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INVESTIGATING PRE-SERVICE MATHEMATICS TEACHER CRITICAL THINKING ABILITY

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Abstract

This research aims at investigate the critical thinking ability of pre-service mathematics teacher at Madura University. The instrument used in this research was using the Watson-Glaser Test with the mathematics content. There was 48 pre-service teachers who participated as the subjects in this research. This research used statistic descriptive method to identify the profile of critical thinking ability of pre-service mathematics teacher. The scores from each sub-skill and the total score were calculated to identify the profile of critical thinking ability of pre-service mathematics teacher. Based on the data analysis, it was found out that the critical thinking ability of pre-service mathematics teacher was in the intermediate level, yet deduction sub-skill became the best pre-service mathematics teacher's critical thinking ability and recognition of assumption skill became the lowest pre-service mathematics teacher's critical thinking ability.

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Keywords: ability, critical thinking, pre-service mathematics teacher

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There are some researches that have been devoted to critical thinking focus (Akgun & Duruk, 2016; Emir, 2009; Rasiman, 2015). Emir (2009) states that critical thinking does not affect academic achievement. Rasiman (2015) categorized the level of critical thinking ability of pre-service mathematics teacher divided into 4 levels; they are LCTA-0, LCTA-1, LCTA-2, and LCTA-3. Akgun & Duruk (2016) discovered that the critical thinking disposition of Pre-Service of Science teacher is still poor. Some researches indicate the importance of critical thinking, therefore this issue needs to be studied and examined further.

Critical thinking ability is incredibly important for every people. (As'ari, 2016) states that most people always use a part of critical thinking ability in daily life. Emir (2009) points out that if critical thinking is included in education, students will not only be successful in their academic but also be positive in their social interaction. Critical thinking ability in mathematics is also the basic competence of curriculum in Indonesia. Besides, critical thinking is also one of the fundamental thoughts that must be mastered by the students because having critical thinking ability, it will make someone's life less complicated.

Regarding the importance of critical thinking ability that must be possessed by the student, the teachers should guide the students to have the critical thinking ability. In order to be able to guide the students to be a critical thinker, the teachers must have the critical thinking ability first. Pre-service mathematics teacher who will be teachers in the future also ought to have critical thinking ability. The investigation about this critical thinking ability of pre-service teacher must be carried out in order to know their critical thinking ability. The information obtained will absolutely be beneficial in deciding some policies to be applied to enhance the critical thinking ability of pre-service mathematics teacher.

The previous research conducted by (Akgun & Duruk, 2016; Aktaş & Ünlü, 2013; Akyüz & Samsa, 2009; Emir, 2009; Kezer & Turker, 2012) used test outside mathematics content to measure the critical thinking ability. Akgun & Duruk (2016), Emir (2009) and (Kezer & Turker, 2012) used California Critical Thinking Disposition Inventory (CCTDI) to investigate the teacher' disposition, Aktaş & Ünlü (2013) used Cornell Critical Thinking Skills Test-Level X (CCTTLX) to know the teacher candidates' critical thinking skill, Akyüz & Samsa (2009) used Watson-Glaser Critical Thinking Appraisal to identify the effects of blended learning. Tests employed with mathematics content are really appropriate to measure the critical thinking ability in mathematics. It becomes one of the reasons for the researcher to adapt the test of critical thinking ability from Watson-Glaser by changing the content in mathematics.

As'ari (2016) explains that in measuring the critical thinking ability of the individual, it needs to observe these nine sub-skills as follows: Claim/Argument Identification, Premises and Conclusion Identification, Possible Assumption(s) Identification, Inference, Validating, Other points of view identification, Comparing & Contrasting of Claims/Conclusions, Decision Making, and Communicating Ideas. Ennis (2011) identifies six cognitive critical thinking abilities which is commonly abbreviated to FRISCO: focus, reasons, inferences, situation, clarity, and overview. Facione (1990) identifies six cognitive critical thinking abilities; they are Interpretation, Analysis, Explanation, Evaluation, Self-regulation, and Inference, while Watson & Glaser (2002) assess the critical thinking ability in these five sub-skills; those are: Inference, Recognition of assumption, Deduction, Interpretation and Evaluation. The researcher used sub-skill employed by Watson-Glaser since the test item is in multiple choices which simplified the assessment process; moreover, the sub skill proposed by Watson Glaser is lesser hence it is more efficient and uncomplicated.

The purpose of this study is to investigate the critical thinking ability of pre-service mathematics teacher. The questions proposed in this research are as follows:

1. How is the critical thinking ability of pre-service mathematics teachers?
2. How is the critical thinking ability of pre-service mathematics teacher based on critical thinking ability sub-skill?

METHOD

This research employed the descriptive method. There were 48 pre-service mathematics teachers who participated as the subjects in this research. The following is the information of pre-service mathematics teachers participated in this research.

Table 1. The Information of Research Subject

Gender	Numbers	Percentage
Female	32	66, 67%
Male	16	33,33%

The test instrument used in this research was adapted from Watson-Glaser, covering five sub-skills of critical thinking ability; they are an inference, recognition of assumption, deduction, interpretation, and evaluation. This instrument had been validated by two experts in mathematics. The folloiwng Table 2. presents the employed instrument.

Table 2. Test Instrument

Sub Skill	No. of question	Answer Choice	Maximum Score
Inference	1a, 1b, 1c, 1d	T, PT, ID, PF, F	4
Recognition of assumption	2a, 2b, 2c	Yes, No	3
Deduction	3a, 3b, 3c	Yes, No	3
Interpretation	4a, 4b	Yes, No	2
Evaluation	5	Strong, Not Strong	1
The highest score			13

Table description:
T : True
PT : Probably true
ID : Insufficient Data
PF : Probably False
F : False

Each correct answer will obtaine score "1" and the false answer will obtain score "0". This data analysis was finished using Microsoft Excel.

The classification of critical thinking ability of pre-service mathematics teachers are based on criteria suggested by (Badjeber, 2017) as follows.

Table 3. Criteria of critical thinking ability

Low ability	Medium ability	High Ability
Test score < 50	50 ≤ Test Score ≤ 70	Test Score > 70

RESULTS AND DISCUSSION

Analysis Recapitulation of Pre-Service Mathematics Teacher Critical Thinking Ability

The table below explains the data analysis result of pre-service mathematics teacher classified in high, medium and low criteria. The overview result of 48 pre-service mathematics teachers, including 16 male and 32 female, as follows.

Table 4. Classification of Critical Thinking Ability

Category	The numbers of pre-service teacher	Percentage
High	9	18,75%
Medium	22	45,83%
Low	17	35,42%
Total	48	100%

Based on the recapitulation above, it can be seen that the critical thinking ability of pre-service mathematics teachers mostly is in the medium category, which is 22 teachers or 45,83%, meanwhile, in the low category, there are 17 teachers or 35,42%, and there are only 9 teachers or 18,75% in the

high category. In other words, the critical thinking ability of pre-service mathematics teacher test should be improved.

The Analysis of Critical Thinking Ability of Pre-Service Mathematics Teacher in Each Critical Thinking Sub-Skills

These are the analysis result of each critical thinking sub-skills, they are an inference, recognition of assumption, deduction, interpretation, and evaluation based on the category of critical thinking ability.

Table 5. Critical Thinking Ability Sub-Skill of Pre-Service Mathematics Teachers with High Category

Sub-skill	Total (Correct answer)	Percentage
Inference	29 (max score 36)	81%
Recognition of assumption	20 (max score 27)	74%
Deduction	26 (max score 27)	96%
Interpretation	13 (max score 18)	72%
Evaluation	7 (max score 9)	78%

Based on the recapitulation above, it can be seen that the critical thinking ability of a high category pre-service teacher is already good in all critical thinking ability sub-skills. However, the least percentage of the correct answer is interpretation sub-skill, which is 72% and the biggest percentage of the correct answer is deduction sub-skill, which is 96%.

Table 6. Critical Thinking Sub-skill of Pre-Service Mathematics Teacher with Medium Category

Subskill	Total (Correct answer)	Percentage
Inference	53 (max score 88)	60%
Recognition of assumption	33 (max score 66)	50%
Deduction	54 (max score 66)	82%
Interpretation	32 (max score 44)	73%
Evaluation	16 (max score 22)	73%

Based on the above recapitulation, it is obtained that sub-skill with the least percentage of the correct answer is recognition of assumption, which is 50% and sub-skill with the most percentage of the right answer is a deduction, which is 82%.

Table 7. Critical thinking sub-skill of Pre-Service Mathematics Teacher with Low Category

Sub-skill	Total (Correct answer)	Percentage
Inference	25 (max score 68)	37%
Recognition of assumption	19 (max score 51)	37%
Deduction	33 (max score 51)	65%
Interpretation	15 (max score 34)	44%
Evaluation	6 (max score 17)	35%

Based on the above recapitulation, it is gained that overall the ability of pre-service mathematics teachers in every critical thinking ability is poor; the deduction skill, however, is good

enough with the percentage of the right answer 65%. Meanwhile, for the other critical thinking sub-skills are still poor with the percentage of the right answer under 45%.

Analysis of Critical Thinking Sub-Skill

The table below presents the analysis of critical thinking sub-skill, particularly Inference, based on the test result of 48 pre-service mathematics teachers.

Table 8. Inference Sub-skill of Critical Thinking Ability

Inference Ability	Correct	Wrong	Percentage of the right answer
1.a	29	19	60%
1.b	23	25	48%
1.c	19	29	40%
1.d	36	12	75%
Total	107	85	
Percentage	56%	44%	

Based on the above data analysis, it can be seen that most pre-service mathematics teachers made a mistake in answering question number 1c. Overall, the ability of pre-service teacher in inference aspect is in a low category with the percentage of the right answer 56%.

The following is the analysis result of the Recognition of Assumption sub-skill in critical thinking ability, based on the test result of 48 pre-service mathematics teachers.

Table 9. Recognition of Assumption Sub-Skill of Critical Thinking Ability

Recognition of Assumption Ability	Correct	Wrong	Percentage of the right answer
2.a	22	26	46%
2.b	32	16	67%
2.c	18	30	38%
Total	72	72	
Percentage	50%	50%	

Based on the above data analysis, it can be obtained that pre-service mathematics teachers mostly made a mistake in answering question number 2.c. Overall, the ability of pre-service mathematics teacher in recognition of assumption aspect is in a poor category with the percentage of the right answer 50%. Recognition of assumption sub-skill became the lowest critical thinking ability, based on interview obtained information that most subjects cannot answer correctly since they do not understand the problem (Irfan & Nusantara, 2018).

The following is the analysis of Deduction sub-skill in critical thinking ability based on the test result of 48 pre-service mathematics teacher.

Table 10. Deduction Sub-Skill in Critical Thinking Ability

Deduction Ability	Correct	Wrong	Percentage of the right answer
3.a	37	11	77%
3.b	43	5	90%
3.c	33	15	69%
Total	113	31	
Percentage	78%	22%	

From the data analysis above, it can be seen that overall, pre-service mathematics teacher could answer each item in Deduction sub-skill correctly. Overall, the ability of pre-service mathematics teachers in Deduction sub-skill is in a good category, with the percentage of the right answer 78%.

The analysis result of Interpretation sub-skill of critical thinking ability based on the test result of 48 pre-service mathematics teacher is presented as follows.

Table 11. Interpretation Sub-Skill in Critical Thinking Ability

Sub-skill Interpretation	Correct	Wrong	Percentage of the right answer
4.a	17	31	35%
4.b	43	5	90%
Total	60	36	
Percentage	63%	37%	

Based on the above data analysis, most pre-service mathematics teachers answered item 4.a incorrectly. Overall, the interpretation sub-skill ability of pre-service mathematics teacher is good enough with the percentage of the right answer 63%.

The table shown below is the analysis of Evaluation sub-skill of critical thinking ability, based on the test result of 48 pre-service mathematics teacher.

Table 12. Evaluation Sub-Skill of Critical Thinking Ability

Sub-skill Evaluation	Correct	Wrong	Percentage of the right answer
5	29	19	60%
Percentage	60%	40%	

Based on the data analysis above, it can be concluded that the Evaluation sub-skill of pre-service mathematics teacher is in the medium category with the percentage of the right answer 60%.

From the data analysis, the critical thinking ability of pre-service mathematics teacher in the medium category near the low category. This finding is same with the research conducted by Aktaş & Ünlü (2013) who discovered that the critical thinking ability of teacher candidates of elementary mathematics are in medium category and As'ari, Mahmudi, & Nuerlaelah (2017) that critical thinking disposition stage of Indonesian prospective mathematics teachers is mostly at the lowest stage, namely *Non-Critical Thinker* level. However, there is also different finding Aktaş & Ünlü (2013) found that deduction sub-skill is the lowest sub-skill mastered by teacher candidates of elementary

mathematics. This is in contrast with the findings obtained in this research in which deduction sub-skill is the highest sub-skill among the other sub-skills.

CONCLUSION

From the data analysis, overall the pre-service mathematics teacher have critical thinking skills at the medium level and tend to be low since of 48 respondents only 9 (18.75%) have high thinking skills. Based on the analysis of each critical thinking sub-skill, it can be seen that the pre-service mathematics teacher has the highest critical thinking ability in the Deduction sub-skill and low critical thinking ability in the Recognition of Assumption sub-skill.

Pre-service teacher with high, medium and low categories have good ability in deduction sub-skill compared to other sub-skills. The ability to think critically of pre-service teacher in recognition of assumption sub-skill can be categorized as the lowest. This is different from pre-service teacher with high critical thinking skills who have better recognition of assumption sub-skill than interpretational sub-skills.

Last but not least, it is recommended for the future researchers to develop mathematics concept as the instrument of critical thinking ability, since according to the researcher's best knowledge, the instruments used in critical thinking ability do not deal with mathematical concept. Therefore, it is not relevant to measure the critical thinking ability in mathematics. In addition, the critical thinking ability should be improved, for instance, to develop a learning model that can enhance the critical thinking ability.

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