EFFECT OF LEARNING CLIMATE, THINKING PATTERN, AND CURIOSITY ON ACADEMIC PERFORMANCE IN HIGHER EDUCATION

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Abstract

This research aimed to examine the theoretical model that explains the relations among learning climate, thinking patterns, and curiosity on academic performance. This research was a non-experimental research with 1,000 respondents from State University of Surabaya, Indonesia. They came from 20 departments, consisting of 324 men and 676 women with a mean age of 19.81 years. Data were collected using a questionnaire, including inventory of learning climate, thinking patterns, and curiosity. Data were analyzed using Structural Equation Modeling. The results showed that the model was compatible with the data. The examination also showed the effect of the learning climate on thinking patterns, the influence of thinking patterns on curiosity, the influence of the learning climate on curiosity, and the influence of curiosity on academic performance. It is concluded that learning climate, thinking pattern, and curiosity play an important role in academic performance. Thus, the quality of students can be improved if curiosity is cultivated and reflective thinking patterns are formed. This requires serious efforts, both in policy and practice, to build a learning climate for the growth of students' thinking and curiosity.
Keywords: *academic performance, epistemic curiosity, learning climate, structural equation modelling, thinking pattern.*

Introduction

The quality of education in several developing countries, including Indonesia, is still a very serious problem. All countries will certainly try to improve the quality of education, because only with education the quality of a country's human resources can be improved. With a population of 265 million spread across a number of islands with diverse socioeconomic status, it is certainly not easy for Indonesia to make policies that are appropriate for all levels of society. Although Indonesia has adopted a policy of education costs of at least 20% of the national budget, the results are still far from expectations. The achievements of Indonesian students are relatively low compared to a number of other countries (OECD, 2019; 2013). In competitions that test critical thinking skills and ability to overcome problems such as Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS), the thinking ability of Indonesian children is very low (OECD, 2013; PIRLS, 2015). In PISA, for example, of the 65 countries that were assessed, Indonesia ranked 64th, while Malaysia ranked 52nd, Thailand ranked 50th, Singapore ranked 2nd, and China ranked 1st (OECD, 2013). In the TIMSS score, for mathematics, Indonesia is ranked 45 out of 50 countries surveyed. While in the field of science, Indonesia's ranking is in 45 out of 48 countries (PIRLS, 2015). The results of an evaluation conducted by the Ministry of Education in 2016 through the Indonesian Student Competency Assessment program also showed relatively similar conditions (Nugroho, 2019). Students who entered the category lacking in mathematics

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by 77.13%, the category lacking in science by 73.61%, and the category lacking in the ability to read by 46.83%.

The low quality of human resources will in turn have an impact on the competitiveness of a country. Based on the report of the World Economic Forum 2019, Indonesia's competitiveness index weakened, from 45th in 2018 to 50th in 2019 (World Economic Forum, 2019). From the report it was stated that the contribution of the downgrade was mainly contributed by the low ability of innovation, part of the resource aspect humans including education. The question then, what is the matter with education in Indonesia? Why did some of the policies carried out have not produced optimal results? How to improve academic performance of students? The main problem is still the same from time to time, namely the quality of education. Education in Indonesia has not been able to develop critical and creative thinking which is a prerequisite for the competitiveness of a nation. The data shows that in a number of countries that have a high competitiveness index, the quality of education is also good, such as Singapore, Hong Kong, and South Korea. Good quality education correlates with the level of thinking of students. In simple reasoning, the higher the quality of education, the higher the level of thinking.

Discourse about thinking patterns is not merely a matter of cognitive style, but has a neural basis in brain structure (Evans, 2008; Kahneman, 2011; Peters, 2012; Rosenzweig, 2015). Reflective thinking patterns, which reflect depth in thinking, rest on the neocortex area, including the anterior cingulate cortex, prefrontal cortex, and hippocampus. The intuitive mindset which tends to be emotional relies on the limbic system area, including the amygdala, hypothalamus, and basal ganglia. Research conducted by Maksum and Khory (2018) on State University of Surabaya students showed that the majority (80%) of students think using emotions and only a few (20%) of them use reasoning. If the individual is accustomed to putting forward an intuitive thinking model, then in the long run his thinking cannot function optimally. Critical thinking habits become undeveloped. Finally, individuals lose reference to understanding problems clearly, including solving problems in life. This situation is not only unfavorable but also counterproductive to progress. From the perspective of neuroscience, the brain's default mechanism is the limbic system (Chopra & Tanzi, 2012; Peters, 2012) and the brain will instruct the body to release hormones such as dopamine and endorphin to gain comfort (Amen, 2010; Pfaff & Joels, 2017). That is why, most people like the comfort zone and don't like difficulties.

Research results showed that thinking patterns are closely related to curiosity, namely a trait that drives people to ask exploratory questions and find creative ways to solve problems (Hagtvedt, Dossinger, Harrison, and Huang, 2019; Hardy, Ness, & Mecca, 2017; Ligneul, Mermillod, & Morisseau, 2018). The desire to know has more to do with reflective thinking. Individuals who have reflective thinking patterns try to find information, collect data, and evaluate the information they have. Such characteristics are positively correlated with curiosity. Thinking patterns and curiosity are also related to academic performance (Wulandari, Widayati, & Suryobroto, 2016; Zhang, 2002). Individuals who have high curiosity have high creativity and innovation. This is what has happened in developed countries like South Korea, Singapore and Hong Kong. Students are stimulated by their desire to find something. The teacher's task is to create a learning environment conducive to growing curiosity (Hagtvedt, Dossinger, Harrison, & Huang, 2019; Hardy, Ness, & Mecca, 2017; Leslie, 2014). Therefore, active learning models such as case studies, discussions, group projects, individual projects, and peer reviews must be the main pattern in learning (Cumming & Blatherwick, 2017).

Reflective thinking and curiosity are the main determinants in developing an advanced and intelligent human civilization (Brockman, 2013; Maksum, 2015; Schwab, 2017). In the history of civilization, many new discoveries were built on the foundation of these two things. How Charles Darwin discovered the theory of evolution, he spent many years travelling sea and land to study, record, and analyze the various species that exist on earth. About the same

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thing happened to Albert Einstein when he discovered the theory of relativity and the law of photo electricity which became an important step in the development of quantum theory. James Maxwell as well in developing the theory of electromagnetic radiation was carried out with repeated trials with full perseverance and hard work until a mathematical equation was found that connected electricity with magnetism. Even in the present context, such as the Silicon Valley phenomenon, which is the location of the discovery and development of new technologies that change the way of life of world citizens, it is also built through a tradition of curiosity and an extraordinary research enthusiasm (Fisher, 2018). In the region, technology-based companies such as Apple Computer, Google, Hewlett-Packard, and Intel are growing, and are supported by Stanford University, which stimulates research-based ideas and innovations. In short, the great findings that changed civilization were born not through intuitive thinking patterns that prioritize emotions, but through reflective thinking patterns that prioritize the mind supported by curiosity that does not know the final word.

The pattern of thinking and curiosity is not a talent that is brought from birth but is the result of the learning process through the environment. Because of that the environment is that allows the mindset and curiosity to grow to be important (Burns, 2010; Joe, Hiver, & Al-Hoorie, 2017). Referring to the thought of Bronfenbrenner, the microscopic environment such as family and education has a strategic role in the formation of mindset and curiosity (Bronfenbrenner, 2005). Related to the learning environment, there are some things that need attention. First, does the learning process provide optimal opportunities for students to explore their thoughts, ideas and performance? The approach that is often referred to as student centered needs to color the lecture process (Cumming & Blatherwick, 2017; Hagtvedt, Dossinger, Harrison, & Huang, 2019). Active student participation in learning becomes an important indicator in assessing the success of this approach. Thus, students feel have the freedom and autonomy to develop themselves. Learning resources are provided on a variety basis and the role of lecturers is more as a facilitator and inspiratory (Cummings & Blatherwick, 2017; Zhang, 2002). Second, the attitude of lecturers should be democratic and responsive. Lecturers must stimulate students' minds to read, make observations, question, analyze, evaluate, and ultimately create something (Lamnina & Chase, 2019; Moreira, Ferreira, Cardoso, Gomes, & Collazos, 2018). Third, the functional relations between lecturers and students are relatively warm. That is, if students face problems in learning, the lecturer is at least willing to listen and understand and if possible, provide alternative solutions.

Research Problem

From the explanation above it appears that macroscopically the learning climate, patterns of thinking and curiosity become crucial problems in building civilizations and microscopically become fundamental problems in learning. The aim of this research was to find a theoretical model that explains the structural relations of the academic climate, thinking patterns, curiosity, and academic performance. The theoretical model explained how academic performance is formed through a tradition of strong thinking and curiosity and a conducive learning climate. The results of this research were useful for lecturers, including policy makers in education, to construct thinking patterns and provide appropriate treatment to students. Mistakes of thinking have an impact on errors in behavior, including achievement in academics. Thus, the results of this research were very useful for building academic civilization in a constructive and progressive manner. Specifically, this research attempts to answer the following problem formulation: Did the theoretical model that explained the structural relationship among the learning climate, thinking patterns, curiosity, and academic performance fit the data?

Research Methodology

General Background

This research specifically developed a theoretical model, structural relations among the learning climate, thinking patterns, curiosity, and academic performance. To achieve the objectives of this research, systematic and accountable steps are needed. This research used a non-experimental method that no treatment is given to the research subjects (Cresswel, 2013; Kerlinger, 1986). The theoretical model was formulated based on literature review, especially the results of research in the last ten years. In this research there were independent variables, moderator variables, and dependent variables. As the independent variable was the learning climate, the moderator variable was thinking patterns and curiosity, and as the dependent variable was academic performance.

Sample

The participants of this research were 1000 students of State University of Surabaya taken by proportional random sampling. They consisted of 324 men and 676 women with a mean age of 19.8 years and *SD* of 3.7 years. They come from 20 departments that were incorporated in 8 faculties including postgraduate. Most respondents came from the engineering faculty, which amounted to 223 (22.3%), consisting of 127 men and 96 women. The smallest number of respondents came from postgraduate, which is 44 (4.4%), consisting of master and doctoral students, including 22 men and 22 women.

Table 1
Number of respondents by faculty and gender

		Gender		Total	
		Male	Female		%
Faculty	Language & Art	52	143	195	19.5
	Economy	21	94	115	11.5
	Sport Science	29	20	49	4.9
	Education Science	22	115	137	13.7
	Social Science & Law	30	115	145	14.5
	Science & Math	21	71	92	9.2
	Engineering	127	96	223	22.3
	Postgraduate	22	22	44	4.4
Total		324	676	1000	100

Instruments and Procedures

Measurement of research variables was carried out with a set of questionnaires consisting of three inventories. The thinking pattern variable was measured using the Intuitive-Reflective Scale (Maksum & Khory, 2018). The instrument consists of 20 statements that are bipolar, positive and negative. From the item validity test found a correlation of .44 to .69 and Cronbach's alpha reliability of .72. Learning climate variable was measured by Learning Climate Questionnaire (Williams & Deci, 1996). The instrument consists of 24 items. From the validity test obtained a correlation coefficient of .54 - .80. Reliability test with Cronbach's alpha showed a coefficient of .93. The variable of curiosity was measured using Need for Cognition

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(Cacioppo & Petty, 1982). The instrument consists of 18 bipolar statements, positive and negative. From the item validity test the correlation coefficient was obtained from .41 to .70. Reliability test using Cronbach's alpha showed a coefficient of .74. Academic performance was measured using the grade point average [IPK]. IPK was calculated as the ratio of the score gotten in every subject matter weighted with the total number of class credit she/he took. The IPK scale from 0 to 4. It is assessed at the end of each semester. Data collection involved a number of students who had received research methods courses. Before conducting data collection, team members were given an explanation related to the research instrument, how to fill it out, and provide an explanation to the respondents. In the data collection process, respondents were asked to fill in a set of questionnaires consisting of the 3 inventories. Each respondent filled out the questionnaire for ± 30 minutes. Data collection was carried out in each faculty which was used as a sample. After the data has been collected, verification is carried out to ensure that the data entry of the respondents is in accordance with the provisions.

Data Analysis

Data were analyzed using Structural Equation Modeling (SEM), which is a confirmatory multivariate statistical technique to examine the structural relations of a number of variables simultaneously (Byrne, 2010; Hair, Anderson, Tatham, & Black, 1998). The final result of SEM is a theoretical model, which is a summary of theories that illustrate the interrelation between variables that are normally expressed in mathematical formulations. A model is said to be good if it is able to explain the actual phenomenon with a small error. In SEM, there are two interrelated stages. First, examination of the model by seeing whether there are significant differences between the model and data. Second, if there is a match between the model and the data (the difference is not significant), then the analysis can proceed with testing the structural relations in the model.

Table 2
Model testing criteria

Goodness of Fit Index	Criteria
Chi-square	Small score
p-value	$p \geq .05$
Root mean square error of approximation (RMSEA)	RMSEA $\leq .08$
Goodness of fit index (GFI)	GFI $\geq .90$
Adjusted goodness of fit index (AGFI)	AGFI $\geq .90$
t-value	$t > 1.96$ ($p < .05$)

To test the suitability of the theoretical model with the data, the goodness of fit test was used, the testing criteria are shown in table 1. If the null hypothesis is accepted, which means there is no difference between the model and the data, the proposed theoretical model is fit to explain the data. If an appropriate model has been obtained, then each hypothesis can be tested which shows the impact of a variable on other variables. The testing criteria are based on Chi-square, GFI, AGFI, and RMSEA.

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Research Results

Before arriving at the testing of models and hypotheses, an overview of the descriptive statistics of the main variables was presented. Table 3 showed that the mean of thinking patterns and curiosity were relatively moderate, respectively 3.76 and 3.8. On a scale of 1-6, the score was only a few points above the mean. The data proved that students' thinking patterns were generally moderate, between intuitive and reflective. The same thing happened to the curiosity variable. The relatively high mean was in the learning climate and academic performance variables.

Table 3
Mean and standard deviation of main variables

Variables	Mean	SD	Score Scale
Learning Climate	4.59	.61	1-6
Thinking Pattern	3.76	.42	1-6
Curiosity	3.8	.40	1-6
Academic Performance	3.5	.52	0-4

The next step was to test the relations between variables constructed in the form of theoretical models as visualized in Figure 1. The model connects four main variables, namely the learning climate, thinking patterns, curiosity, and academic performance. In the context of these relations, the learning climate was an exogenous variable, while thinking patterns, curiosity, and academic performance were endogenous. In the model also explained how the pattern of thinking affects the variables of curiosity and academic performance. Furthermore, the variable of curiosity affects academic performance. In the relation model, a variable can exchange functions as independent variables and at other times function as moderator variables and dependent variables.

Figure 1
Theoretical model of relations among variables
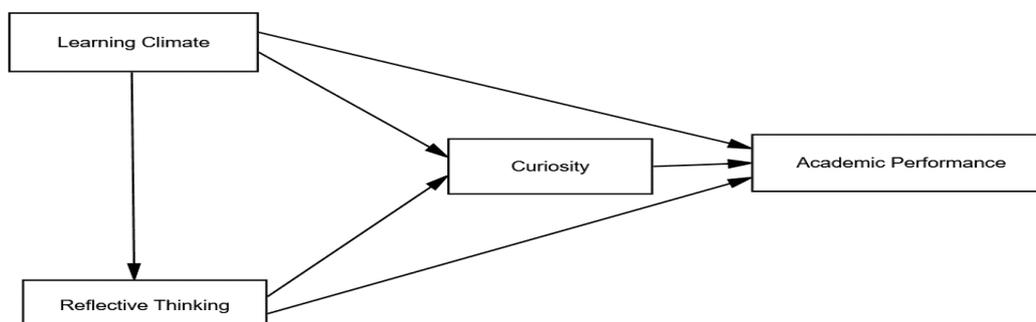
The theoretical model was tested using SEM with IBM Amos 23. The test results as shown in Figure 2 showed that the model was not fit because it did not meet the test criteria, namely: chi-square with $p > .05$, GFI $\geq .90$, AGFI $\geq .90$, RMSEA $\leq .08$, and t-value > 1.96. The test results showed $p = .0001$, GFI $= .848$, AGFI $= .746$, RMSEA $= .237$, and t-value < 1.96. The test also showed that regression coefficient of the learning climate on academic performance

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was .016 with $p > .05$ so it was not significant. The regression coefficient of thinking pattern variables on academic performance was .007 with $p > .05$ so it was not significant. Because the direct relations between the learning climate and thinking pattern on academic performance was not significant, the relation between the two was removed from the model.

Figure 2
First test of structural relations model among variables
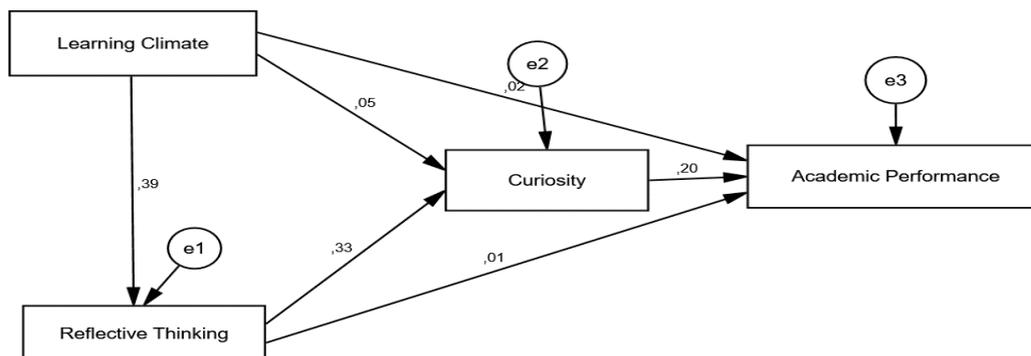
Considering the results of testing the model do not meet the criteria, it was necessary to change relations among variables, including the possibility of removing variables that were considered not to contribute to the model. From the process obtained Model 2 as shown in Figure 3. From the second examination obtained a chi-square value = .387 with $p = .824$, GFI = 1, AGFI = .999, RMSEA = .000, and t-value > 1.96. This means that the model was compatible with the data. The examination also showed the regression coefficient of the learning climate to thinking patterns of .39 with $p < .05$, the regression coefficient of thinking patterns to curiosity of .33 with $p < .05$, the regression coefficient of the learning climate to curiosity of .05 with $p > .05$, and the coefficient regression of curiosity on academic performance was .20 with $p < .05$. That was, all relations between variables proved to be significant, except for the effect of the learning climate on curiosity.

Figure 3
Second test of structural relations model among variables
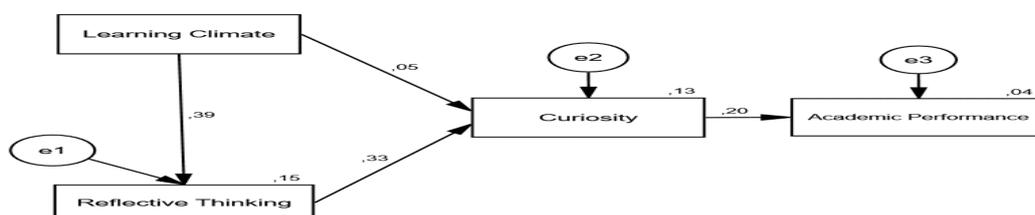
Discussion

The final result of this research was a theoretical model that explains the structural relations of the learning climate, thinking patterns, curiosity, and academic performance. This research has found that the learning climate influences the thinking patterns of students. The interaction between lecturers and students that prioritizes freedom of thought and strengthening competencies has a positive impact on students' reflective thinking. Constructive lecturer-student relations will create feelings of comfort, openness, and trust in each other. This finding is in line

with research (Back, Polk, Keys, & McMahon, 2016; Joe et al., 2017; Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013) which states that the learning climate is positively correlated with student commitment and involvement in learning. The way students think, including motivation and achievement orientation can be changed by improving the learning climate. Referring to the thought of Baumrind (1971) and Maccoby and Martin (1983), parenting or teacher parenting is needed which gives achievement demands to children and at the same time is also responsive to their needs. Thus, the child is motivated to achieve certain goals or targets and at the same time get attention and affection.

This research also found the influence of thinking patterns on student curiosity. Reflective thinking patterns, which require serious and evaluative thinking efforts, have a positive impact on students' needs for information, raise challenges, and are creative in solving problems (Brockman, 2013; Hagtvedt, Dossinger, Harrison, & Huang, 2019). Thinking skills and curiosity are important factors in building a creative and innovative culture that impacts the nation's competitiveness. Referring to the results of previous studies (Cumming & Blatherwick, 2017; Dwyer, Hogan, & Stewart, 2014; Koenig, 2011) that there are two things that now and in the future will become needs, namely critical thinking and problem solving. Critical thinking is the ability to analyze and evaluate something based on relevant logic, information, and data. While problem solving is the ability to find the right solution to a problem. Both of these are important parts of 21st century skills, including the industrial revolution 4.0 (Schwab, 2017). A country that dreams of competitiveness needs to pay serious attention to both of these. In the 2019 world economic report, Indonesia's competitiveness index dropped five ranks among 140 countries, from the ranking of the previous 45 years to rank 50. Of the 12 pillars that became indicators, the ability to innovate ranks lowest. From this report, we can see that countries with high competitiveness are those with high levels of thinking and curiosity, such as Singapore, the United States, Hong Kong, and South Korea.

From a neuroscience perspective (Lomanowska, Boivin, Hertzman, & Fleming, 2017; Peters, 2012), the findings of this research reinforce the notion that reflective thinking based on neocortex needs to be continually cultivated in order to produce creative and innovative ideas and works. Although it is recognized that humans generally experience biases in thinking, not using the ratio optimally, and tend to discourage short-term interests. As a result, many actions taken, as a result of decision making, are counterproductive and less effective in achieving goals (Kahneman, 2011). People who think logically and deeply, many use the frontal area, especially the dorsolateral prefrontal cortex and anterior cingulate cortex in the thought process. People who respond emotionally to problems without thinking long, prejudice without data, and draw conclusions speculatively, use many limbic areas in their thought processes. The results of research conducted by Maksum and Khory (2018) of 383 State University of Surabaya students showed that 80% of students used intuitive thinking. If the individual is accustomed to prioritizing intuitive thinking in making decisions, then in the long run will disfunction his/her common sense. Critical thinking habits become undeveloped. Finally, individuals lose reference to understanding problems clearly, including solving problems in life.

Another finding of this research is the positive impact of curiosity on academic performance. This is in line with the research results of Lammina and Chase (2019) and Oudeyer, Gottlieb, and Lopes (2016) which states that curiosity influences academic performance, including creativity. In the research it was also mentioned that uncertainty conditions actually increase students' curiosity, even though on the other hand it causes anxiety. Learning that is too much to give instructions, it turns out it is less encouraging to students to seek and find their own knowledge. Along with today's post truth era (McIntyre, 2018), where perceptions are more dominant in influencing people's judgment than facts (Nichols, 2017), reflective thinking and curiosity become a necessity.

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The most important variable is how to strengthen students' curiosity. Because curiosity has a significant effect on academic performance as the findings of this research and is a precondition for discovering something new. Many great scientists, such as Charles Darwin and Albert Einstein, produced theories that had a profound impact on human life because of an extraordinary curiosity. For them, nothing is more important than the desire to know. There are three main needs that are the same between primates and humans, namely food, sex, and shelter (Leslie, 2014; Peters, 2012). But there is one type of need that distinguishes between them, namely the desire to know. Curiosity is only unique to humans (Leslie, 2014).

Although in the context of this research the thinking pattern and curiosity are moderating variables, but its role is so strategic in building a culture of innovation and productivity. In the academic world, interest in something new is important. Leslie (2014) called it diversified curiosity, which is an open mind to be interested in something new and look for answers to unsolved problems. Restless desire for the new and the next. In the academic world this is referred to as epistemic curiosity or intellectual curiosity (Hardy, Ness, & Mecca, 2017), which is the desire to continue to explore thought. The low level of thinking of Indonesian students shown in the PISA and TIMSS assessments, including the low competitiveness index and the global innovation index, proves that the failure of the education system in Indonesia is precisely at this point, namely the inability to foster curiosity in students (Maksum, 2015; 2011). Perhaps energy is focused on how to make students as teachers, economists or engineers, not to make them as curious learners. Prepared them to enter the workforce, rather than inspire them. In the end, we will only get uninspired students and mediocre professionals.

Conclusions and Implications

This research has succeeded in building a theoretical model among the learning climate, thinking patterns, curiosity, and academic performance. Simply stated, this research concludes that academic performance was influenced by curiosity, curiosity is influenced by reflective thinking patterns, and reflective thinking patterns are influenced by the learning climate. From the results of testing the model using SEM it is explained that the learning climate has a direct impact on reflective thinking and an indirect effect on curiosity. Reflective thinking patterns have a direct impact on curiosity and an indirect effect on academic performance. Curiosity has a direct impact on academic performance. The findings of this research provide a framework about how to explain academic performance from students' cognitive aspects, namely curiosity and thinking patterns, as well as from environmental aspects in term of learning climate. Of course, there are other aspects outside the variables above that affect academic performance. Therefore, this research can encourage other researcher studying academic performance to generate and validate new question as well. The results of this research can provide guidance to policy makers and education practitioners to improve student learning outcomes. Academic performance can be stimulated, especially related to creativity and innovation, by improving thinking patterns and fostering curiosity. Therefore, learning that explores higher order thinking must be an inseparable part of lectures. Reflective thinking can be fostered by creating a conducive learning climate, where lecturers provide opportunities for students to think freely, build competencies, and be responsive. Reflective thinking and curiosity are two things that are closely related, and both are crucial factors in the academic world. Therefore, these two things must continue to be developed for students in order to build an innovative and productive culture.

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