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Perceptions Towards Lecturers' Leadership Skills And Determinant Factors Of Creative Thinking Skills On Prospective Mathematics Lecturers

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Abstract

The study aims to: (1) determine the factors that significantly influence one's ability on creative mathematical thinking and (2) determine the magnitude of the direct or indirect influence of prospective lecturers' perceptions on lecturers' leadership skills and the three other variables examined (namely, motivation to learn mathematics, mathematical connections skills, and critical thinking skills). The population was prospective mathematics lecturers who are currently students at the Institut Agama Islam Ma'arif NU (IAIMNU) Metro Lampung. Cluster random sampling was the sampling technique used. The sample size for this study was 110 students. A test and a questionnaire in the form of a Likert scale were used as research instruments. The test assessed students' ability to make mathematical connections and engage in critical thinking and mathematical creativity. Meanwhile, the questionnaire was used to determine the motivation to learn mathematics and the lecturer's perceived leadership abilities. Additionally, parametric statistics with Structural Equation Modeling (SEM) test. The findings of this study indicate that: 1) there is a positive but not statistically significant relationship between motivation to learn mathematics and critical thinking skills; 2) there is a positive and statistically significant relationship between motivation to learn mathematics and creative thinking skills, and 3) there is a positive and statistically significant relationship between the ability of mathematical connections and creative thinking skills. Critical thinking skills have the most significant direct influence on creative thinking skills. Additionally, this study's findings indicate that making mathematical connections has a more significant indirect influence than motivation to learn mathematics.

Keywords: Creative Thinking, Critical Thinking, Lecturer Leadership, Mathematical Connections, Motivation.

A. Introduction

The changes and developments occurring in various spheres of life in the contemporary era necessitate the ability of someone to think and act flexibly, critically, innovatively, and creatively. Due to the rapid advancement of information technology, an individual must also possess various media literacy, information, and technology skills. (P21, 2015). Possessing these diverse competencies enables one to solve a variety of complex problems in the twenty-first century. Mosley & Friedman (2006) and Wagner (2008) explain that Numerous organizations, including companies and industries, will require

employees with qualified competencies such as critical thinking, creativity, and effective communication and collaboration in a team-based performance system. Individuals who meet these various criteria will be more frequently employed by various companies and organizations (Bellanca & Brandt, 2015).

Students in Indonesia should be equipped with these diverse competencies to compete in today's information and technology-driven world. Referring to P21 (2015), students should possess various competencies: problem-solving skills, critical thinking, innovation, creativity, communication, and collaboration skills. It is hoped that by developing these diverse competencies, students will be able to solve various life problems that arise in the twenty-first century.

Among the numerous competencies required in the twenty-first century, creative thinking skills are critical abilities that students in Indonesia should possess, including mathematics education. Students' ability to solve problems using various mathematical perspectives will improve (NCTM, 2000). This statement implies that the problem-solving process is invariably characterized by creative thinking. Whitcombe (2014) describes that one facet of mathematics is creativity, which encompasses problem solving, investigation, pattern formation, reasoning, and strategy development. Additionally, one can deduce that learning mathematics cannot be divorced from the creative thinking process. Numerous relevant studies have also demonstrated a genuine correlation between students' ability to think creatively and their achievement in mathematics. (Sak & Maker, 2006; Brunkalla, 2009; Bahar & Maker, 2011; Walia, 2012; danTabach & Friedlander, 2013).

According to the findings of the preceding studies, it can be concluded that creative thinking skills in mathematics are one of the critical and necessary competencies that students must possess during the mathematics learning process. Additionally, it has been stated in the Indonesian educational system that one of the goals of education in schools is to develop students' creativity (Minister of National Education Regulation No. 41 of 2007).

While creative thinking skills are critical, students in Indonesia may lack this ability. From the Trends in International Mathematics and Science Study (TIMSS) Report in 2011 (Ina V.S. Mullis, Michael O. Martin, Pierre Foy, 2012) and in 2015 (Mullis et al., 2016), it can be seen that only about 5% of students in Indonesia are capable of solving high and advanced level questions, which both require students' mathematical Creative Thinking Skills. The results of PISA in 2015 (OECD, 2016) and 2018 (OECD, 2018) also show that the mathematical Creative Thinking Skills of students in Indonesia are still meager, even below the standard.

Considering these facts, it is exciting and necessary to dig deeper into the factors contributing to students' thinking ability in Indonesia. The study's primary objective is to provide educators with a more comprehensive reference for designing mathematics lessons to improve the quality of learning.

Various factors can affect the Creative Thinking Skills of students in Indonesia. Factors that may affect creative thinking skills are Mathematical Connections abilities, critical thinking abilities, and learning motivation as part of learning achievement attitudes. From the research results of Karakoç & Alacacı (2015), most students agree that making real-world connections with mathematics helps them develop mathematical process skills such as problem-solving and analytical thinking, including critical and creative thinking skills. Other studies also show a significant relationship between Mathematical Connections skills and logical thinking abilities (Hanifah & Karyati, 2019). This argument is supported by the opinion of NCTM (2000), which states that the power of students to connect mathematical ideas will

increase their understanding of mathematics. A good performance is very likely to help students in solving math problems that require creative thinking skills.

Learning motivation is the next factor that is possible to contribute to the highs and lows of mathematical creative thinking skills. Several studies have shown a significant relationship between learning motivation and Creative Thinking Skills (Grant & Berry, 2011; Auger & Woodman, 2016; Al-Zu'bii et al., 2017; and Steele et al., 2017). It shows that learning motivation is one of the essential variables related to developing creative mathematical thinking.

Critical thinking skills are also possible to be a factor that contributes significantly to students' achievement in terms of creative mathematical thinking. Empirically, it has been shown that critical thinking skills are linearly related to thinking creatively (Baker et al., 2001; Fatmawati et al., 2019; Ulger, 2016; and Mayarni & Yulianti, 2020). These various studies indicate that critical thinking skills are one aspect that can affect students' Creative Thinking Skills.

Another factor that can influence is the students' perception of the lecturer's leadership skills that affect the students' creative thinking skills. Lecturers are an essential aspect in developing the potential of students. Everything that Lecturers do will always be remembered by students (Kagan, 1992). Student assessment is also one of the essential measuring tools to see the effectiveness of lecturers' performance (Ferguson, 2012). Leadership skills themselves are an essential component in growing creativity and creating new shared values in the scope of learning. (Humala, 2015). Several studies have also shown that a lecturer's leadership skills in learning can significantly contribute to creative thinking skills (Nurdianti & Nurdin, 2020) and (Usman & Eko Raharjo, 2013).

By examining several of these studies, this study discusses the effects of these three factors and their contribution to students' level of Creative Thinking Skills in greater detail. The three variables were analyzed to understand the ability to develop creative mathematical thinking, either directly or indirectly. They provide a broader picture of how the variables in this study correlate with each other, either directly or indirectly.

The purpose of this study is to determine (1) whether there is a positive and significant relationship between mathematical learning motivation, Mathematical Connections Skills, prospective lecturers' perceptions of lecturer leadership abilities, and critical thinking abilities, and mathematical Creative Thinking Skills. (2) How much influence does motivation to learn mathematics, Mathematical Connections Skills, and the candidate's perception of lecturer leadership skills and critical thinking skills have on creative thinking skills mathematically.

B. Research Methodology

This was a quantitative study using a correlational methodology. The population for this study was all Mathematics Education students at IAIMNU Metro. A proportional sample was calculated based on the number of students in each batch. Proportional random sampling was the sampling technique used. The study enrolled 110 students, 65 of whom were male and 45 of whom were female.

The method of data collection for this research is through tests and questionnaires. The questionnaire method was used to assess learners' motivation to acquire critical thinking skills, learners' motivation to develop creative thinking skills, and learners' perceptions of lecturers' leadership abilities to acquire creative thinking skills. The test method is used to assess mathematical ability concerning Critical Thinking Skills, cognitive thinking skills, and Critical Thinking Skills concerning Creative Thinking Skills.

The research instrument used was an essay-based test to assess Mathematical

Connections skills, critical thinking abilities, and Creative Thinking Skills, and a Likert scale questionnaire to assess learning motivation and prospective lecturers' perceptions of lecturers' leadership abilities. The five instruments were proven valid and reliable using Confirmatory Factor Analysis (CFA).

The data analysis technique used was the statistical test of Structural Equation Modeling (SEM) (Pedhazur, 1997). As for helping analyze the data, LISREL software was used.

C. Findings and Discussion

1. Theoretical Framework

a. Creative Thinking Skills

According to Semiawan (2009), creativity can transform an existing concept into a new one. Santrock (2007) also states that creativity shows a person's ability to think about something new and unusual and get unique solutions. Vale and Barbosa (2015) argue that creativity is an activity that starts from curiosity and involves students in exploration and experimentation, which also involves imagination and originality.

From these disparate viewpoints, it can be concluded that creativity, in general, refers to a person's capacity to create something novel, both in the form of thoughts and actual works, that is significantly different from what has existed previously. Because this research is examining creativity in mathematics, it is defined further in this study as the ability of students to generate a variety of ideas and solutions for resolving various problems in the domain of mathematics learning.

As informed by Silver (1997), in 1966 and 1974, Torrance has developed an instrument to measure creative thinking skills for children and adults, which is then known as The Torrance Tests of Creative Thinking (TTCT) (Silver, 1997). There are three main components in the instrument, namely fluency, flexibility, and novelty.

In line with Silver (1997) to be applied in mathematics (Balka, 1974) in developing its instrument, it asks subjects to pose mathematical problems that can be answered based on the information provided in a series of stories in real-world situations. In the analysis of student answers, fluency refers to the number of problems posed or questions generated, flexibility refers to several different categories of problems, and originality refers to the infrequency of students' answers to all available answers.

b. Mathematical Connections Skills

NCTM (2000) explains that mathematical connections are the interactions between mathematics topics or between mathematics topics and non-mathematical topics. Connections between topics outside of mathematics can occur with other subjects and students' actual conditions (NCTM, 2000). Hiebert & Carpenter (1992) defines Mathematical Connections as relationships between mathematical ideas. Furthermore, Marshall (1995) defines mathematical connections as schema components interconnected in a mental network.

Considering these divergent viewpoints, mathematical connections can be defined operationally in this study as students' ability to connect mathematical concepts and principles both within and outside the realm of mathematics. Furthermore, referring to NCTM's (2000) opinion, the indicators of Mathematical Connections Skills are as follows. 1) Recognizing and using connections between mathematical ideas. 2). Understand how mathematical ideas relate to each other and build on each other to produce a coherent whole. 3). Recognize and apply mathematics in contexts outside of mathematics. These indicators are in this research. There are three aspects: inter-topic connections in mathematics, between-topic

connections in mathematics, and inter-topic connections with other fields outside of mathematics.

c. Critical Thinking Skills

Santrock (2007) states that critical thinking skills are a person's ability to think reflectively and productively while evaluating evidence. Critical thinking in the 21st century is described as the ability to design and manage projects, solve problems, and make effective decisions using various tools and resources (Fullan, 2005). Critical thinking skills are the ability to critically evaluate information and arguments, see patterns and connections, build meaningful knowledge, and apply it in the real world (Fullan & Scott, 2014). Critical thinking requires students to acquire, process, interpret, rationalize, and critically analyze often conflicting information in large volumes to make the right decisions and take timely action (C-21 Canada, 2012).

Based on these various opinions, it can be concluded that critical thinking skills are the ability of students to design and manage projects, analyze and solve problems, and evaluate to the stage of making appropriate and effective decisions in the domain of mathematics.

d. Motivation to Learn

In educational psychology, motivation theory investigates what makes individuals move towards what activities and describes the characteristics (Pintrich & De Groot, 2003). Motivation is a theoretical construction that implies the direction, intensity, persistence, and quality of behavior, especially behavior that focuses on achieving a goal (Brophy, 2004). Meanwhile, according to Santrock (2007), motivation is a process that gives enthusiasm, direction, and persistence in behaving. In this concept, a behavior is said to have motivation if the behavior is full of energy, has a clear direction, and is sustainable.

A more comprehensive definition related to motivation is given by Ames (1992), which states that motivation exists as part of one's goal structure, one's beliefs about what is important, and determines whether one will engage in a particular pursuit or not.

The motivation for learning mathematics in this study is the desire of students to behave in a directed, high-intensity, and sustainable manner in learning mathematics. Students will be said to have motivation if they have the awareness to participate in mathematics learning actively.

Motivation is often divided into two aspects: 1) internal motivation and 2) external motivation (Santrock, 2007). Internal motivation refers to motivation from within a person, such as interest or pleasure in a task. The external motivation comes from outside the individual. Common external motivations are rewards such as money and value, coercion, threats, punishment, and competition (Tohidi & Jabbari, 2012). These two aspects will later become indicators of learning motivation in this study.

e. Leadership Skills

Leadership skills involve two essential aspects, namely conceptual skills, and technical skills. Leadership skills are related to the ability to analyze a problem. Riso et al. (2019) stated that conceptual skills are general analytical skills, the power of opinion, and the process of logical thinking. It was further explained that in conceptual skills, there are two components, namely: judgment and creativity. Fajrina et al. (2018) state that conceptual skills are the ability to coordinate and integrate all organizational interests and activities. Dessler et al. (2015) state that conceptual skills are mental abilities to analyze and diagnose complex situations and cognitive skills, including analyzing, thinking logically, formulating concepts, and giving inductive considerations. Based on the description above, conceptual skills are the ability

to design and coordinate students learning activities based on organizational needs.

Furthermore, Hendarman & Cantner (2018) state that Technical skills are the knowledge of methods, processes, procedures, and techniques for performing a specific task and using the tools necessary to perform these tasks. Technical skills include knowledge of methods, processes, procedures, and techniques for carrying out specific activities of organizational units (McLaughlin, 2018) and (Sandifer, 2018). A similar opinion is also shared by Sawyer et al. (2014) that technical skills are human abilities to use procedures, techniques, and knowledge about a particular field. According to the description above, the technical skills in question are the abilities possessed by the leader or principal to determine the policy direction taken to deal with problems of the effectiveness of the learning implementation process.

Referring to the explanation above, two main components were used as indicators of leadership skills in this study, namely conceptual skills and technical skills.

2. Conceptual Framework of the Model

a. The Relationship between Learning Motivation and Critical Thinking Skills

Research has shown that, both qualitatively and quantitatively, motivation makes a positive and significant contribution to critical thinking skills (Miele & Wigfield, 2014; Friedman & Förster, 2005; Fraser et al., 1992; danFahim, 2014). These results provide an initial assumption that motivation will affect critical thinking skills.

b. Relationship between Motivation and Creative Thinking

Several correlational studies have provided significant results regarding the relationship between learning motivation and Creative Thinking Skills (Grant & Berry, 2011; Auger & Woodman, 2016; Al-Zu'bii et al., 2017; and Steele et al., 2017). This empirical study provides an initial hypothesis that learning motivation will contribute positively and significantly to critical thinking skills.

c. The Relationship between Mathematical Connections and Critical Thinking Skills

In the results of the quantitative descriptive research of Karakoç & Alacacı (2015), information was obtained that the majority of students agreed that making real-world connections with mathematics helped them in mathematical process skills such as problem-solving and reasoning and analytical thinking. Other studies revealed a linear relationship between Mathematical Connections and mathematical knowledge (Eli et al., 2013). This empirical study leads to an initial assumption that Mathematical Connections skills will have a positive and significant influence on creative thinking skills. This hypothesis is supported by the opinion of NCTM (2000), which states that the ability of students to connect mathematical ideas will increase their understanding of mathematics. Other studies have also shown a significant relationship between Mathematical Connections abilities and problem-solving abilities (Widada, 2019).

d. Mathematical Connections Relationship with Creative Thinking Skills

In the research results by Karakoç & Alacacı (2015), most students agreed that making real-world connections with mathematics helped them in mathematical process skills such as problem-solving and analytical thinking, including mathematical creative thinking skills. This is supported by the opinion of NCTM (2000), which states that the ability of students to connect mathematical ideas will increase their understanding of mathematics.

e. The relationship between critical thinking skills and creative thinking skills

Empirically it has been shown that critical thinking skills are positively correlated with Creative Thinking Skills (Baker et al., 2001; Fatmawati et al., 2019; Ulger, 2016; and Mayarni & Yulianti, 2020). These studies provide an initial assumption that critical thinking skills will significantly influence creative thinking skills.

Empirically, it has been shown that critical thinking skills are positively correlated with thinking creatively. These studies provide an initial assumption that critical thinking skills will significantly influence creative thinking skills.

f. The relationship between teacher candidates' perceptions towards lecturers' leadership skills and Creative Thinking Skills.

Student assessment is one of the essential measuring tools to see the effectiveness of lecturer performance (Ferguson, 2012). On the other hand, leadership skills play an essential role in growing creativity and creating new shared values in the scope of learning (Humala, 2015). Several studies have also shown that the leadership skills of an educator in learning can make a real contribution to creative thinking skills (Nurdianti & Nurdin, 2020) and (Usman & Eko Raharjo, 2013). These studies support a hypothesis that the teacher candidate's perception of lecturers' leadership skills will positively influence creative thinking skills.

Model Conceptual Framework

The relationship between these variables can be conceptually modeled as follows.

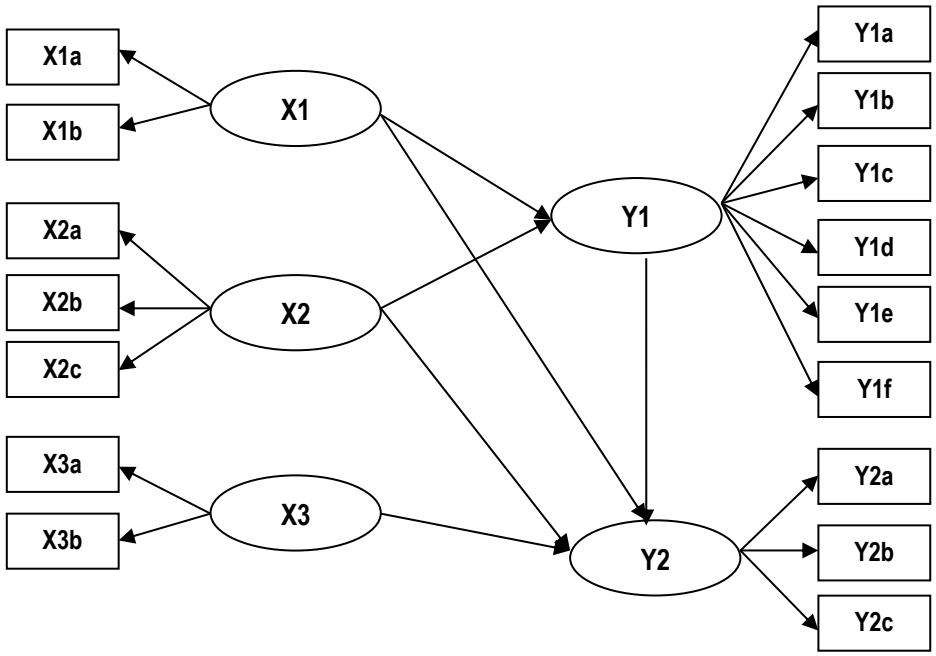

Figure 1. Model Conceptual Framework

Information:

X1 : Motivation to learn
X2 : Mathematical connections skills
X3 : Lecturer's perception of leadership skills
Y1 : Critical thinking skills
Y2 : Creative thinking skills

RESEARCH RESULTS

The initial stage of data analysis is the model fit test. The results of the model fit test in this study are presented in the following table.

Table 1. Model Fit Test

FIT INDEX	CUT OFF CRITERIA	ESTIMATION RESULTS	FIT LEVEL
ABSOLUTE FITNESS INDEX			
χ^2	P-Value> 0,05	P-Value = 0,184	Good
Relative χ^2	$\chi^2 < 2df$	$83,72 < 2\ (73)$	Good
RMSEA	$\leq 0,07$	0,050	Good
GFI	$> 0,95$	0,90	Not Good
AGFI	$> 0,95$	0,85	Not Good
SRMR	$\leq 0,08$	0,08	Good
INCREMENTAL FITNESS INDEKS			
NFI	$> 0,95$	0,94	Pretty Good
NNFI	$> 0,95$	0,96	Good
CFI	$> 0,95$	0,99	Good
PARSIMONY FITNESS INDEX			
AIC	Lebih kecil atau dekat dengan Saturated AIC	Model AIC = 159.47 Saturated AIC = 210.00	Good
CAIC	Lebih kecil atau dekat dengan Saturated CAIC	Model CAIC = 283.90 Saturated CAIC = 605.92	Good

Based on these findings, it is clear that the various measures of fit for the model used in this study indicate that the index indicating fit is greater than the index indicating non-fit, implying that the model in this study is in the fit category.

Additionally, the following table illustrates the results of the construct validity proof. The following table summarizes the validation results for the constructs.

Table 2. Summary of Item Validity

Latent Variable	Indikator	Standardized Loading Factor	T-value	Conclusion
Motivation to Learn	X1a	0,53	3,67	Valid
	X1b	0,55	4,56	Valid
Mathematical Connections Skills (X1)	X1a	0,80	4,40	Valid
	X2b	0,42	6,67	Valid
	X2c	0,55	7,45	Valid
Critical Thinking Skills (Y1)	Y2a	0,53	***	Valid
	Y1b	0,72	11,44	Valid
	Y1c	0,63	10,66	Valid

Latent Variable	Indikator	Standardized Loading Factor	T-value	Conclusion
Motivation to Learn	X1a	0,53	3,67	Valid
	X1b	0,55	4,56	Valid
	Y1d	0,52	9,34	Valid
	Y1e	0,44	8,65	Valid
	Y1f	0,51	8,02	Valid
Creative Thinking Skills (Y2)	Y2a	0,64	***	Valid
	Y2b	0,62	11,41	Valid
	Y2c	0,55	11,26	Valid
Students' Perception of Leadership Skills	X3a	0,56	3,62	Valid
	X3b	0,55	4,55	Valid

Based on the table, it is known that from 2 indicators for learning motivation, three indicators for mathematical connections skills, six indicators for critical thinking skills and three indicators for mathematical creative thinking skills, and two indicators for the perception variable of prospective lecturers on lecturer leadership skills have a standard Loading Factor value of more than 0.40 and a t-value of more than 1.96. Referring to these results, it can be concluded that all indicators for each latent variable are valid indicators.

Furthermore, a summary of the results of construct reliability estimates can be seen in the following table.

Table 2. Recapitulation of Reliability Measurement Results

Latent Variables	CR Value	Conclusion
Mathematical connections skills	0,84	Reliable
Critical thinking skills	0,89	Reliable
Motivation to learn	0,78	Reliable
Creative thinking skills	0,91	Reliable
Prospective lecturer's perception towards lecturer's leadership skills	0,74	Reliable

These results show that the instrument developed for the five latent variables in this study is reliable because it has a reliability coefficient of more than 0.70.

Additionally, the table below summarizes the evaluation results for structural relationships in this study.

Tabel 2. Evaluation of structural model

c	SLF	T-Value	Conclusion
X1 → Y1	0,29	0,25	Positive and insignificant influence
X1 → Y2	0,62	5,43	Positive and significant influence

X2→ Y1	0,56	2,74	Positive and significant influence
X2→ Y2	0,46	2,24	Positive and significant influence
Y1→ Y2	0,67	2,32	Positive and significant influence
X3 → Y2	0,41	2,02	Positive and significant influence

Based on the table, it can be concluded that: 1) There is a positive but insignificant influence of motivation to learn mathematics on critical thinking skills, 2) there is a positive and significant influence of motivation to learn mathematics on creative thinking skills, 3) there is a positive and significant influence of mathematical connections skills on critical thinking skills, 4) there is a positive and significant influence of mathematical connections skills on creative thinking skills and 5) there is a positive and significant influence of critical thinking skills on creative thinking skills and 6) there is a positive and significant influence of prospective lecturers' perceptions about the lecturers' leadership skills on creative thinking skills. The following table illustrates the indirect influence on the structural model's construction.

Table 4. Indirect Influence

Causal Relationship	Indirect Influence
$X_1 \rightarrow Y_1 \rightarrow Y_2$	0.18
$X_2 \rightarrow Y_1 \rightarrow Y_2$	0.26

The table shows that the indirect relationship between motivation to learn mathematics and creative thinking skills through critical thinking skills is 0.18. Meanwhile, the indirect influence between mathematical connections skills on creative thinking skills with moderated critical thinking skills is 0.26.

DISCUSSION

Based on the results of data analysis, it was found that the motivation to learn mathematics has a positive but not significant influence on critical thinking skills. The direct influence of this variable on critical thinking skills is known to be 0.29. This result is inconsistent with several previous studies, such as research conducted by Miele & Wigfield (2014), Friedman & Förster (2005), Fraser et al. (1992), and Fahim (2014). However, from the test results, it is known that learning motivation has a positive influence. It means that the higher the motivation of students, the higher their critical thinking skills. These results need to be a record of mathematics educators paying attention to this aspect in learning mathematics.

Furthermore, motivation to learn mathematics is a positive and significant influence on creative thinking skills. The more motivated the students are to learn mathematics, the higher their Creative Thinking Skills will be. Several correlational studies conducted by other studies have shown significant results regarding the relationship between learning motivation and Creative Thinking Skills (Grant & Berry, 2011; Auger & Woodman, 2016; Al-Zu'bii et al., 2017; and Steele et al., 2017). This empirical study has provided support for other relevant studies. The direct influence between motivation to learn mathematics on Creative Thinking Skills are 0.62.

Empirical studies also show that mathematical connections skills contribute

positively and significantly to creative thinking skills. The results on this path have strengthened other studies used as references in this study, namely the research of Karakoç & Alacacı (2015) and Eli et al. (2013). The results of this study also support the opinion of NCTM (2000), which states that the ability of students to connect mathematical ideas will increase their understanding of mathematics.

In other structural relationships, Mathematical Connections skills are known to have a positive and significant influence on creative thinking skills. These results also support the research of Karakoç & Alacacı (2015). In the research results by Karakoç & Alacacı (2015), most students agreed that making real-world connections with mathematics helped them in terms of mathematical process skills. The results of this study also support the opinion of NCTM (2000), which states that the ability of students to connect mathematical ideas will increase their understanding of mathematics. Students who have a good understanding of mathematics will help them solve mathematical problems that require creative thinking skills.

Furthermore, the fifth hypothesis test in this study shows that critical thinking skills positively influence critical thinking skills as expected. Several studies also show that these two variables are positively and significantly correlated (Baker et al., 2001; Fatmawati et al., 2019; Ulger, 2016; and Mayarni & Yulianti, 2020). The direct influence of this variable on creative thinking skills is 0.67.

The results of the last hypothesis test in this study indicate that prospective lecturers' perception towards lecturer leadership skills has a positive and significant influence on creative thinking skills. Several previous studies have also shown that lecturer leadership skills in learning can contribute to creative thinking skills (Nurdianti & Nurdin, 2020) and (Usman & Eko Raharjo, 2013). It is by the hypothesis proposed previously. Lecturer performance will significantly contribute to the ability of prospective lecturers to think creatively.

According to the results of this study, critical thinking skills have a more significant influence on creative thinking skills than the other two variables. This variable contributes 0.67 directly while learning motivation contributes 0.62, and mathematical connections skills contribute 0.46. Students' ability to think critically will aid them in resolving mathematical problems that require creative thinking. Additionally, these findings indicate that students' cognitive ability contributes more to solving mathematical problems that require creative thinking skills.

Furthermore, it can be seen that the indirect relationship between learning motivation and creative thinking skills through critical thinking skills is 0.18. Meanwhile, the indirect influence between mathematical connections skills on creative thinking skills through the moderator variable of critical thinking skills is 0.26. These results indicate that mathematical connections skills have a more significant indirect influence than learning motivation. In general, it can also be seen that the cognitive domain influences students' creative thinking skills more than affective factors, either directly or indirectly.

CONCLUSION

Empirical tests in this study using SEM have given results that the four variables studied are: 1) motivation to learn mathematics, 2) Mathematical Connections skills, 3) critical thinking skills, and 4) the prospective lecturers' perceptions towards the leadership skills of lecturers contribute positively and significantly to creative thinking skills. It is well established that critical thinking skills have the most significant direct influence among the four variables. In comparison to motivation to learn mathematics, mathematical connections skills have the most significant indirect influence. It becomes a

valuable resource for mathematics educators when developing programs to enhance the learning process. Educators must manage learning by addressing these influential factors. As demonstrated in this study, developing students' potential through various learning models also requires considering factors that affect student achievement in learning. Critical thinking abilities and creative thinking skills are critical competencies that students must possess in the twenty-first century.

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