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Mathematical Problem Solving Skill Viewed from Epistemic Curiosity on *Fostering Communities of Learners*

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Abstract

This research aims to describe mathematics problem solving skill viewed from epistemic curiosity of students on *Fostering Communities of Learners* of VIII graders about probability material. The design of this research was mixed concurrent – triangulation method. This *mixed method* took the research subjects *purposively.* They consisted of 6 students, each of 3 students with high and moderate epistemic curiosity. The findings showed that mathematics problem solving skill viewed from epistemic curiosity were varied. It was shown by 8 students with high epistemic curiosity whom obtained 4 high mathematics problem solving skilled students and 4 moderate skilled students. From 22 students with moderate epistemic curiosity, it obtained 10 high mathematics problem solving skilled students and 12 moderate skilled students. The students with high and moderate epistemic curiosity tended to be incapable in determining appropriate problem solving strategy.

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INTRODUCTION

Education is a competence of students in knowledge, skill, attitude, and behavioural fields. Mathematics in school curriculum is an obligatory lesson for each school – aged child to get appropriate mathematics skill. National Council of Teaching Mathematics determine seven standards of mathematics skill to master by students from school – learning, one of them is problem solving. The main purpose of mathematics learning is to solve various complex mathematics problems (Suherman, et al, 2003; Prusak, et al. 2013; Budhiarti & Suyitno, 2017; Psycharis & Kallia, 2017; Masri, et al. 2018; Rosiani, et al. 2019). Student ability on problem solving aspect is ability to communicate mathematics ideas/notions learnt by certain ways to find solution.

According to NCTM as quoted by Bosse et al (2010), school problem solving teaching program should allow students to (1) build new mathematical knowledge through problem solving, (2) solve problems that arise in mathematics and in other contexts, (3) apply and adapt a variety of appropriate strategies to solve problems, and (4) monitor and reflect on the process of mathematical problem solving.

Indicators to solve the used questions used Polya problem solving skill stages. Said & Ghani (2008), it consisted of (1) understand the problem, (2) devise a plan, (3) carry out the plan, and (4) looking back.

Character education could be integrated into mathematics learning through contextual problem. One of character values to be developed on students is curiosity. It is defined as intention and need of an individual to get an answer upon a question or other things triggering deep curiosities. According to Latifah & Wijajanti (2017), curiosity of students should be owned during learning in the form of curiosity and interest to learn and investigate.

Leherissey (1971) and Ye, et al. (2010) stated two natures of curiosity of students: (1) *Specific Curiosity*, an emotional or motivational condition which temporarily owned by students to be activated in learning knowledge and experience by having stimulus or certain activities, and (2) *Diverse Curiosity,* a curious attitude referring to various new and challenging stimulus with purpose to integrate knowledge and experience. There are two types of *specific curiosity*: (1) epistemic curiosity, a curiosity motivated by lack of knowledge and (2) perceptual curiosity, a curiosity motivated by visual and auditory stimulus (Levitt et al, 2009).

Epistemic curiosity motivates students to learn, to think new ideas, to ask questions, and to solve problems (Richards et al, 2013). Students with epistemic curiosity are assumed to have connection to know: 1) more about the learnt task, 2) the approach of the new task or unrecognized task, 3) approach complex or abstract tasks, and 4) keep seeking the information in learning.

Based on the interview with the mathematics teacher of SMP N 37 Semarang, it was known that there were several hindrances in mathematics learning process, such as students' laziness and lack of motivation in using technology during learning mathematics. It results to poor test score of the students. The highest one was known only 61. Casey (2014) stated that there is a need of pedagogical and practical learning design to motivate curiosity. *Fostering Communities of Learners* (FCL) is a learning model based on community learning so it allows students to discuss and develop mathematics problem skill. Garcia – Carrion & Diez – Palomar (2015) and Boersma et al (2016) stated that learning based on community was an effective learning because it provided significant improvement to students' mathematics problem solving skill. FCL focuses on *research – sharing – consequential task* cycle activity.

The main purpose of FCL is student – learning community interaction to investigate mathematics contextual problem and to share their friends as well as to do the consequential task. The process of FCL model could improve social

interaction among students and contribute them to classically discuss. Learning by focusing on FCL provides research – based learning for students. It improves activeness, collaboration, and ethos of knowledge community for the whole class (Ehrlick & Slotta, 2017). Based on that framework, the purpose of this research was to find out the description of mathematics problem solving skill of the students viewed from epistemic curiosity on *Fostering Communities of Learners* model.

METHOD

This *mixed – method* research with concurrent – triangulation strategy used *nonequivalent posttest – only control group* design. This research was begun by preliminary study before quantitative data collection and qualitative data analysis and interpretation stage.

This research was conducted at SMP N 37 Semarang. The sample consisted of 66 students and there were 6 students as the subjects taken by purposive sampling grouped into 3 students with high epistemic curiosity and 3 students with moderate epistemic curiosity.

The technique of collecting quantitative data was done by mathematics problem solving test. The techniques of collecting qualitative data were *State Curiosity Scale* (Leherissey, 1971), interview, and documentation. Widhiarso (2011) categorized the subjects into three epistemic curiosity categories based on limit of group. The quantitative analysis used normality, homogeneity, variance, proportional, and two way variance tests. The qualitative data analysis used Miles & Huberman's concept (2007) through data reduction, data presentation, and data conclusion.

FINDINGS AND DISCUSSION

In research stage, the learning result was measured quantitatively by giving mathematics problem solving test skill and *State Curiosity Scale.* The test was given to experimental and control groups. The requirement test result showed that result of mathematics problem solving test was normally distributed and homogeneous. Based on the analysis of statistical test, the average of passing grade achievement individually was counted by $t_{count} = 5.37$ higher than $t_{table} = 1.7$. It showed the average score of the students' skills was higher than actual minimum passing grade (BLA = 68).

Based on result of statistic test analysis of classical passing grade achievement, it obtained $z = 1.89$ higher than $z_{table} = -1.65$. Therefore, $z > z_{table}$ so the proportion of student passing grade achievement classically was higher than 75%. Based on statistic test analysis of two average equality, it was obtained $t = 7.32$ and $t_{table} = 1.67$. Therefore, $t > t_{table}$ so that the average score of mathematics problem solving skill of group taught by FCL was higher than mathematics problem solving skill of group taught by PBL. Based on result of proportional test analysis, it was obtained that $t_{count} = 7.32$ and $t_{table} = 1.67$. It showed that $t_{count} > t_{table}$, meaning the average score of mathematics problem solving skill of group taught by FCL was better than mathematics problem solving skill of students taught by PBL.

The results of epistemic curiosity score of the students were grouped into 3 categories: high, moderate, and poor. Respondents of *State Curiosity Scale* consisted of 30 experimental group students with 8 high epistemic curiosity students and 22 poor epistemic curiosity students. Table 1 shows the categorization viewed from epistemic curiosity of the students.

Table 1. Student Categorization Viewed from Epistemic Curiosity

Criteria	Numbers of Students	Percentage
High *Epistemic Curiosity*	8	26.67
Moderate *Epistemic Curiosity*	22	73.33
Poor *Epistemic Curiosity*	0	0
Total	30	100

The results showed that *Fostering Community Learners* had higher improvement and various mathematics problem solving skill description viewed from their epistemic curiosities. Table 1 shows 8 students with high epistemic curiosity

consisting of 4 high mathematics problem solving skilled students and 4 moderate skilled students. Meanwhile, the students with moderate epistemic curiosity consisted of 22 students with 10 high skilled students and 12 moderate skilled students.

Based on the analysis of the answers and interview with the high epistemic curiosity students, it could be concluded that the students (1) reached the indicators of problem solving skill based on NCTM and were able to solve the questions systematically based on Polya stages, and (2) tended to be careless in summing up and subtracting process of fraction during working on mathematics problem solving question. It led to mistakes in answering the final questions/writing the conclusion. It was in line with Arfiana & Wijaya (2018) that students did mistake in calculating process while implementing problem solving strategy.

According to Suherman et al (2003) & Huang et al (2018), skill in determining various techniques and problem solving strategies need to be improved to develop problem solving skill. Zhang et al (2014) stated that teaching a problem solving strategy only in a time would be effective for poor achievement students rather than asking them to individually determine and discuss several strategies.

The analysis of the answers and interview toward students with moderate epistemic curiosity showed that the students reached indicators of NCTM problem solving skill but they were not perfect. They tended to be careless in problem solving process. It could be viewed from in the way they wrote the solution and inaccurate mathematics sentences. According to Ulya (2016), Prabawa & Zaenuri (2017), students whom did not master mathematics notation tended to have difficulties in writing the solution into mathematics language.

Generally, the students had been able to work on the questions systematically and accurately based on Polya sates because the questions were discussed in *research* stages with FCL model viewed from worksheet. It was in line with Said and Ghani (2008) whom stated that one of the main concepts to solve problem was algorithm. Algorithm is a specific problem solving procedure. Its implementation in solving a certain problem would guarantee all students to solve problems correctly with same ways.

Generally, the research subjects had checked again their answers. It showed the rechecking process of what they had been writing on paper allowed them to identify problems during the process and answers. However, their carelessness in rechecking process made them having no ideas to recognize their mistakes in working the questions. Lee (2015) stated that students whom implemented rechecking process tended to be better in determining various solution as the method. Annable in Karatas and Bakti (2013) stated that when a problem solving strategy was emphasized in learning environment then the students discussed it with their peers, their skills in problem solving would improve.

CONCLUSION

It could be concluded that problem solving skill of the students viewed from epistemic curiosity were varied. Therefore, qualified *Fostering Communities of Learners* would influence various mathematics problem solving skills.

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