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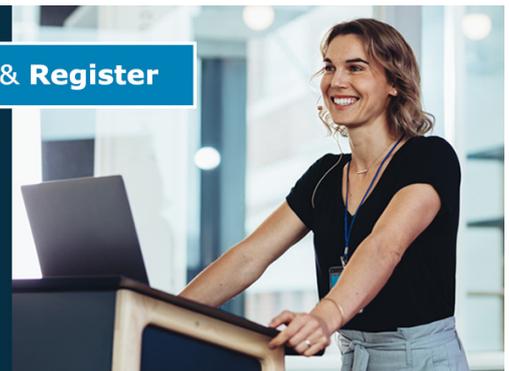
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The Profile of Creativity and Proposing Statistical Problem Quality Level Reviewed From Cognitive Style

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Abstract. This research aims to reveal the profile about the level of creativity and the ability to propose statistical problem of students at Mathematics Education 2014 Batch in the State University of Makassar in terms of their cognitive style. This research uses explorative qualitative method by giving meta-cognitive scaffolding at the time of research. The hypothesis of research is that students who have field independent (FI) cognitive style in statistics problem posing from the provided information already able to propose the statistical problem that can be solved and create new data and the problem is already been included as a high quality statistical problem, while students who have dependent cognitive field (FD) commonly are still limited in statistics problem posing that can be finished and do not load new data and the problem is included as medium quality statistical problem.

Keywords: scaffolding, cognitive style, field independent, field dependent

1. Introduction

Problem posing in learning is important to be owned by students or even college students. This is supported by the result of the research from many experts. Some of them are the research that was conducted by Hashimoto in [1] which showed that learning by using problem posing approach can cause positive impact towards students' ability in solving problem. In addition, Leung, Silver, English (in [2]) reported that:

Problem posing has a positive influence on students' ability to solve word problems, and provided a chance to gain insight into students' understanding of mathematical concepts and processes (p.150).

Problem posing, according to this research, has positive influence towards students' ability in solving math word problem and give chance to the teacher to know the students' understanding about the concept and mathematical process. In line with that, Mestre stated that problem posing can be used to investigate concept transfer cross context and identify knowledge, reasoning, as well as concept development that is owned by students [3]. Meanwhile, in mathematics learning, the implementation of problem posing is the approach that is really recommended by The National Council of Teachers of Mathematics (NCTM), because problem posing has an advantage in developing knowledge and children's understanding towards important concept in school mathematics [4].



Many college students, on the other hand, still experience difficulty in problem posing during teaching and learning activity. This is supported by the findings of Romagnano (in [5]) research that there are three main dilemmas in teaching and learning activity of mathematics, namely: (1) “ask them or tell them” dilemma, (2) “good problems” dilemma, and (3) “grading” dilemma. From those three dilemmas, dilemma number (2) is related to the difficulty in problem posing during teaching and learning activity.

Kilpatrick (in [2]) stated that problem quality that is posed by students is independent variable that can be predictor towards students’ ability in solving problem. Then, Kontorovich et.al., mentioned that problem posing is the special type of problem solving [6]. This means that problem posing and problem solving is inseparable. College students pose problem to be then solved again by themselves.

Before doing problem posing based on the situation that is given by a teacher, college students need to pay attention the kind of information and language structure of a problem that is going to be posed. This is important to be considered to avoid the question or problem that has no solution. The result of the research from Mayer et. al., (in [1]) found that students experience difficulties in solving mathematics problem, because it is difficult to understand the question’s language. Besides, the question that has relationship proposition and imagery proposition is more difficult to be finished by the students in comparison to the question that has tasking proposition. College students’ creativity is really needed in this case to overcome the difficulties in solving mathematics question. Mathematics question has been done by Haylock in [7], and one of the ways to see the posing problem ability is by creative ability. This research focuses more on the result aspect of problem posing by using creativity criteria, i.e. fluency, flexibility and originality, and do not stuck on the aspect of creative process which emphasizes more on cognitive side of the students when posing problem, whether the problem that is posed of the students fulfill the creative thinking criteria or not. Moreover, Silver said that the problem solving and problem posing can increase creative ability through creative dimension, i.e. namely, fluency, flexibility, and novelty [8].

Then, in the research that had been done by Rahman for the students of XII grade IPA-1 Makassar State High School 11, it is found that students who have cognitive style field-independent ask more statistics question that has its completeness (53.21%) in comparison to the students who have field-dependent cognitive style (19,23%) [9]. This is because not all the students have the same way in receiving and processing data in the information given. In other words, there are cognitive style differences between a student and another [10][11].

From the above description, it is known that statistics problem posing in one side is important to be owned by student. On the other hand, there are still students who do not have this ability yet. Furthermore, when students have already posed problem, it turns out that the students have its own ways in receiving and processing data from the given information. This is the way that can be stated as creativity. This fact that encourages the writer to reveal the profile in the level of creativity and ability posing problem quality of statistics problem reviewed from their cognitive style [12]-[15].

2. Research Methods

This research is qualitative research. The focus of the research is to know the creativity and quality of problem posing statistics of students that have different cognitive style, by revealing response image (statement, non-statistical question, and statistical question), students that are proposed based on the given information. Response that is in the form of statistical questions is continued by language analysis that focuses on the semantic and syntaxes relationship.

The subject of this research is the students of 2014 batch Mathematics Education Study Program of Mathematics and Natural Science Faculty in the State University of Makassar. The determination of subject in this research is done by following steps as follows:

- a. Guided to cognitive style test result. Based on the cognitive style test, the students are grouped into two groups, namely: students who have field-independent (FI) cognitive style and the group of students that have field-dependent (FD) cognitive style.

- b. By taking the minimum of two field-dependent students, two field-independent students minimum, and minimum of two field-dependent approaching field-independent or vice versa.
- c. Thus, the number of subjects in this research is 6 students.

The data collection in this research uses main instrument, i.e. the researcher himself, besides the main instrument, supporting instrument is also used, namely: Instrument to know the students' cognitive style: Group Embedded Figures Test (GEFT) and Statistics problem posing instrument.

After developing instrument and deciding the subject of the research, so the data collection is done as follows:

- a. The researchers prepare the place that is representative to conduct statistics problem posing test.
- b. In the first meeting, the first subject is called, i.e. a student that have file-independent cognitive style, then test of statistics problem posing is given to be worked without giving meta-cognitive *scaffolding* with the time that has been set.
- c. The researcher checks the result of the work of the first subject and decide what parts that have already correct and what parts that needs to be fixed.
- d. The part that still needs to be fixed, designed type and meta-cognitive scaffolding shape that will be given at the second meeting of the first subject.
- e. The second meeting of the first subject i.e. given again the test of problem posing to be worked by giving meta-cognitive scaffolding.
- f. The researcher that is helped by the research helper collects data when the subject works on the test by giving meta-cognitive scaffolding in the form of interview.
- g. The data that will be collected at this time is the data that is related to:
 - Subject ability in problem posing after being given meta-cognitive scaffolding.
 - Kinds of meta-cognitive *scaffolding* that are needed by the subject in posing statistics problem.
 - The students' difficulties in posing statistics problem
- h. The result of the work of the first subject by giving meta-cognitive scaffolding is analyzed and recorded its profile image. When the data is considered not enough, so that additional interview will be done until it is adequate to be drawn a conclusion.

After data collecting for the first subject that has file-independent cognitive style, in the next meeting it is continued by calling the second subject namely other field-independents with the same steps like the first subject. So it goes on until all the subjects' data are taken. The implementation of this data collection is done for each subject by using 2 days minimum time.

According to Moleong, the data analysis process is started with analyzing all data that are available from various resources [16]. In this research the available data is the ability of Statistics problem posing in this case response image that is posed by students with consider kind of response, syntaxes, and semantic relationship, the result of the interview, and meta-cognitive scaffolding kinds that are given. The data of this research is analyzed by paying attention the ability of statistics problem posing, meta-cognitive scaffolding types that are given in posing statistics problem that is done by the students.

Data analysis steps that are done in this research i.e.: First: reducting data, in this case separate between data that is appropriate to this research and the other one is not appropriate, *Second*: spreading data that are gotten from all data resources by paying more attention between steps and the result of problem posing with the result of the interview with meta-cognitive scaffolding, the obstacles that are experienced by students, kinds of meta-cognitive scaffolding that are given, as well as students' response. In the data explanation of this research, labeling is also done. Meta-cognitive scaffolding type on each is also given. *Third*: the data explanation is continued by grouping data according to the level of statistics problem posing and meta-cognitive scaffolding type that is given. *Fourth*, to determine the authenticity of the data in this research, it is done resource triangulation namely, each couple two or more subjects on each cognitive style group is matched with creative equality, problem quality that is posed as well as meta-cognitive scaffolding type that is given. If

creativity, problem quality that is posed as well as meta-cognitive scaffolding type that is given is the same, so that those data are considered as valid, and if the opposite happens, the data is considered as invalid. *Fifth*, because the purpose in this research describes creativity level profile and problem posing quality and meta-cognitive scaffolding type that is given to the students when they pose statistics problem, so the valid data will be further analyzed and the invalid data will be reduced or analyzed as side findings. Reduction is done to separate invalid data and do not give a new information.

3. Result and Discussion

3.1. The Description of Students' Cognitive Style

The data of students' cognitive style in this research is obtained from the test of cognitive test on 20 students of 2014 batch in mathematics education study program FMIPA UNM. Based on the result of the test, the cognitive style itself achieves the data as seen the following table.

Table 1 Description of Students' Cognitive Style

Respondents	Cognitive Style		Sum
	FI	FD	
Angk. 2014	7	13	20
Percentage	35,0	65,0	100

Note: FI=field-independent; FD=field-dependent

Based on Table 6, it is obtained that 20 students who followed cognitive style test, there are 6 (35.0%) students that are in the *field-independent* cognitive style (GK-FI), and 14 (65,0%) students that are in the *field-dependent* cognitive style (GK-FD), from this grouping election of research subject is done.

3.2. The Level of Creativity and Quality of Statistics Problem Posing

GK-FI students from average in posing statistics problem from the information given pose more statistics problems than GK-FD students (1.88). And the GK-FD students pose more statistics problem in the form of Non-Statistical Question (PNs) than GK-FI students.

Table 2 The comparison of Creative Statistics Problem Posing and The level of Creative Thinking (TKBK) between GK-FI Group and GK-FD Group

	Flexibility			Sum	Fluency	Sum	Total
TKBK	1	2	3		1		
FD	1	0	0	1	12	12	13
FI	0	5	1	6	1	1	7
Total	1	5	1	7	13	13	20

The comparison of statistics problem posing creativity and the level of creative thinking (TKBK) between the GK-FI group and GK-FD group can be seen that problem posing creativity of GK-FI is more dominant on flexibility part and GK-FD more dominant on fluency which means GK-FI better than GK-FD. Meanwhile from the level of creative thinking ability (TKBK) GK-FI group has higher level (Level 2 and Level 3) if it is compared to GK-FD (Level 1). This is in accordance with Septiadi (2016) opinion which stated that field independent cognitive style subject have a tendency to finish problem by using reasoning in connecting ideas/information while field dependent cognitive style tend

to finish problem by using reasoning, in other words, the level of thinking GK-FI is better than GK-FD.

Table 3 Creativity and Statistics Problem Posing Quality in Statistics Group GK-FI and GK-FD

Quality	Flexibility		Sum	Fluency		Sum	Total
	Low	Medium		Low	Medium		
FD	1	0	1	10	2	12	13
FI	0	6	6	1	0	1	7
Total	1	6	7	11	2	13	20

In relation to the comparison of statistics problem posing creativity and the creative thinking ability (TKBK), the comparison of creativity and problem posing quality of Statistics Group GK-FI and GK-FD can be seen that problem posing creativity GK-FI is more dominant in the flexibility part and GK-FD is more dominant in fluency which means that GK-FI is better than GK-FD. While from the level of problem posing quality, GK-FI has more dominance and problem posing quality in medium level while GK-FD are dominant in the quality of problem posing side and even problem posing creativity. This is in accordance with Sasongko & Siswono which states that from creative side FI subject is more creative than FD subject [17].

4. Conclusion

Based on the result of the data analysis of the research from the previous chapter, several conclusions of this research are: (1) the level of problem posing creativity GK-FI subject in flexibility level and subject GK-FD on fluency level. (2) The level of creative thinking ability (TKBK) subject GK-FI are on the level 2 and 3 and subject GK-FD is in the level 1. (3) The level of problem posing quality subject GK-FI is in the medium level and subject GK-FD is in the low level. (4) From creativity level, the creative thinking ability (TKBK) and statistics problem posing quality of the students from mathematics education 2014 batch FMIPA UNM can be stated that GK-FI subject is better than GK-FD subject.

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References

- [1] Silver, E.A. & Cai, Jinfa 1996. An analysis of arithmetic problem posing by middle school students, *Journal for Research in Mathematics Education*, 27 (5), 521-539.
- [2] Christou, Constantinos., Nicholas Mousoulides, Marios Pittalis, Demetra Pitta-Pantazi, Bharath Sriraman., 2005. *An Empirical Taxonomy of Problem Posing Processes*. In ZDM 2005, 37 (3). 149-158.
- [3] Mestre, P. J. 2002. Probing adults' conceptual understanding and transfer of learning via problem posing. In: *Applied Developmental Psychology*. 23, 9-50.
- [4] English, Lyn D. 1998. Children's problem posing within formal and informal Contexts, *Journal for Research in Mathematics Education*, 29 (1), 83-106.
- [5] Jaeng, M, 2004. Pengembangan Model Pembelajaran Matematika Sekolah dengan Cara Perseorangan Dan Kelompok Kecil. Surabaya: Disertasi. PPs. UNESA Surabaya.
- [6] Kontorovich, I., Koichu, B., Leikin, R., & Berman, A. (2012). An exploratory framework for handling the complexity of mathematical problem posing in small groups. *The Journal of*

- Mathematical Behavior*, 31(1), 149-161.
- [7] Leung, Shuk-kwan S. 1997. *On the role of creative thinking in problem solving*. <http://www.emis.de/journals/ZDM/zdm973i.html>. Zentralblatt für Didaktik der Mathematik (ZDM) Volume 29 (June 1997) Number 3. Electronic Edition ISSN 1615-679X. didownload tanggal 14 Januari 2016.
- [8] Silver, E. A. 1997. *Fostering Creativity through Instruction Rich in Mathematical Problem Solving and Thinking in Problem Posing*. <http://www.emis.de/journals/ZDM/zdm973i.html>. Zentralblatt für Didaktik der Mathematik (ZDM) Volume 29 (June 1997) Number 3. Electronic Edition ISSN 1615-679X. didownload tanggal 14 Januari 2016.
- [9] Rahman, Abdul. 2006. Deskripsi pengajaran masalah statistika Berdasarkan Gaya Kognitif Siswa Kelas XII(IA)-1 SMA Negeri 11 Makassar. Surabaya: Makalah Seminar, PPs UNESA Surabaya.
- [10] Mulbar, U., Rahman, A., & Ahmar, A. S. (2017). Analysis of the ability in mathematical problem-solving based on SOLO taxonomy and cognitive style. *World Transactions on Engineering and Technology Education*, 15(1), 68-73. doi:10.26858/wtetev15i1y2017p6873
- [11] Rahman, A., Ahmar, A.S, & Rusli. 2016. The influence of cooperative learning models on learning outcomes based on students' learning styles. *World Transactions on Engineering and Technology Education*, 14(3), 425-430.
- [12] Rahman, A., & Ahmar, A. S. (2017). Relationship between learning styles and learning achievement in mathematics based on genders. *World Transactions on Engineering and Technology Education*, 15(1), 74-77. doi:10.26858/wtetev15i1y2017p7477
- [13] Rahman, A. & Ahmar, A.S. 2016. Exploration of Mathematics Problem Solving Process Based on The Thinking Level of Students in Junior High School. *International Journal of Environmental and Science Education*, 11(14), 7278-7285.
- [14] Arsyad, N., Rahman, A., & Ahmar, A. S. (2017). Developing a self-learning model based on open-ended questions to increase the students' creativity in calculus. *Global Journal of Engineering Education*, 9(2), 143-147.
- [15] Ahmar, A. S., & Rahman, A. (2017). Development of teaching material using an android. *Global Journal of Engineering Education*, 19(1), 72-76. doi:10.26858/gjeev19i1y2017p7376
- [16] Moleong, L. J. (2005). *Metodologi Penelitian Kualitatif*. Jakarta: Remaja Rosdakarya.
- [17] Sasongko, D. F., & Siswono, T. Y. E. (2013). Kreativitas Siswa dalam Pengajaran Soal Matematika ditinjau dari Gaya Kognitif Field-Independent (FI) dan Field-Dependent (FD). *Jurnal Mahasiswa Teknologi Pendidikan*, 2(1).