. So it can be concluded that the ARCS learning model is more able to improve students' mathematical connection abilities compared to conventional student learning.

To see how students' attitudes about the learning process using the ARCS model will be used a student attitude scale questionnaire. The questionnaire contains 15 statements related to the implementation of the ARCS learning model. The questionnaire was distributed to students after participating in learning using the ARCS model. The following are the results of the analysis of students' attitude scores which can be observed in the following Table 11.

4. CONCLUSION

Based on the results of research and discussion on the mathematical connection ability of students who receive ARCS learning and conventional learning, the final results are:

The description of the learning process of teachers who teach mathematics on statistical material by applying the ARCS learning model is included in the very good category. This situation is based on the percentage of teacher activity achievement that increases at each meeting with an average percentage of teacher activity achievement of 86%. While the description of the student learning process using the ARCS learning model is in a very good category as well. This situation is seen from the percentage of student activity achievement which increases each meeting with an average percentage of 83%.

Students who use learning with the ARCS model have differences in increasing mathematical connection abilities with students who use conventional learning in learning. This can be seen through the results of the N-Gain test of students' mathematical connection abilities using the ARCS learning model which is 0.47 better than students using conventional learning, which is 0.38. So it can be concluded that the ARCS

Table 11: Scores of students' attitudes regarding learning mathematics using the ARCS learning model.

Student Attitude	Indicator	Statement		Answer				Student Attitude Score		Neutral Score	
		No	Type	SS	S	TS	STS	items	average	items	average
	Students are made to remember again with material that has been understood	1	+	5	25	-	-	3.16	3.12	2.50	2.50
			score	4	3	2	1				
		3	-	-	13	15	2	2.63		2.50	
			score	1	2	3	4				
	Communicating learning objectives and benefits	5	+	10	18	2	-	3.26		2.50	
			score	4	3	2	1				
		8	-	-	4	20	6	3.06		2.50	
			score	4	3	2	1				
	Delivering learning materials	2	+	6	24	-	-	3.20		2.50	
			score	4	3	2	1				
		12	+	6	23	1	-	3.16		2.50	
			score	4	3	2	1				
	Using concrete examples in everyday life	6	+	6	19	5	-	3.06		2.50	
			score	4	3	2	1				
		7	+	8	22	-	-	3.26		2.50	
			score	4	3	2	1				
	Provide study guidance	9	+	7	19	4	-	3.10		2.50	
			score	4	3	2	1				
		10	-	-	11	12	7	2.83		2.50	
			score	1	2	3	4				
		13	+	16	14	-	-	3.53		2.50	
			score	4	3	2	1				
	Provide students with opportunities to become participants in learning	4	+	10	20	-	-	3.33		2.50	
			score	4	3	2	1				
		11	+	14	15	1	-	3.40		2.50	
			score	4	3	2	1				
	Give feedback	14	+	4	20	6	-	2.93		2.50	
			score	4	3	2	1				
		15	-	-	3	19	8	3.16		2.50	
			score	1	2	4	5				

learning model can further improve students' mathematical connection skills compared to conventional learning.

1. In general, students who receive learning using the ARCS learning model have a good response to learning using the ARCS model in mathematics subjects, this can be observed from the acquisition of questionnaires regarding students' attitudes towards the learning process using the ARCS model in mathematics subjects, namely with an average the average score of 3.12 is better than the student's neutral attitude score, which is 2.50.

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