E – 43

Developing A Balanced Hard Skill And Soft Skill Of Students' Math Through The Character-Oriented Scientific Approach

Euis Eti Rohaeti
Siliwangi STKIP Bandung
e2rht@yahoo.com

Abstract

Scientific approach mandated curriculum 2013 to be implemented in the process of teaching and learning is expected to reach the hard skills and soft skills of students. Therefore, this study tried to apply the character oriented-scientific approach to the process of math teaching and learning, namely the multicultural scientific approach and metaforming scientific approach to one of the high school that has implemented curriculum 2013. The research subjects consisted of 133 students. The results showed that the character-oriented scientific approach is more effective in developing a balanced hard skills and soft skills of students' math than the usual scientific approach. Each of the character oriented scientific approach has advantages in developing aspects of the hard skills and soft skills of certain mathematics.

Keywords: *scientific approach, character, hard skills, soft skills*

1. INTRODUCTION

Curriculum 2013, which has begun to be applied in some schools starting in the academic year 2013/2014, mandates the use of a scientific approach to all learning, including the learning of mathematics. Scientific approach referred to in learning activities include observing, questioning, associating, experimenting and networking for all subjects.

Through this approach, according to Kemendikbud (2013:1), the learning process is expected to cover the three domains, namely attitudes, skills and cognitive. Through the learning process on the basis of scientific approach, according to Kemendikbud (2013:4), the attitude domain covers the transformation of substance or teaching materials so that the students "know why." The skills domain covers the transformation of substance or teaching materials so that the students "know how". The cognitive domain covers the transformation of substance or teaching materials so that learners "know what." Thus, it is expected that the results of learning produces students who have a balance between the ability to be a good man (soft skills) and people who have the skills and knowledge to live a decent (hard skills).

Based on the results of preliminary observations conducted by the researcher and some graduate students of mathematics education of STKIP Siliwangi to some junior and senior high schools where the curriculum 2013enacted, there are still many teachers who did not master the essence of the scientific approach and even for some topics in mathematics, teachers face difficulty applying this approach because the material is completely new to the students. Therefore teachers should use their own learning strategies so that the scientific approach to be effective.

Based on the explanation above, the researcher conducted a study to combine a variety of character-oriented learning approach with scientific approach to the study of mathematics in order to obtain an overview of effective scientific approach that can balance students' mathematic hard skills and soft skills.

2. Scientific Approach

According to Kemendikbud (2013) Curriculum 2013 emphasis on the modern pedagogical dimension in learning, using a scientific approach or scientific approach.

Scientific approach is subjects that include the following activities: observing, questioning, experimenting, processing, presenting, summarizing, and creating. Thus scientific learning step can be described as follows:

1) Observing, in which students make observations to discover and link analyzed objects with new concepts to be learned.
2) Questioning, in which the teacher asks, the students ask, or the teacher encourages students to ask.
3) Associating, where students classify diverse ideas and associate diverse events then put it into a fragment of memory.
4) Experimenting, where students experiment or do experiments related to the material to be studied.
5) Networking, where students work in groups to interact with each other, share ideas and jointly face the various changes and demands of studying.

Based on the study of Kemendikbud (2013:2) learning on the basis of scientific approach has more effective results compared with traditional learning. The research proves that the traditional learning, teacher retention of information by 10 percent after fifteen minutes and the acquisition of contextual understanding by 25 percent. In learning on the basis of scientific approach, retention of information from the teacher was more than 90 percent after two days and the acquisition of contextual understanding of 50-70 percent.

3. Multicultural Scientific Approach

Indonesia's cultural diversity and its uniqueness that describe the peculiarities of each region is a potential that can be integrated into learning in school into a contextual learning approach towards ethnic and socio-cultural differences in our country. This approach is called a multicultural approach. Multicultural approach (Rohidi, 2002) is designed to emphasize the importance of social pluralism, cultural diversity, ethnic and contextualism. Based on this approach learning is seen as a social and cultural intervention, so that through this approach the use of education to be responsive culture. Multicultural approach has become a necessity and an integral in the life of the nation. This approach is expected to give birth to a generation who are aware of cultural diversity. Zainudin (2008) says that multicultural learning is an idea based on the education reform movement to achieve the goal. Pluralism should be seen as a necessity in life.

To combine these approaches to the scientific approach, we can put it into the steps in the scientific approach. For example, in the steps of observing we can display images of customs houses, regional clothes or traditional dances from various regions as an introduction to the material to be taught, then we ask the picture presented by region of origin, then invite students to present reasoned problems associated with the image, and then ask the students to try to sketch a picture or a mathematical model based on a given issue and create a network by discussing it with their friends. Example 1:

Stage of observing, presented pictures of traditional clothing from several regions in Indonesia:




Picture 1 Picture 2 Picture 3 Picture 4

Stage of questioning: Which areas of traditional clothing are the pictures above?

Stage of associating, given the following math problem:

A lady will sew traditional clothing to a tailor. The tailor only distinguishes costs for traditional clothing of Java and outside Java. Sewing 2 Javanese traditional clothing and 3 traditional clothing of outside Java, the lady must pay Rp 900.000,00. While sewing 1 Javanese clothes and 4 traditional clothes from outside Java, the lady had to pay Rp 950,000.00. What is the cost for sewing 1traditional clothing of Java? What is also the cost for sewing 1traditional clothing from outside of Java?

Stages of experimenting and networking, students in groups or in pairs make a mathematical model of the problem and discuss its solution.

Example 2:

Stage of observing:

Note the pictures of custom house below:


Stage of questioning:

Where does the custom home of the picture above come from?

Stage of associating:

Traditionally the Sundanese house shaped stage with a height of 0.5 m - 0.8 m or 1 m above ground level. In the old houses, there is a high achieving 1.8 meters. The vault itself is generally used to bind domestic animals such as cattle, horses, or to store farming tools such as hoes, plows, rakes and so on. To climb to the house a ladder is

provided called Golodog, made of wood or bamboo, which usually consists of no more than three steps. Golodog also serves to clean the feet before going up to the house. If the high under the house is 1.2 meters and there is golodog consisting of 4 pieces stairs, try to count how many cm height of each stair.
Then students perform steps associating by drawing a sketch of the house and the ladders as well as creating a network to discuss with their friends.

4. Metacognition-Scientific Approach

The term is derived from the word *meta*, meaning pertaining/relating, and *cognition* which means consciousness. Gorofallo and Lester (Goos, 1995:300) suggests that metacognition is the ability to control the cognitive processes that are often regarded as an effective critical thinking in solving problems. According to Haller, Child and Wallberg (Jacob, 2000:2) there are 3 metacognitive activity, namely: (1) Awareness: knowing one implicit and explicit information; (2) Monitoring: questioning yourself and describe in your own words to simulation of understanding; (3) Regulation: comparing and contrasting solution allows troubleshooting.
To integrate these metacognitive activities into the scientific approach, the teacher can use metacognition questions that Kramarski and Hirsch (2002:1) includes:

a. Comprehension question is questions that encourage students to read question, illustrate the concept with their own words and try to understand the meaning of the concept. Example of the question: What is the whole issue about?
b. Strategy question: questions that encourage students to consider appropriate strategies to solve the given problem and give reasons. Example question: What strategy / tactics / principles is suitable to solve the problem? Why?
c. Connection question: questions that encourage students to see the similarities and differences in the concept / problem. Examples of the question: What are the similarities / differences between the problems now with the problems I have solved in the past?/
d. Reflection question: questions that encourage students to focus on the completion of the process and ask themselves. Example question: What is wrong that I have done here? Does the solution make sense?

Examples of integration in the scientific approach steps are as follows:
Stage of observing:
Consider the following information:
Ms. Hani had two sons namely Budi and Fani, Bu Dian only had a son that is Aam, while Bu Yani had two sons namely Reza and Candra
Stages of questioning and associating:
If A = the set of mothers' names and B = set of mothers and children's names, what is the name of the possible relation of set A to set B? Describe the relationship!
Is the relation a function? Why?
Metacognition question:
What is the overall problem that we talked about earlier?
Ask yourself this: Have I ever come across a problem like this before? What are the similarities and differences with the problems I have solved?

Stages of experimenting and networking:
Based on the previous information, try to make some other possible relationships and draw them. Then discuss with your friends whether the relation is a function or not.
Metacognition question:
What is the appropriate strategy I employ to resolve the problem?
When finished, ask yourself: Is there something wrong with my answer? Does the answer make sense?
By combining these metacognitive activities in scientific approach, according to Goos (1995: 300) it is expected that metacognitive processes in students will affect the students' mathematical behavior in terms of their way and strategies in selecting and deploying metacognitive knowledge and strategies that may be sustained by beliefs about mathematics and how mathematics is learned.

5. Research Methodology

This study is an experimental study conducted on 133 high school students consisting of 3 X classes which have been enacted curriculum 2013. One class gets scientific-teaching with a multicultural approach, another class gets metacognition and the other one gets common scientific approach used to be done by the teacher. The three classes were tested to get the hard skills in the form of high-level mathematical thinking skills and attitude scale to measure soft skills in the form of students' learning mathematical disposition and independent. The data were then processed using SPSS to determine the character-oriented scientific approach is most effective to improve the students' soft skills and hard skills in balance.

6. Results and Discussions

As previously mentioned this study was conducted on 133 high school students comprising 44 students who received instruction using a scientific approach to multicultural, 43 students got a scientific approach using metacognition and 46 students received instruction by using the common scientific approach. Before and after the learning the students were given a test to measure the achievement of the mathematic hard skills. As for measuring soft skills it was done after the instruction. From the results of tests conducted to measure the students' hard skills obtained the following data:

Table 1

Description of Students' Hard Skills and Soft Skills Pre Test Value Based on Learning

Variable	Stat. Data	Learning								
		Multicultural Scientific			Metacognitive Scientific			Common Scientific		
		n	Pre-test	% of Ideal Score	n	Pretest	% of Ideal Score	n	Pre-test	% of Ideal Score

Hard Skills (SMI:35)	$\bar{x}$	44	11.83	33.8	43	11.72	33.48	46	11.75	33.57
	SD		1.52			2.13			2.15	

And from the results obtained that the students' beginning capabilities of math hard skills do not differ significantly.

Table 2
Description of Students' Hard Skills and Soft Skills Post Test Value Based on Learning

Variable	Stat. Data	Pembelajaran								
		Multicultural Scientific			Metacognitive Scientific			Common Scientific		
		n	Post-test	% of Ideal Score	n	Post-test	% of Ideal Score	n	Post-test	% of Ideal Score
Hard Skills (SMI:35)	$\bar{x}$	44	24.79	70.3	43	24.82	70.91	46	20.85	59.57
	SD		2.54			3.13			3.85	
Soft Skills (SMI:155)	$\bar{x}$	44	115.19	74.32	43	111.88	72.18	46	100.41	64.78
	SD		9.82			11.03			11.03	

From the data in Table 1 and the results of processing by using SPSS at a significance level of 5% it was concluded that there was no significant difference between mathematics hard skills achievement of students who use multicultural scientific approach to the use of metacognitive scientific approach, but the hard skills achievement of students who used multicultural scientific approach was better than those who used common scientific approach. Similarly, the hard skills achievement of students who used metacognition scientific approach is better than those who used common scientific approach. Students' mathematic hard skills that use the multicultural scientific approach and metacognition scientific approach were at the level of fair while those using the common scientific approach at the level of less.
Meanwhile, in terms of soft skills, students who used multicultural scientific approach were better than others. Those who used metacognition scientific approach were better than the common scientific approach. Math soft skills of students who used multicultural scientific approach, metacognition scientific approach, and common scientific approach, all of them were at the level of medium.
From the results of the study metacognition scientific approach developed students'

hard skills ability, especially in aspects of students' mathematical comprehension and communication, also soft skills on aspects of independent learning. Metacognitive questions made the students able to control the thinking process so that students' answer became more thorough and systematic. The questions according to Jacob (2000:2) made the students aware not only of what they know but also about what they need to do if they fail to understand. Metacognitive questions in line with what was stated by Kramarski (2000) that is able to maximize the students to discuss with each other, express their ideas with their peers so that they can give and receive feedback.

Multicultural scientific approach that focuses on the culture material associated with the region was able to enhance the students' hard skills better, especially in aspects of students' mathematical understanding and connection as well as their soft skills on aspects of students' mathematical dispositions. This is in line with the opinion of Sofa (2008:1) stated that multicultural learning can describe the relationship between concepts in mathematics with community of students, and help students to be able to show or express mathematical concepts learned associated with the community's culture, so that learning is perceived can make meaningful and contextual learning which are strongly associated with the culture of the community in which a field of science will be learned and applied later to the community where the students come. As a result, learning becomes interesting and fun because it enables the creation of meaning which is contextually based on students' early experiences as a member of a cultural community.

From the above description it can be concluded that multicultural scientific approach is more effective in developing students' mathematic hard skills and soft skills in balance compared to other scientific approaches. Metacognition scientific approach is more effective than the common scientific approach.

7. Conclusions

a. In developing the students' hard skills and soft skills in balance, multicultural scientific approach is more effective than other scientific approaches; metacognition scientific approach is more effective than the common scientific approach.
b. Multicultural scientific approach more effectively develops students' hard skills in aspects of mathematical understanding and mathematical connections, while metacognition scientific approach more effectively develops students' hard skills in aspects of mathematical understanding and mathematical communication.
c. Multicultural scientific approach more effectively develops students' soft skills in aspect of mathematical dispositions whereas metacognition scientific approach more effectively develops students' math soft skills in aspect of learning independence.

8. Bibliography

[1] Goos, M (1995). "Metacognitive Knowledge, Beliefs, and Classroom Mathematics". *Eighteen Annual Conference of The Mathematics Education Research Group of Australasia, Darwin, July 7-10 1995.*

[2] Jacob, C (2000). *Mengajar Keterampilan Metakognitif dan Meningkatkan Kemampuan Belajar Matematika.* Bandung: FPMIPA.

[3] Kemendikbud (2013). *Konsep Pendekatan Scientific.* Jakarta: Kemendikbud.

[4] Kramarski, B (2000). *The Effects of Different Instructional Methods on The Ability to Communicate Mathematical Reasonong.* Proceeding of the 24th Conference of The International Group for The Psychology on Mathematics Education.
[5] Kramarski, B and Hirsch (2002). "Effects of Computer Algebra System (CAS) with Metacognitive Training on Mathematical reasoning". *Journal of Computer Assisted Learning.*
[6] Rohidi, T.R (2002). *Pendidikan Seni Multikultural.* Jakarta: Suara Merdeka.
[7] Sofa, P (2008). *Pembelajaran Berbasis Budaya.* [Online]. Available: http://duniaguru.com/index.php?option=com_content&task=view&id=1014&Itemid=1
(20 February 2014)
[8] Zainudin, R.B. (2008). *Pembelajaran Berbasis Multikultur sebagai Gerakan Pembaharuan dalamPendidikan.* [Online]. Available: http://waykanan.go.id/index.php?option=com_content&task=view&id=78&Itemid=2(11 March 2014)