Applying SARAC Approach and The Effect in Learning Mathematics For Students Grade VIII

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Abstract. This study aims to explore the application of approach in terms of see, ask, reason, associate, and communicate (SARAC) in learning mathematics. The type of research is pre-experiment with One-Group Pretest Posttest Design. The population of research is students of grade VIII in SMPN 22 Makassar. By using simple random sampling, there are 35 students who are getting involved in this experimental activities. As concerns in this study, three kinds of instruments are used to collect data, such as students' achievement test, observation sheet, and responds sheet. For analyzing the data, two kinds of statistics were applied, namely descriptive and inferential statistics. The result shows that students' achievement can reach the score of 77.9, satisfying the criteria of minimum completeness. Beside, this score brings students' achievement in high category and support the percentage of classical completeness (88.57%). Then, students' activities exhibit the category of active, and their responds toward SARAC approach indicate positive point. Shortly, SARAC approach share beneficial contribution to support learning mathematics.
Keywords: Growth, Von Bertalanffy, Varying Coefficient, actualization

INTRODUCTION

One approach recommended curriculum in 2013 is the scientific approach. With a scientific approach to the learning process is not just a process of moving science, in this case mathematics. The learning process with a scientific-based approach provides the opportunity and experience in the search process information, solve problems, and make decisions for the life of the students themselves, as well as communicate.

Bell et al. (2010), identified nine main science inquiry processes supported by different computer environments that could be used (IBSE) and STEM, namely: orienting and asking questions; generating hypotheses; planning; investigating; analyzing and interpreting; exploring and creating models; evaluating and concluding; communicating; predicting. The nine inquiry tools of (Bell et al., 2010) are closely related to the essential features of inquiry based learning (Asay & Orgill, 2010), namely: Question (the learner engages in scientifically oriented questions), Evidence (the learner gives priority to evidence), Analysis (the learner analyses evidence), Explain (the learner formulates explanations from evidence), Connect (the learner connects explanations to scientific knowledge and Communicate (the learner communicates and justifies explanations). Our learning and teaching approach integrates the inquiry based approach and (CE) through the relation of the (CE) spaces, namely the hypotheses space, the experimental space and the prediction space with the essential features of inquiry, the Computational Thinking(CT) features and the inquiry tools of (Bell et al., 2010).

Proverb says that "experience" is the best teacher. Therefore, such an approach relevant to the proposed Confucius that "I do, then I understand." By doing so directly, not just know the theory students be able to, from the experiences that students can gain some knowledge, skills even more tangible. Mathematical communication, a fundamental mathematics educational objective that involves cognitive and social activities (Baroody & Ginsburg,

1990), is used to engage students in communicative situations for increasing learning interaction with others to obtain mutual mathematical ideas (Silver & Smith, 1996), share mathematical thoughts, develop mathematical concepts and strategies, and reflect on their current mathematical understanding (Whitin & Whitin, 2000; Cooke & Buchholz, 2005). Mathematical communication abilities also include expressing mathematical thought by using mathematical language clearly, precisely, and succinctly (National Council of Teachers of Mathematics, 2000); understanding others' mathematical equations and concepts (Lin & Lee, 2004; Lin, Shann, & Lin, 2008); and evaluating others' mathematical concepts by, for example, asking meaningful questions and explaining the reasons for others' incorrect mathematical thought (Lin & Lee, 2004).

One of the challenges faced by teachers, in addition to the new curriculum implemented by the government does not take the user to better understand, the recommended approach is scientific approach is not well understood. However, the core of this approach is how teachers can use the approach in supporting math learning activities of students in the classroom. Another pattern that is consistent with this approach, namely SARAC. As we know that the scientific approach includes five stages, namely observation, questioning, reasoning, associating, and communicating. Additional modifications to mathematics learning activities, due to the activities of scientific approach to a more dominant given to science subjects such that observation connoted by the term look. This means that the ability of students to not just see but read what is seen with meaningful

In line with a scientific approach to learning materials provided by the teacher based on facts or phenomena that can be explained by the specific logic or reasoning, so that students can understand, solve the given problem and apply their knowledge in life. This article provide information about scientific approach in learning mathematics as we considered including see, ask, reason, associate and communicate (SARAC). So, in The learning process with a scientific approach used little different from the scientific approach which the teacher is the transfer person who became active to engage students doing observation without following such kind of meaning behind the facts or information of the given problems.

In order to complete the useful kind of SARAC as learning approach in the subject of mathematics, this article also measure how effective is in the learning process that involves the ability of students to show their abilities in terms of learning achievement, activities, and responses.

METHOD

This research was pre-experimental (Pre Experimental Research) with one treatment, namely the application of the approach SARAC in mathematics. By not using the control class, as a comparison used subject conditions before being given treatment, through the provision of pretest. Furthermore, the subjects were given a posttest to determine the changes brought about by using SARAC approach (Research Connections, 2016)

By using research design "One-group pretest-posttest", there are steps or stages that shows a sequence of activities that pre-test research, treatment, post-test. For more details of this study design can be seen in Table 1 below:

Table 1 One Group Pretest-Posttest Design

Pretes t	Treatment	Posttes t
O_1	X	O_2

Keterangan :
O_1 = Pre-test
X = Treatment
O_2 = Post-test

The population of research is students of grade VIII in SMPN 22 Makassar. By using simple random sampling, there are 35 students who are getting involved in this experimental activities. As concerns in this study, three kinds of instruments are used to collect data, such as students' achievement test, observation sheet, and responds sheet. For analyzing the data, two kinds of statistics were applied, namely descriptive and inferential statistics.

To ascertain whether or not the effect caused by the application of this SARAC approach, there are three (3) indicators to measure it, is the result of learning mathematics, student activities and student responses. As for the intended learning outcomes of mathematics is score obtained by the students after being given a mathematics achievement test. Then the student activity in learning activities is the average value of the frequency of all the

activities of students as measured by student activity observation instruments. Lastly, the student response is the average of the value of students' responses to learning as measured by the instrument granting student responses.

RESULT AND DISCUSSION

Learning activities carried out by at least seven meetings. At the meeting the learning, students are involved in learning activities with SARAC approach. During the learning process, students are involved in activities viewed by reading that meaning can be interpreted from a problem, to support this activity students are given the context of the problems related to everyday life. The advantages with the provision of this kind of problem inviting the involvement of students to argue and express opinions they have about their understanding of the problem. Furthermore, the activity was followed by a part of the circuit, which is asking the question. In this case, the question that has been provided by the teacher to stimulate learners construct questions so that they can define what it wants to be understood. From this experience, giving questions to learners not just turn their thoughts to answer the problem given. However, directing ideas which they were collected to restrict the idea which is important and useful to resolve the existing problems. It is important for students to recognize their questions so that a construction ideas can be well fit the purpose desired.

To that end, the process of reasoning will work with not too heavy before associates the whole idea that being part of the reasoning process. Last is the part that is not easy for most students is to communicate both orally and in writing. This latter activity is not easy because of the skills needed not only writing, but also orally. Most students and even teachers actually have a weakness in conveying something orally. Therefore, learning activities will be more attractive to involve both these capabilities in a learning process.

In general, with such learning activities. Next is to measure the extent to which achievement can be given by applying this SARAC approach in mathematics. For this, there are three indicators to measure the achievement of this approach, namely the learning achievement, student activities, and the response they received with the application of this approach. Data intended learning outcomes in this study are the results of the initial test (pre-test) and final test (post-test) students taught using SARAC approach presented in the following table.

Table 2. Learning Achievement by Using SARAC Approach

Statistics	***Pre-Test***	***Post-Test***
Number of Sample	35	35
Mean	35,31	82,60
Median	34,00	83,00
Mode	30	78
Std. Deviation	7,99	5,85
Skewness	0,469	0,450
Kurtosis	-0,783	-0,184
Minimum Score	24	73
Maximum Score	52	95

According to this table, the results of students' mathematics learning in the pre-test shows the mean and median 35.31 34.00 (about 50% of students received grades below 34.00) with a standard deviation of 7.99. The maximum value is 52 and the minimum value of 24. While on the post-test shows the mean and median 82.60 83.00 (about 50% of students received grades below 83.00) with a standard deviation of 5.85. The maximum value is 95 and the minimum score is 73. The average value (mean) post-test is greater than the average value of the pre-test, so descriptively it can be said that the results of students' mathematics learning as applied approach SARAC increased or become better.

If the learning achievement of learners are grouped into five categories, the obtained frequency distribution and percentages as follows:

Table 3. Distribution Score of Learning Achievement in The Learning Process of SARAC Approach

Interval Score	Category	*Pre-Test*		*Post-Test*	
		Frequency	Percentage	Frequency	Percentage
0 – 54	Lower	35	100%	0	0%
55 – 64	Low	0	0%	0	0%
65 – 79	Fair	0	0%	12	34,29%
80 – 89	High	0	0%	18	51,43%
90 – 100	Higher	0	0%	5	14,28%

Based on table 3, it appears that the pre-test scores of 35 students who became the subject of the study was all students gain values at intervals of 0-54 is classified in the category of very low on the topic of the circle. This means that before the application SARAC approach, the students' knowledge is still lacking on the topic of the circle. While the provision of post-test seen that out of 35 which is the subject of the study 12 students gain values at intervals of 65-79 were classified in the medium category, 18 students received grades in the interval 80-89 were classified in the high category, and 5 students gain values at intervals 90 -100 belonging to the very high category. This means that the knowledge of students on the material circle has increased. Post-test score is 82.60, if converted in the category of learning outcomes at the high category (80-89). Descriptively, thus it can be concluded that after the adoption SARAC approach to mathematics learning outcomes of students meet the criteria of effectiveness.

Based on the minimum completeness criteria (MCC) applies, namely 78, is used to determine the level of achievement of learning outcomes completeness of classical mathematics student at SARAC approach application, can be seen in the following table.

Table 4. Distribution of mastery learning outcomes Students

	Standard Score	Persentage of Classical Completeness (%)	
		Completed	Not Completed
Pre-test	78	0	100
Post-test		88,57	11,43

The table above shows that the percentage of students who completed the classical amounted to 88.57%> 79.99%, so it can be argued that the results of students' mathematics learning in SARAC approach application meets the criteria of effectiveness. Then, the need to ensure that this increase applies significantly, following t-test results that have been done.

Table 5. T-test results on MCC Achievement of Students

	Test Value = 77.9					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Post_Test	4,755	34	,000	4,7000	2,6915	6,7085

From the results of this analysis indicate that the average learning outcomes of students after being taught by SARAC approach significantly greater than 77.9 (MCC)

Further analysis gain value against improving student learning outcomes. The magnitude of improving student learning outcomes are taught through SARAC approach is calculated as normalized gain can be seen in the following table.

Table 6. Frequency Distribution and Percentage Increase Student Results

Coefficient of normalization gain	Category	Frequency	Percentage
$g \leq 0,3$	Low	0	0%
$0,3 < g \leq 0,7$	Middle	15	42,86%
$g > 0,7$	High	20	57,14%
		35	100 %

The information shown on table 6, note that of the 35 students who became the subject of the study 27 students at the high category and 8 students in middle category in terms of improving learning outcomes approach mathematics with application SARAC. The average value of improving student learning outcomes by 0.74, including the high category.

Furthermore, if the increase in normalized gain value indicated by such learners apply significantly? To prove it used t-test and the results are presented in table 7 below

Table 7. T-test Results against the Results of Value Improvement Math Students

	Test Value = 0.29					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
N_Gain	34,636	34	,000	,44571	,4196	,4719

This table 7 shows that the probability of gain is 0,000 <α = 0.05, H_0 rejected. It is informed that that the average gain is normalized students who are taught by SARAC approach is greater than 0.29, in other words, minimal middle category.

For students' activities data derived from observations at each meeting by using student activity observation instruments performed during the learning process. Student activity indicator consists of nine aspects of the observations are based on the characteristics of applied learning in the classroom. Observations carried out by observing each student based on user activity on the instrument observations made at each meeting. Recapitulation of the student activity observation presented in the following table.

Table 8. Summary of Observations Student Activities

Indicators of Observation	Mean	Category
1	3,86	Very Active
2	3,62	Very Active
3	3,24	Active
4	3,43	Very Active
5	3,45	Very Active
6	3,17	Active
7	3,36	Active
8	3,62	Very Active
9	3,60	Very Active
Mean of Total	3,48	Active

Based on table 8 it appears that the average score in the category of student activity very active, descriptive approach the student activity SARAC meet the criteria of effectiveness.

Student response data obtained using a questionnaire sheet student's response. The questionnaire was administered after applying SARAC approach. Descriptive analysis of the score a student's response through SARAC approach can be seen from the following table:

Table 9. Category aspect Student Response

Mean	Category
3,53	Positive

This table state that the response of the students towards learning with SARAC approach is positive. Thus descriptive effectiveness criteria are met.

Because of the three indicators proposed that learning outcomes, activities and student responses are met according to criteria specified. First, more than 80% of students meet the minimum completeness, the tendency of student activity indicated are in two categories, if not highly active, more active. Recently the students' responses to the application of the approach as defined by the average size of 3.53, including a positive category. Therefore, it can be stated that the approach SARAC supporting math learning activities in class VIII.

SARAC approach is one of the innovations developed in view of the usefulness of the scientific approach to the curriculum in 2013 becomes important to give to learners. The existence SARAC approach complements the weaknesses of the scientific approach, particularly in mathematics. As we know, the ability of the factual or declarative knowledge learners need to be developed mainly in interpreting information from a given problem. As performed Fulton & Sabatino (2008), scientific methods used to motivate Biology learners to study pre-calculus.

The main point of SARAC approach in this study is to emphasize activity viewed simultaneously read the context of the problem is given so that the literacy skills of learners can develop well, especially mathematical literacy (OECD, 2004). In addition, this SARAC approach directs learners to identify other skills such as identifying ideas and construct with the ability to ask, reasonable, associate and communicate (Bell et al., 2010; Asay & Orgill, 2010).

CONCLUSION

SARAC approach or see, ask, reason, associate, and communicate is one of the innovations developed in view of the usefulness of the scientific approach to the curriculum in 2013 becomes important to give to learners. The existence SARAC approach complements the weaknesses of the scientific approach, particularly in mathematics. As we know, the ability of the factual or declarative knowledge learners need to be developed mainly in interpreting information from a given problem.

Through this study, the progress of learners using SARAC approach can be viewed in three indicators, such as learning achievement, students' activities, and responds toward learning process. The average learning outcomes of students after being taught by SARAC approach significantly greater than 77.9 (MCC). Subsequently, the average gain is normalized students who are taught by SARAC approach is greater than 0.29, in other words, minimal middle category.

In affective domain, the average score in the category of student activity very active, descriptive approach the student activity SARAC meet the criteria of effectiveness. While the students' responses to the application of the approach as defined by the average size of 3.53, including a positive category.

That's why, this study brings information that SARAC approach is an alternative learning approach can be applied in order to support the development of students' competencies.

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REFERENCES

1. Asay, L. D., & Orgill, M. K. Analysis of essential features of inquiry found in articles published in the Science Teacher, 1998-2007. *Journal of Science Teacher Education*, (2010). *21*, 57-79.
2. Bell, T., Urhahne, D., Schanze, S., & Ploetzner, R. Collaborative inquiry learning: Models, tools and challenges. *International Journal of Science Education*, (2010). *32*(3), 349-377.
3. Baroody, A. J., & Ginsburg, H. P. Children's mathematical learning: A Cognitive view. In C. Maher & N. Noddings (Eds.), *Constructivist views on the teaching and learning of mathematics*. Reston, VA: National Council of Teachers of Mathematics. (1990). (pp. 51–64)
4. Cooke, B. D., & Buchholz, D. Mathematical communication in the classroom: A Teacher makes a difference. *Early Childhood Education Journal*, *32*(6), (2005). 365–369.
5. Whitin, P., & Whitin, D. J. *Math is language too: Talking and writing in the mathematics classroom.* Reston, VA: National Council of Teachers of Mathematics. (2000).
6. National Council of Teachers of Mathematics. *Principles and standards for school mathematics.* Reston, VA: National Council of Teachers of Mathematics. (2000)
7. Lin, C. S., Shann, W. C., & Lin, S. C. *Reflections on mathematical communication from Taiwan math curriculum guideline and PISA 2003*. Retrieved from http://www.criced.tsukuba.ac.jp/math/apec/apec2008/papers/PDF/16.Lin_Su_Chun_Taiwan.pdf . (2008)
8. Lin, Y. H., & Lee, Q. Y. 國小學生數學解題溝通能力評量之實證研究 [A Study of ability on mathematical communication for pupils of elementary schools]. *Journal of Educational Measurement and Statistics*, . (2004). *12*, 233–268.
9. OECD. *Learning for tomorrow's world. First results from PISA 2003*. Paris: OECD. (2004)
10. Silver, E. A., & Smith, M. S. Building discourse communities in mathematics classrooms: A Worthwhile but challenging journey. In P. C. Elliott (Ed.), *Communication in mathematics, K–12 and beyond: 1996 yearbook* (pp. 20–28). Reston, VA: National Council of Teachers of Mathematics.
11. Research Connections, Pre-Experimental Designs. Retrieved by http://www.researchconnections.org/childcare/datamethods/preexperimental.jsp, 2016