

MATHEMATICAL CRITICAL THINKING ABILITY OF MATHEMATICS EDUCATION STUDENTS

By
R Maya*, E Farlina, E S Cipta

Presented at ISAMME 2019
IKIP SILIWANGI
July 31, 2019



Introduction

- Based on the curriculum and learning objectives in high school, critical thinking skills are one of the mathematical thinking skills that need to be possessed by a student who studies mathematics.
- Most of the students are rarely given the opportunity to exercise their critical thinking skills in learning (Noer, 2018)
- Critical thinking is based on individual questions about the thinking process itself and others (Kilick and Sen in Noer, 2018)
- Learning with a direct approach (hereinafter referred to as direct learning) is a learning approach, where the teacher provides information to students directly (teacher centered).
- Direct learning is an effective strategy to gradually provide information from subtopics to subtopics (Huitt in Maya, 2006)
- The indirect approach in this study is a learning approach where learning material is not given directly (explained) by the instructor
- Indirect learning will encourage students to be more involved in the learning process, especially in terms of observing, investigating, drawing conclusions from the data provided or making hypotheses (Maya, 2006)



Mathematical Critical Thinking Ability

- Identify the concepts underlying the problem solving
 - Check the truth of statements and explain it
 - Answer questions with relevant reasons
- 



Direct Instruction (ordinary approach) vs Indirect Instruction

➤ Direct Instruction:

Students read, listen, record the material given by the instructor and do exercises

➤ Indirect instructions:

Learning with this instruction required:

- Learning in a group of 5-6 students
- Students are given the task to study course material by themselves, based on the material prepared by the instructor, other sources such as library books and material from the internet
- Students discuss the material in groups, arrange it in writing, and then presented to the classmates
- The teacher/Instructor role as a guide, a motivator, a fasilitator, or a cheerleader.



Research Method

- ▶ In this study, the method used is descriptive qualitative.
- ▶ The subjects of the study were 86 sixth semester students (two classes) from one state university in Bandung, who were taking a semester of Differential Equation course.
- ▶ In the first half semester, students get learning with a direct approach (ordinary learning), and in the next half semester students get learning with an indirect approach.
- ▶ The instrument used in measuring mathematical critical thinking skills is in the form of two sets questions, each of which consists of three description questions.
- ▶ A description of the package (TEST I) is given after students get learning with a direct approach, and one more question package (TEST II) is given after students get learning with an indirect approach.

Examples of Material Course

Here is one example of a test of critical thinking skills with indicators identifying the concepts underlying problem solving:

Diketahui $v = v(r)$ adalah solusi dari persamaan diferensial $r^2v'' + rv' - v = 0$, dengan $v' = dv/dr$. Tentukan potensial elektrostatik v di antara dua bola konsentrik dengan jari-jari $r_1 = 6$ cm dan $r_2 = 12$ cm, yang masing-masing terjaga pada potensial $v_1 = 110$ volt dan $v_2 = 0$.

An example of a test question with the indicator: "checking the truth of the statement and explaining it":

Periksa apakah fungsi-fungsi e^x dan xe^x membentuk basis solusi homogen dari persamaan diferensial nonhomogen: $y'' - 2y' + y = 2e^x$.

- Apakah kombinasi linier dari fungsi-fungsi tersebut juga merupakan solusi dari persamaan diferensial homogennya? Jelaskan pendapatmu.
- Carilah solusi khususnya.

Result and Discussion

Table 1. Results of tests of critical thinking ability

NO	Critical Thinking Ability Indicators	Mean		
		Test I	Test II	Test I + II
1	Identify the concepts underlying the problem solving	32.14	29.55	30.85
2	Check the thruth of statements and explain it	52.06	47.56	49.81
3	Answer questions with relevant reasons	16.88	29.87	23.38
	Mean	34.68	35.71	35.20

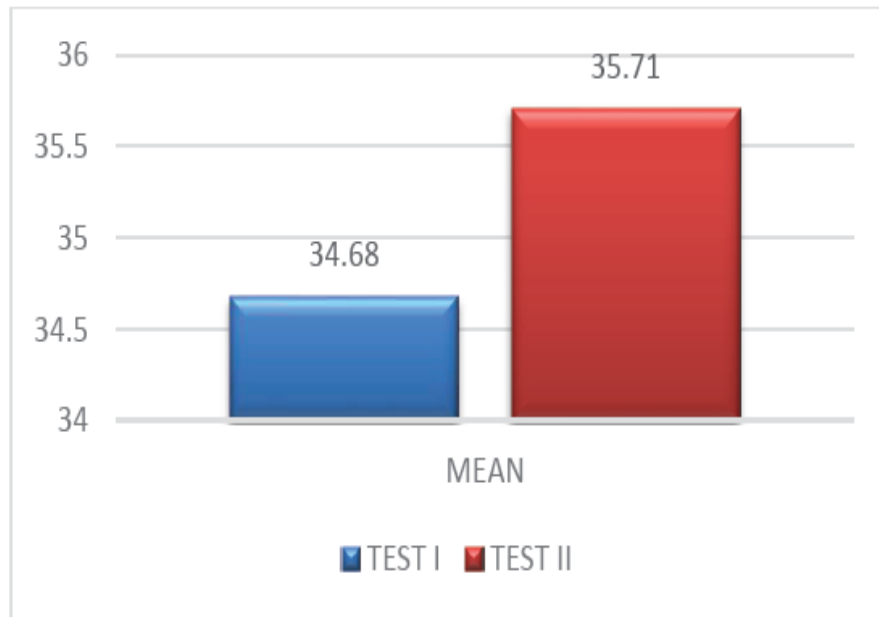


Figure 1. Mathematical critical thinking ability

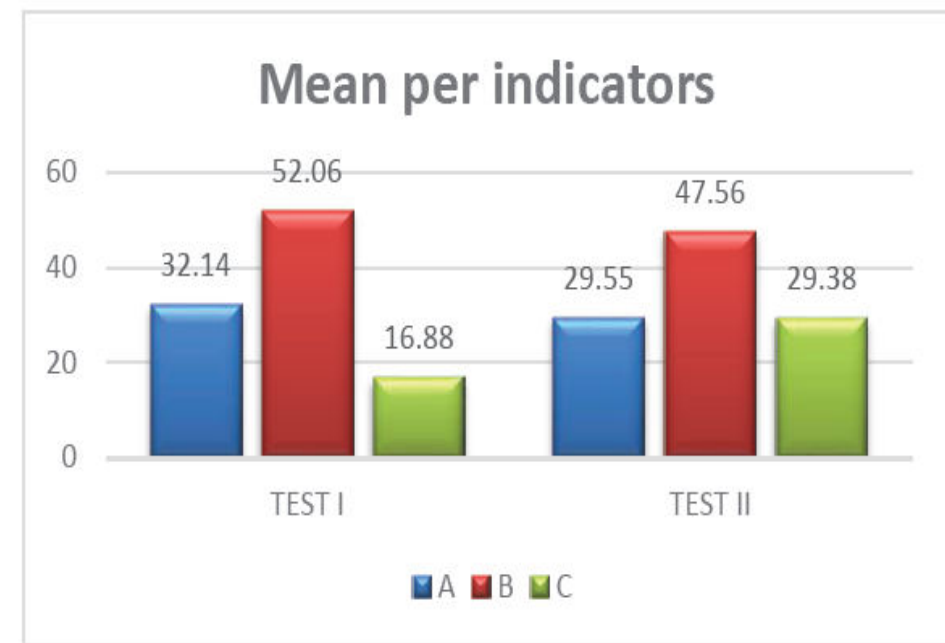


Figure 2. Mathematical critical thinking ability per indicators

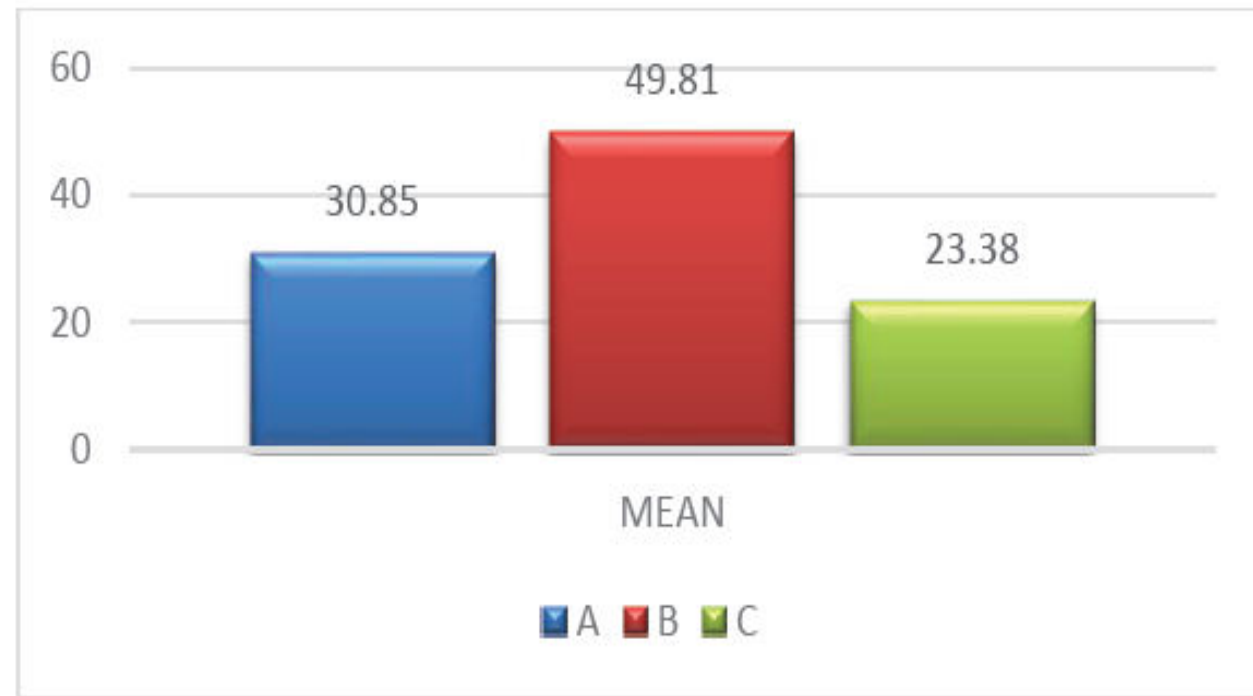


Figure 3. Mathematical critical thinking ability per indicators from Test I and II



Conclusion

- The results showed that mathematical critical thinking skills of mathematics education students whose learning using direct and indirect approaches were still low. Of the three indicators studied, the ability to think critically increased on indicators answering questions along with relevant reasons.
- 