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Students' Creative Thinking Ability and Thinking Schemata in Cool-Critical-Creative-Meaningful (3CM) Learning

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To be creative is the highest competence in the newest Bloom's taxonomy that must be achieved by everyone, including student teachers. This research aims to 1) describe the 3CM learning model and ability of creative thinking skills in solving mathematics problems, 2) describe the student teachers' pattern and skill of creative thinking in solving mathematics problems, 3) find out the schemata pattern in creative thinking according to the level of creative thinking. This research uses mixed method and explanatory sequential design. The population is the student teachers for elementary school. The quality of learning is determined from expert validation, a practicality test and an effectivity test (paired sample T-test). Ability and creative thinking patterns was measured by triangulation method with test, observation and interview techniques. The result shows 1) the 3CM learning model is effective and gave student teachers the opportunity to think creatively in a systematic manner, 2) the skill of student teachers' creative thinking is various according to the schemata structure that they possess, whether it was a formal, content, or linguistic schemata, 3) the schemata structure of the student teachers is various, viewed from the level of creative thinking.

Key words: *3CM learning model, creative thinking, thinking schemata.*

Introduction

Creating an enjoyable atmosphere and fostering creativity are the two most required components in learning mathematics. Hence, creativity would enable students to formulate something new. In addition, creativity is one of the most important and highest competencies in Bloom's latest taxonomy (Stanny, 2016). Furthermore, it is necessary for everyone, including prospective teachers. Not only for producing products in the form of objects, the term creative also refers to problem solving in mathematical problems. Creativity is also one of the main components in 21st century education (Mann, 2006; Tindowen, Bassig & Cagurangi, 2017; Telegina, Drovosekov, Vasbieva, & Zakharova, 2019), thus enhancing content competency in developing students' creative thinking skills (Vale & Barbosa, 2015; Sternberg, 2006). How to think about resolving and solving problems and the ability to think creatively grows from one's creativity, and the presence of opportunities to do (Wahyudi, Waluya, & Rochmad, 2018a). Thus creativity becomes something very important and needs to be developed. One way that can be done is through learning mathematics, because mathematics provides an opportunity to develop thinking skills including creative thinking (Shen & Lai, 2018; Li & Cheng, 2018).

Mathematics learning has not been properly presented. Learning mathematics in schools and colleges has not provided an opportunity to develop the ability to think creatively. Learning is more oriented to the amount of material and the acquisition of academic values that focus on cognitive abilities. Mathematics learning has not provided the opportunity for students to improve reasoning and thinking skills in solving problems (Cracolice, Deming & Ehlert, 2008; Vyas, Ottis & Caligiuri, 2011). Mathematics is often unattractive information that is simply forgotten; does not last long in the student brain.

This condition causes children to have difficulty solving problems that involve thinking skills, including creative thinking. The ability to think creatively involves the work of the brain, memory, representation and manipulation (Wahyudi, Waluya, & Rochmad, 2018a). This is not in accordance with the paradigm of learning mathematics today, where mathematics close to humans mathematics is part of human culture (Hersh, 1997; Greer, 1997; Rosa, 2011) and is part of social reality (Hersh, 1997; Zevenbergen, 2004). Hence learning mathematics must be associated with the context of human life and human culture, thus mathematics is easy to remember, imagine, represent, manipulate and assemble in cognitive maps, thus it makes it easier for students to learn mathematics without having to be burdened with so many mathematical formulas.

Besides having to be contextual, aspects of language become something very important in learning mathematics, because the wrong language will give a wrong understanding. An example of that issue is the mistakes of students in interpreting the words in the problem. Not because they do not know the question, but because inappropriate language will give a different interpretation than what the teacher wants. Thus the mathematical communication process, in this case working on the problem, does not occur well (Zevenbergen, 2004; Orton, 2004; Anthony & Walshaw, 2009). Good language will make mathematics interesting information, easy to remember and stored for a long time in the brains of students with a correct and stable scheme. The scheme will be used to solve the problem given. Someone uses memory, representation and manipulation to solve a given mathematical problem. This ability is called problem solving ability (Matlin, 2009).

Thus the design of learning is needed with the right study of theory in the hope that it can provide a cool learning atmosphere and opportunities for critical, creative and meaningful thinking. Learning must provide a memorable experience and opportunities for students to use the left and right brain in activities that are cool, critical, creative, and meaningful, which will later be called the Cool-Critical-Creative-Meaningful (3CM) model (Wahyudi, Waluya, Suyitno, & Isnarto, 2019). With this learning, the hope of mathematics is introduced and studied in interesting and challenging ways. Learning that assesses comprehensively with a thought hierarchy that collapses in interesting ways. By way of learning like this, the schema formation process occurs well (Wahyudi, Waluya, Suyitno, & Isnarto, 2019). The schemata is a cognitive / knowledge structure that describes patterns of thought and behavior that are interrelated and systematic, built from experience, stored in memory and serves to establish and / or shape new knowledge through the process of adaptation (Piaget, 1980; Rumelhart & Norman, 1985; Neuman & Kopcha, 2018; Longo & Perret, 2018).

Schemata is not a tangible thing that can be seen, but a series of processes in human memory; it has no physical form and cannot be viewed. In the process of thinking, and solving problems, students will apply the schemes that they have, both formal, content and linguistic schemes (Dixon et al. 2012; An, 2013). Formal schemes will help and make it easier for students to call and use the schema as a prerequisite knowledge, so that when there is new information, the schema will solidify and update the existing schema. This will make students have better knowledge and gain new knowledge. Content system, which is the student's knowledge of what to study will also help students to think better, because students enter class, and learning does not start from something completely empty. They already have experience even though not all are in a stable situation. With a good linguistic scheme, students will find it easier to understand terms related to the concepts to be learned. Schemata evolves in line with the capacity of experience (Fischbein,1999; Lashley, 1949), thus the schemata is directly proportional to the experience through two processes, namely assimilation and accommodation (Wahyudi, Waluya, Suyitno, & Isnarto, 2018b). Schemata functions to receive, understand, remember, learn, and solve a problem. The way a person solves a problem depends on the scheme that is in his memory. By having a well established formation of schemata (formal, content and linguistic schemes), students as prospectus teachers will improve the ability of mathematical creative thinking in solving mathematical problems.

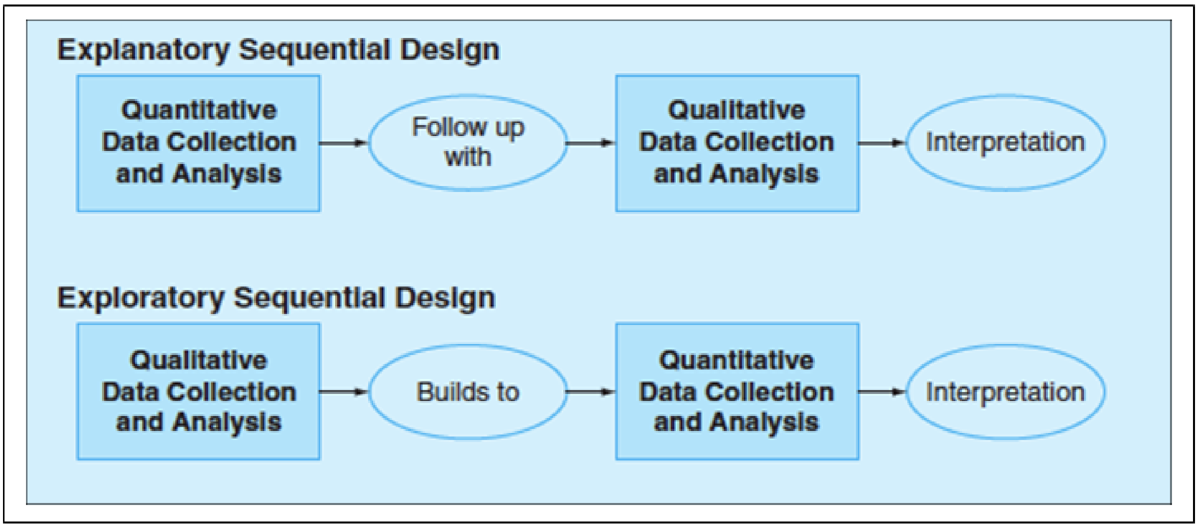
This research will give an idea of how to improve creative thinking and schemata thinking by applying 3CM (cool-critical-creative-meaningful) in maths learning. This learning model provides a learning experience with a burst pattern that begins with interesting, challenging, conjugated problems, followed by criticising the problem of context by finding problem solving with creative ways, the implementation of concepts in creative products, provide confirmation and evaluation of creative products produced, and reflection of results to get the meaning of learning and application of concepts in everyday life. This will give students an experience of how to think creatively in a clear, tiered order ranging from fun to thinking critically and creatively to produce diverse and unique problem solving. Additionally, this study will give an overview of how schemata thinks it is formed in pleasant ways as well as how schemata relationships think with creative thinking skills. The result of this weaving will be a recommendation material as to how the mathematical creative thinking skills of prospective teachers can be well prepared so they are able to teach mathematics the right way.

Methods

This research is a mixed methods study, with explanatory sequential design, namely applying sequential and qualitative data collection sequentially (Creswell, 2012; Giddings, 2006). The first step was collecting and analysing quantitative data to get a description of the ability of creative thinking and levelling, and testing the effectiveness of the application of 3CM learning. The second step was collecting and analysing qualitative data to get a description and map the schema in creative thinking.

The procedure for conducting research with the explanatory sequential design is detailed in Figure 1 below.

Figure 1. Explanatory sequential design



Population and Sample

The population of this research is the first-year elementary school prospective teachers with the subject of Basic Mathematics Concepts, consisting of six classes with an average number of 25 students . The reasons for choosing students as research subjects are as follows: (1) students have not received much influence from learning in college; (2) the level of thinking of students varies because they have completed High School / equivalent; and (3) students are at the formal level, so they are able to think more abstractly to solve problems.

In quantitative research, the sampling technique used is simple random sampling. Simple random sampling is a random sampling technique. The study sample consisted of one experimental class and one control class. The experimental class was where students were taught using 3CM Learning, while the control class with cooperative learning is appropriate for ongoing learning.

In qualitative research, the subject selection technique used is a non-probability sampling technique, which is taking a subject where each member of the population taken does not have the same opportunity to be the subject of research. The type of non-probability sampling used is purposive sampling, which is the taking of subjects used if the researcher has certain considerations with certain objectives. In this study the subject was taken from each level of creative thinking skills, as many as one sample for each level.

Technique and Data Collection Instrument

Technique and data collection instruments are categorised into two, namely quantitative data collection techniques and qualitative data. For quantitative data (creative thinking ability) is measured by tests and observations during the test. The instrument used was a test question in accordance with the aspects of creative thinking given before and after learning. The test problem was open-ended for three questions. Question number one consisted of two problems, for question number two, there were three problems and for question number three, there were three problems. The total of all questions was eight problems. The validity test of test problems is conducted by expert testing. Three professors were asked to assess the validity of the results, as in the following Table 1.

Table 1. Results of expert assessment for instrument of test

Indicator	Ideal score	Actual Score			Average	PN* (%)	Category
		Expert 1	Expert 2	Expert 3			
Instructions for working with questions	10	9	8	8	8.3	83,3%	Very high
Content	30	26	27	26	26.3	87.7%	Very high
Linguistic	15	13	12	12	12.3	82.2%	Very high

$$\text{*PN (Percentage Number)} = \frac{\text{Actual Score}}{\text{Ideal Score}} \text{ x } 100\%$$

Table 2. Results of reliability statistics for instrument of test

Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.704	.708	3

Based on the results of the expert assessment in Table 1, three indicators of the problem of all with very high categories (PN ≥ 61%), so the problem is valid and usable. The result of a reliability test in Table 2 is the Cronbach Alpha 0.704 value, so the test problem has a reliable category so it can be used.

Qualitative data in the form of creative thinking processes and thinking schemes are collected by the method of Think Out a Loud (Charters, 2003) and Task analysis (Someren, 1994), namely by giving test questions and conducting interviews according to student responses and viewed from the components of a thinking system. This was done on the basis of Mayer's thinking (2007); Maclin & Solso (2008) that thinking is cognitive activity that occurs in a person's mental processes or mind, is not visible, but can be inferred from visible behaviour.

Data Analysis Technique

The analysis in this study consisted of an analysis of quantitative and qualitative research described below.

a) Analysis of Quantitative Research Results

Quantitative research analysis in this study was used to discover the effectiveness of the 3CM learning model towards improving students' creative thinking abilities. Before examining the effectiveness of the model, this study used expert validation and limited trials to examine the validity and practicality of the model. To see a picture of creative thinking ability, a description analysis was performed and the levelling was carried out. Creative Thinking Level is divided into three levels, namely CTL 3 (Creative), CTL 2 (Creative Enough), and CTL 1 (Less Creative).

To see the contribution of 3CM learning in improving the ability to think creatively, a comparison of pre-test and post-test was conducted. Hypothesis testing to see the effectiveness of 3CM learning was adjusted to the conditions of the data collected and assisted with the SPSS 23 program.

b. Qualitative Research Results Analysis

Qualitative data analysis to analyse and map mathematical creative thinking schemes was done through several steps according to Miles & Huberman (1994), Creswell (2012) and Bazeley & Jackson (2013), namely data reduction, data display, and drawing conclusions.

Results

Teaching Quality of 3CM Learning Models

Before having the test, students are faced with the 3CM learning models for 10 weeks. Learning is carried out face-to-face and online. Implementation of 3CM learning is carried out in seven steps of learning (syntax) that is, motivation, contextual problem, critical issue, problem solving, concept implementation in creative product, confirmation, reflection. The model that has been developed is then validated by experts, including learning experts, media experts, teaching materials experts and learning resources, as well as learning evaluation experts.

Table 3: Results of Expert Assessment for 3CM Learning Models

No	Indicator	Ideal score	Actual Score		Average	PN* (%)	Category
			Expert 1	Expert 2			
1	Learning activity plan	60	54	55	54.5	91%	Very high
2	Learning media	30	22	22	22	73%	High
3	Teaching aid and source	35	25	25	25	71%	High
4	Learning evaluation instrument	55	40	41	40.5	74%	High

$$*\text{PN (Percentage Number)} = \frac{\text{Actual Score}}{\text{Ideal Score}} \text{ x } 100\%$$

Based on the feasibility criteria of the developed model, the results obtained were very high and high categories (PN ≥ 61%) so that the model was feasible to use. The next step is the model is implemented on a limited scale to see the practicality of the model. Limited testing is carried out on one lecturer with eight students. The results obtained are shown in Table 4 and Table 5 below.

Table 4: Peer assessment (Model Practicality Test)

No	Indicator	Ideal Score	Actual Score	PN* (%)
1	Lesson plan	60	51	85%
2	Learning media	55	44	80%
3	Teaching aid and resource	30	23	77%
4	Learning evaluation instrument	35	26	74%

Based on the results of the assessment and implementation of the model by peers the value of learning designs (face to face and online), media and teaching materials was developed in the category of very high and high (PN ≥ 61%) so that the practical model is used.

Table 5: Students Test Limited Response (Model Practicality Test)

No	Aspect Responded	Students' responses									
		VD	%	NG	%	GE	%	G	%	VG	%
1	Lesson plan	0	0	0	0	1	12.5	4	50	3	37.5
2	Learning media	0	0	0	0	2	25	4	50	2	25
3	Teaching aid and resource	0	0	0	0	1	12.5	3	37.5	4	50
4	Learning evaluation instrument	0	0	0	0	1	12.5	5	62.5	2	25

*Very Good (VG), Good (B), Good Enough (GE), and Not Good (NG), Very Bad (VD)

Mathematical Creative Thinking Initial Level

Before and after learning in 3CM learning models, students are given a pre-test and post-test initial gain ability and end ability in their creative thinking. The mean of pre-test and post-test results are 60.52 and 75.96 with the standard deviation of 9.60 and post-test 6.36 with the standard of precast error 1.85 and post-test 1.22. These results indicate that the creative thinking ability to post results closer to the mean grade compared with the pre-test results. Thus, the value of the post-test variation is smaller than the pre-test seen from the mean value.

Table 6: The Category Pre-test and Post-test of Students' Creative Thinking Ability

Interval	Pre Test		Post Test		Creative Thinking (CTL)	Category
	Total	%	Total	%		
68 - 100	2	7.41	11	40.74	CTL 3	Creative
34 - 67	19	70.37	16	59.26	CTL 2	Creative Enough
0 - 33	6	22.22	0	0	CTL 1	Less Creative
Average	60.52		75.96			

After following the 3CM learning models, there is an increasing number of students, who were rated creative and creative enough. The creative category improvement progressed from 7.41% (two people) to 40.74% (11 people). The number of students with creative enough and less creative categories decreased from 92.59% (25 people), to 59.26% (16 people). This shows an increase in creative thinking abilities before and after following the learning with 3CM learning.

To see more about the impact of the application of 3CM learning, it is necessary to test the effectiveness of the model by using paired T tests. Here are the results of the normal test data as shown in Table 7 below.

Table 7: The Normality Test of Creative Thinking Skills Pre-test and Post-test

	Shapiro-Wilk		
	Statistic	df	Sig.
Pre-Test	.930	27	.068
Post-Test	.932	27	.077

The number of students was taken as a sample of only 27 people so that the results of normality are taken with the result of normality with Shapiro-Wilk. According to the data in Table 7, we get the Sig value. Pre-test and Post-test of 0.068 and 0.077 are both greater than 0.05 so that both data are normally distributed. This is the requirement for the following steps: Paired Samples T Test. The results obtained can be seen in Table 8 and Table 9 below.

Table 8: Paired Samples T-Test Creative Thinking Ability

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	Pre-Test & Post-Test	27	.777	.000

Table 9: Paired Samples T-test Creative Thinking Ability

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	Pre-Test Post-Test	-15.44	6.14	1.182	-13.06	26	.000

Based on the data of Table 8 and Table 9, it is found that the value of sig. 0.000<0.05 and t arithmetic (13.06) > t table (2.05), it is found that there are significant differences between pre-test and post-test results, where post-test results are better than the pre-test results. Thus, it can be concluded that the application of 3CM learning is effective in improving students' creative thinking skills in solving math problems.

Schemata in Creative Thinking

The schema in creative thinking can be seen from student answers and interviews based on these answers which include formal schemes, content schemes, linguistic schemes. To give a description of creative thinking schemes, researchers then selected three subjects with the ability to think creatively in the creative category, creative enough, and less creative.

a. Subject One

Type of Schemata	Note
Formal Schemata	Subject one had very good initial knowledge as a prerequisite concept. The concepts included angle, side, base, height, parallel, right angle, area, and circumference, even the concept of triangle, square, and rectangle. This was what facilitated subject one to produce several alternative answers in a variety of ways by determining the relationship between the concepts.
Content Schemata	The theme content of subject one was also very good. The subject understood in detail what a parallelogram was as the main problem to solve. The subject was able to explain the definition and characteristics of a parallelogram thus making it easier for the subject to solve the problem. The relationship between concepts as a prerequisite can also be associated with the parallelogram concept well, making it easier to solve problems.
Linguistic Schemata	Subject one linguistic schemes was also very good. Many terms can be conveyed by the subject such as angle, side, base, height, parallel, right angle, width, circumference, perpendicular up to straight, parallel, diagonal side, even the subject had a special term to make it easier to remember the parallelogram concept, namely parallelogram p xl only the width is the parallelogram height. This was done so that there wouldn't be too many things to be stored in the brain.

b. Subject Two

Formal Schemata	Subject two had initial knowledge not yet complete as a prerequisite concept. The concepts possessed included area, base, height, and triangle. This concept helped subject two to produce several alternative answers.
Content Schemata	The theme of subject two content about parallelograms was only limited as a stand-alone rectangular building. Subject two only memorised the wide parallelogram, ie. x height. The relationship between concepts as a prerequisite was only related to the Triangle because Subject two only saw that the parallelogram in the question was composed of two Triangles, without looking at other possibilities.
Linguistic Schemata	Subject two linguistic schema / language was limited to area, base, height, triangle and parallelogram. This also limited Subject two to produce other problem solving alternatives.

c. Subject Three

Formal Schemata	Subject three did not have good initial knowledge as a prerequisite concept. Only rectangular concepts in general, and forgot the concepts that existed in the problem given. The subject also experienced confusion in building a rectangle as per the problem. This happened because the presentation of the parallelogram images was not as usual, so subject three was confused.
Content Schemata	The content schemata of subject three on parallelogram was very weak, even having difficulty identifying that the problems presented were related to a parallelogram. This happened because the parallelogram images were different from the pictures presented earlier.
Linguistic Schemata	The subject's linguistic schemes were only limited to rectangular flat, rectangular, wide, but many forgotten names.

These results indicate that creative thinking skills can be improved by improving student schemes both formal, content and linguistic schemes with the 3CM learning model. This will give the opportunity for students to develop schemata that are well organised in their memories, in a systematic sequence / hierarchy. This will make the adaptation process run well so that knowledge will continue to develop according to the good experience received by each student (Piaget, 1980). This good adaptation process enables the formation of interrelated concept schemes, namely schemata in student memory (Rumelhart & Norman, 1985). This scheme will be the capital of students to complete the questions given to them. This is in line with the opinion of Cook, 1989; Piaget, 1980; Rumelhart & Norman, 1985; Neumann, & Kopcha, 2018; Longo, & Perret, 2018, that a person's scheme will develop in line with his experience.

The stages of learning with 3CM learning provide stages of systematic and multilevel thinking that encourage students to be able to criticise problems with contextual problems that are close to students. This is in accordance with the paradigm of learning mathematics today, where mathematics is close to humans, mathematics is part of human culture (Hersh, 1997; Greer, 1997; Rosa, 2011) and is part of social reality (Hersh, 1997; Zevenbergen, 2004). In addition, students are always faced with real problems that are interesting and challenging, which are the application of the concepts to be studied (cool aspects). This pleasant problem is what gives students the opportunity to criticise problems in different ways and not be a pressure in their hearts (critical aspects) when carried out in groups.

The results of critical thinking of each group will result in diverse and unique problem solving by adding activities that require each group to produce creative products and even new / different ones from the others in the form of problem solving ideas and creative products as a result of the application of the concept (creative aspect). This is in accordance with the thinking concept of Best & Thomas (2007); Torrance (1969) and McGregor (2007) that to produce something creative as a result of creative thinking (in this case mathematics) a process is needed to produce something and new original ideas, to solve problems. If a person is not able to think of a solution and does not even understand the problem given, he will not be able to create a solution to the problem, especially if he has to be guided in many ways . Even to achieve creative thinking, especially in mathematics, high curiosity is needed by the process of exploration and observation, as well as imagination and high originality of thought (Vale & Barbosa, 2015). If someone does not like what is being learned, their thinking process will be hampered, especially if they are required to think creatively. The final step (meaningful aspect) of 3CM learning is taking meaning from the learner. Things done at this stage are confirmation and reflection. The results of the presentation and group discussion were confirmed together to identify how many questions were generated by each group and the quality of the questions and how the solutions were solved from the questions that had been made by each group. Based on the questions made and the results of the discussion, the lecturers and students formulated the relevance of the concepts learned with their lives and the benefits obtained from the concept. With this learning pattern students can learn from the reality of their lives, activities that are close to them and take advantage of their lives. This is in accordance with the Brownell learning concept (1935), which is Meaning Theory (meaningful theory) and David Ausubel that learning will be more meaningful if it is associated with the contextual life problems of students.

Student creativity in solving mathematical problems is also supported by a learning environment that fosters creativity from among students themselves (Soh, 2017; Daher & Anabousy, 2018). There is an opportunity for each group to present the results in a face-to-face class, thus encouraging other groups to produce better works. This very positive learning environment triggered students with their teams to continue to improve their creative work. Positive learning environments are also provided by lecturers in the form of learning simulations by lecturers using animation media, images and even video realities of life that are close to students so that they are easy to understand. This is consistent with the results of research by Tsai & Chung, (2015), that a positive learning environment will motivate students and encourage them to be creative to produce something useful.

Conclusion

This paper has presented (1) that the Cool-Critical-Creative-Meaningful (3CM) learning model is effective in improving the schemata and improving students' creative thinking skills with systematic and fun thinking stages, beginning with criticising interesting contextual problems and ending with meaningful reflections on creative thought works in solving problems, (2) the skill of student teachers’ creative thinking is various according to the schemata structure that they possess, whether it was a formal, content, or linguistic schemata, (3) the schemata structure of the student teachers is various, viewed from the level of creative thinking.

The suggestions of the results of this study are that lecturers are suggested to give their students a great opportunity to develop their creativity in solving mathematical problems. This gives students the opportunity to think systematically by beginning by criticising the interesting contextual problems and ending with meaningful reflection with adequate learning resources.

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REFERENCES

An, S. (2013). Schema Theory in Reading. *Theory and Practice in Language Studies*, *3*(1), 130-134.

Anthony, G. & Walshaw, M. (2009). Characteristics of Effective Teaching of Mathematics: A View from the West. Journal of Mathematics Education. Vol. 2, No. 2, pp.147-164.

Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal material. *Journal of educational psychology*, *51*(5), 267.

Bazeley, P., & Jackson, K. (Eds.). (2013). *Qualitative data analysis with NVivo*. Sage Publications Limited.

Best, B. & Thomas, W. (2007). *The Creative Teaching and Learning Toolkit*. NewYork: Continuum International Publishing Group.

Brownell, P. (1982). A field study examination of budgetary participation and locus of control. *Accounting Review*, 766-777.

Charters, E. (2003). The use of think-aloud methods in qualitative research an introduction to think-aloud methods. Brock Education: A Journal of Educational Research and Practice, 12(2).

Cook & Guy. (1989). *Discourse*. Oxford: Oxford University Press.

Cracolice, M. S., Deming, J. C., & Ehlert, B. (2008). Concept learning versus problem solving: a cognitive difference. Journal of Chemical Education, 85(6), 873.

Creswell, J. W. (2012). Educational research: planning. *Conducting, and Evaluating*.

Daher, W., Anabousy, A. (2018). Creativity of Pre-service Teachers in Problem Posing. Eurasia Journal of Mathematics, Science and Technology Education, 14(7), 2929-2945. https://doi.org/10.29333/ejmste/90994

Dixon, L. Q., Zhao, J., Shin, J.-Y., Wu, S., Su, J.-H., Burgess-Brigham, R., … Snow, C. (2012). What We Know About Second Language Acquisition: A Synthesis From Four Perspectives. Review of Educational Research, 82(1), 5–60. https://doi.org/10.3102/0034654311433587

Fischbein, E. (1999). Intuitions and schemata in mathematical reasoning. *Educational studies in mathematics*, *38*(1-3), 11-50.

Giddings, L. S. (2006). Mixed-methods research: Positivism dressed in drag?. *Journal of research in nursing*, *11*(3), 195-203.

Greer, B. (1997). Modelling reality in mathematics classrooms: The case of word problems. Learning and instruction, 7(4), 293-307.

Hersh, Reuben. (1997). *What is Mathematics, Really?*. London: Jonathan Cape.

Lashley, K. S. (1949). Persistent problems in the evolution of mind. *The Quarterly Review of Biology*, *24*(1), 28-42.

Li, W., Cheng, Y. H. G. (2018). A Study on Engineering Students' Creativity through Art-Infused Curriculum. Eurasia Journal of Mathematics, Science and Technology Education, 14(5), 2009-2024. https://doi.org/10.29333/ejmste/85867

Longo, G., & Perret, N. (2018). Rhythms, Retention and Protention: Philosophical Reflections on Geometrical Schemata for Biological Time. In *Building Theories* (pp. 245-259). Springer, Cham.

MacLin, M. K., & Solso, R. L. (2008). *Experimental psychology: a case approach*. Pearson/Allyn & Bacon.

Mann, E. L. (2006). Mathematical creativity and school mathematics: Indicators of mathematical creativity in middle school students 1956. *Dissertation Abstracts International Section A: Humanities and Social Sciences*, *67*, 461.

Matlin, M. (2009). *Cognition, Seventh Edition*. New York: John Wiley & Sons, Inc.

Mayer, J. D., & Salovery, P. (2007). Mayer-Salovery-Caruso emotional intelligence test. Toronto: Multi-Health Systems Incorporated.

McGregor, D. (2007). Developing Thinking; Developing Learning A Guide to Thinking Skills in education. NewYork: Open University Press McGraw-Hill Education

Miles, M. B., Huberman, A. M.(1994). *Qualitative data analysis: An expanded sourcebook*. sage.

Neumann, K. L., & Kopcha, T. J. (2018). The Use of Schema Theory in Learning, Design, and Technology. *TechTrends*, *62*(5), 429-431.

Orton, Anthony. (2004). Learning Mathematics 3rd Edition Issues, Theory and Classroom Pratice. New York: Continuum.

Piaget, J. (1980). The psychogenesis of knowledge and its epistemological significance.

Rosa, M., & Orey, D. (2011). Ethnomathematics: the cultural aspects of mathematics. Revista Latinoamericana de Etnomatemática: Perspectivas Socioculturales de La Educación Matemática, 4(2), 32-54.

Rumelhart, D. E., Norman, D. A., Aitkenbcad, A. M., & Slack, J. M. (1985). Issues in cognitive modeling. *'Representation of Knowledge'*.

Shen, T., Lai, J. (2018). Instructional Design of Creating Creative and Imaginative Works. Eurasia Journal of Mathematics, Science and Technology Education, 14(4), 1509-1517. https://doi.org/10.29333/ejmste/84836

Soh, K. (2017). Fostering student creativity through teacher behaviors. *Thinking Skills and Creativity, 23, 58-66.*

Stanny, C.J. (2016). Reevaluating Bloom ' s Taxonomy : What Measurable Verbs Can and Cannot Say about Student Learning.

Sternberg. R. J. (2006).The Nature of Creativity. Creativity Research Journal. 2006, Vol. 18, No. 1, 87–98.

Someren, M. W., Barnard, Y. F., & Sandberg, J. A. C. (1994). *The think aloud method: a practical approach to modelling cognitive*. Academic Press, London.

Telegina, N. V., Drovosekov, S. E., Vasbieva, D. G., Zakharova, V. L. (2019). The Use of Project Activity in Teaching Mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 15(8), em1738. https://doi.org/10.29333/ejmste/108439

Tindowen, D. J. C., Bassig, J. M., & Cagurangan, J. A. (2017). Twenty-First-Century Skills of Alternative Learning System Learners. *SAGE Open*, *7*(3), 1–8. https://doi.org/10.1177/2158244017726116

Torrance, E. P. (1995). The beyonders' in why fly? A philosophy of creativity.Norwood, NJ: Ablex.

Torrance, E. P. (2000). Research review for the Torrance Tests of Creative Thinking Figural and Verbal forms A and B. Bensenville, IL: Scholastic Testing Services.

Tsai, C.Y., Horng, JS, Liu, CH, Hu, DC, Chung YC. (2015). Awakening student creativity: Empirical evidence in a learning environment context. *Journal of Hospitality, Leisure, Sport & Tourism Education, 17, 28-38*

Vale, I. & Barbosa, A. (2015). Mathematics Creativity in Elementary Teacher Training. *Journal of the European Teacher Education Network. Vol. 10, 101-109.*

Vyas, D., Ottis, E. J., & Caligiuri, F. J. (2011). Teaching clinical reasoning and problem-solving skills using human patient simulation. American journal of pharmaceutical education, 75(9), 189.

Wahyudi, Waluya, B., & Rochmad. (2018a). Mathematical Creative Thinking Ability And Scaffolding Process According With Learning Styles For Pre-Service Teachers. *Anatolian Journal of Instruction*, 3(1), 39–50.

Wahyudi, Waluya, S. B., Rochmad, & Suyitno, H. (2018b). Assimilation and Accommodation Processes in Improving Mathematical Creative Thinking with Scaffolding According to Learning Style. In *Journal of Physics: Conference Series*(Vol. 1097). Institute of Physics Publishing. https://doi.org/10.1088/1742-6596/1097/1/012156

Wahyudi, Waluya, S. B., Rochmad, & Suyitno, H. (2019). Development of 3CM (cool-critical-creative-meaningful) learning model to increase creative thinking skill. In *Journal of Physics: Conference Series*(Vol. 1098). Institute of Physics Publishing.

Zevenbergen, R., Dole, S., & Wright, R. J. (2004.) Teaching mathematics in primary schools. Crows Nest: Allen & Unwin.