

Analysis of Creative Thinking Skill

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Analysis of Creative Thinking Skill and Student Learning Interest through Mind Mapping Based Creative Problem-Solving Learning Model

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Abstract

Creative thinking skill is one of the most important skills in the learning process in 21st century. Creative thinking skills influenced by student's learning interest. Therefore, creative thinking and learning interest must be cultivated through a proper learning process. This research aims to analyze student's creative thinking skills and learning interest through mind mapping-based creative problem solving learning models. This research method used mixed methods with a sequential explanatory design. The population of this research was all students of class X with 30 students as the sample. The instrument used an essay test for creative thinking, an interview sheet, and learning interest questionnaire. The results of the n-gain analysis showed an increase for each indicator of the creative thinking skills with an average of 71.73 included in the high criteria. As for the percentage of student's learning interest is 79.17% which is included in good criteria. The results of the interview showed that there was different creative thinking patterns for each category where students in solving problems tended to begin by understanding the problem, linking scientific theory with their own knowledge, then developing it based on experience and reasoning. However, seen from the answers and interview results, students with very high creative thinking skills are better at providing ideas or conclusions than students with high, medium, and low categories. The results of the correlation analysis showed that there was a positive and significant relationship between student's learning interest and four indicators of creative thinking skills.

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INTRODUCTION

Physics learning includes scientific processes that needs interaction with real objects and interactions with the learning environment (Wiyanto & Yulianti, 2009). One important aspect of the learning process in the 2013 curriculum is creativity or creative thinking skill, which according to Songkram (2015) has strategic value in the 21st century.

Creative thinking skills are defined as skills that are needed on almost all subjects (Heilmann & Korte, 2010). Creative thinking skills can be obtained through education and learning in schools (Cachia *et al.*, 2010). Creative thinking skills is to think based on available data and information, and to find many answers (Sulistiarmi *et al.*, 2016). Meanwhile, according to Munandar (2012) creative thinking is a pattern of thinking that encourages creative products and involves rational and imaginative thinking in solving a problem. Cognitive characteristics of creative thinking are fluency, flexibility, originality, and elaboration. While the non-cognitive characteristics of creative thinking are motivation, attitudes, and creative personality (Munandar, 2012).

Some researchers argued that learning interest can affect student's creative thinking skills. Wilda *et al.* (2017) concluded that creativity and interest in learning have an effect on student learning outcomes. Tambunan (2016) showed that strategies and interest in learning affect student's mathematical creative thinking skills. Interest is a sense of preference, impressed, attention, focus, effort, skills, and interaction results (Lin & Huang, 2016). Learning interest measured through four indicators as mentioned by Safari (2003) which include sense of preference, impressed, attention, and involvement.

This research conducted in Vocational School because the creative thinking is an important aspect, so that students can proceed to develop creativity in making products and create more new innovations. As one graduate competency standards for vocational students is creativity. Moreover, vocational schools expected to be a forum for producing workers who are ready to work. Therefore, vocational students must always be able to develop their creativity in order to compete in the world of work. This is in line with the research of Turkmen & Sertkahya (2015) that students must have creative thinking skills, especially vocational students who are require to always developing their creativity in working.

The results of observations in class X SMK Negeri 10 Semarang found that the students are low in creativity, low interest, low concept mastery, students are not given the opportunity to develop thinking skills, and are weak in mathematical abilities.

One of the efforts to bring out creative thinking skills and learning interest is to implement a mind mapping-based creative problem solving (CPS) learning model. CPS is learning by solving problems through systematic techniques in organizing creative ideas to solve a problem (Ngalimun, 2014). The mind mapping-based CPS learning model that is applied provides benefits to students in training creative thinking skills through problem solving made in the form of mind mapping which requires creativity in its manufacture.

Previous researchers concluded that CPS can developed adaptive skills (Muin *et al.*, 2018) and affected the creativity of junior high school students (Triyono *et al.*, 2017). Research by Swestyani *et al.* (2014) showed that the CPS can improved the creative thinking skills, but not significant. This can be seen from the category of creative thinking ability from low to medium. The research by Syamsu *et al.* (2016) showed that the application of CPS can improved creative thinking skills after learning in cycle II, but the increase that occurs is also not significant.

One way to overcome the shortcomings in previous research is mind mapping. Mind mapping in this study is applied to one of the learning stages in the CPS model, namely the finding solution stage so that students can be more creative in providing solutions to various problems given. Making mind mapping also requires students to be more creative in providing attractive images, colors, and lines so as to generate student interest in learning. Mind mapping uses visual imagery and graphic infrastructure that can optimize the potential of the brain and improve memory (Tee *et al.*, 2014). Previous research has shown that mind mapping can improved creative thinking skills in making science learning concepts (Agustina, 2018), significantly improved creative thinking skills and learning outcomes (Karo-Karo *et al.*, 2017), and affect learning interest which has an impact on improving learning outcomes (Darmayoga *et al.*, 2013). Therefore, in this research, a mind mapping-based CPS was conducted which is expected to form a creative mindset so as to improve student's creative thinking skills and interest in learning.

METHOD

The method used in this research is mixed-methods with sequential explanatory design. This method combines quantitative and qualitative research methods sequentially (Sugiyono, 2018). Quantitative research uses a one-group pretest-posttest design in the chapter on temperature and heat. The population of this research was all students of class X SMK Negeri 10 Semarang in the 2019/2020 academic year. The sample selection used by

purposive sampling technique. The results of the selected sample collection is class X TIPK, amounting to 30 people. The class chosen because it had problems identified at the time of initial observation, that is, they tended not to participate in learning, as well as low interest in learning and creative thinking skills. The instruments used were essay tests, learning interest questionnaires, and interviews to determine student's creative thinking patterns.

The first stage of the research was to collect quantitative data from the pretest results. After that, provide treatment in the form of a mind mapping-based CPS learning model. Then collect quantitative data from the posttest results. The data from the pretest and posttest are quantitative data obtained by giving essay test then analyzed using gain analysis to determine the increase in creative thinking skills. The next stage is to collect qualitative data in the form of interviews and questionnaires. Interviews conducted to determine student's creative thinking patterns and to determine the effect of mind mapping on learning interests and creative thinking skills. Interviews were conducted on several students with very high, high, medium, and low creative thinking skills categories related to the answers to the questions they had previously completed to get a deeper explanation of the differences in creative thinking skills of each student category. Meanwhile, the questionnaire was to find out how much student's learning interest. After the qualitative data collected, it analyzed using interview analysis and questionnaire analysis. Correlation analysis then carried out to determine the

correlation between interest in learning and creative thinking skill. After all data has been collected and analyzed, the next step is to conclude the results that have been obtained

RESULTS AND DISCUSSION

This research has implemented a mind mapping-based CPS learning model, which means that one of the stages in CPS combined with mind mapping. The CPS learning learning model used in this research has six stages as stated by Treffinger et al. (2003) which consists of 1) identifying problems, 2) confirming information, 3) finding problems, 4) finding solutions, 5) selecting solutions, and 6) acceptance. Mind mapping in this research is applied in the 4th stage, finding solutions.

Increased creative thinking skills for the four indicators of creative thinking were analyzed using n-gain based on the pretest and posttest results from given treatment of a mind mapping-based CPS learning model. The four indicators are 1) fluency, which measures students' ability to provide many relevant answers, 2) flexibility, which measures the ability to provide a variety of relevant answers, 3) originality, which measures student's ability to provide ideas that most people rarely give, and 4) elaboration, which measures student's ability to detail an object, idea, or situation. The pretest and posttest results shown in Figure 1.

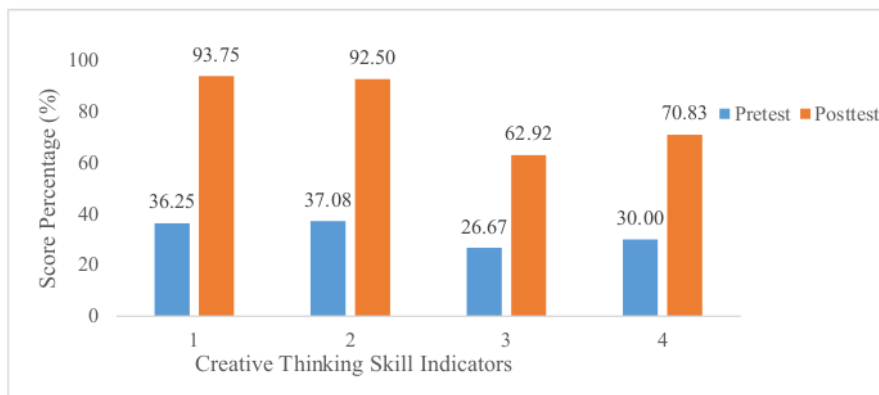


Figure 1. The pretest and posttest results of creative thinking skills

The improvement of student's creative thinking skills analyzed with n-gain based on four indicators of creative thinking skills. The increase in test results obtained in the experimental class is calculated based on the N-gain score by Hake (1999):

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} \times 100 \tag{1}$$

with :
 S_{post} : posttest score

S_{pre} : pretest score

S_{maks} : maximum score = 8

The results of the calculation are then analyzed based on the category for the N-gain level in Table 1. The increased results of creative thinking skills shown in Figure 2.

Table 1. Category N-gain level

N-gain level	Category
$g > 70$	High
$30 \leq g \leq 70$	Medium
$g < 30$	Low

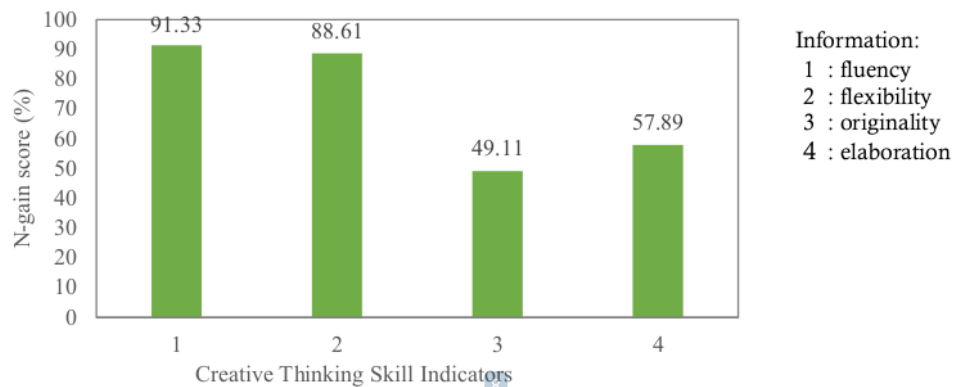


Figure 2. The increased indicators of creative thinking skills

The increased results fluency and flexibility indicators are on high category. Meanwhile, the originality and elaboration indicators are in the medium category. That means the habit of students always doing assignments in the same way and writing as the textbooks or notes can be the cause of inhibition of creative thinking skills. Students also have difficulty developing, adding, and detailing objects, ideas or situations. The problem of limited study time and a lot of schoolwork also makes students lazy to think about different ways of completing assignments, and most students feel satisfied with tasks that they done improperly. This is in line with the results of research by Chena *et al.* (2015) which states that continuous repetition is a factor that can affect the development of creative thinking skills. This is also in line with Olson (1992) which argues that the resistance in creative thinking are habits, limited time and energy, unsupportive social environments, urgent needs, unsupportive criticism, fear of failure and complacency.

Mind mapping-based CPS learning model has improved student's creative thinking skills seen from an average n-gain of 71.73 on high criteria. This increase occurred because in mind mapping-based CPS learning there was a finding solution stage. This stage begins with the teacher guiding students to produce various ideas or solutions in groups which are then poured out by the students in the form of mind mapping. At this stage, the teacher also explains the

use of mind mapping and its examples. During the learning process, there several students who had difficulties. The teacher invited the students to ask questions then guide students to find a solution. Then the solution formed in mind mapping. This stage trains students to work together and be more creative in thinking because it is driven by a sense of competition between groups to be the best with a pleasant learning atmosphere. The existence of group work at this stage provides students with experiences to get some creative ideas which can then be collected and concluded in groups.

Mind mapping-based CPS model trains student's skills in solving problems and trains students actively to construct their own knowledge. According to Piaget's theory that the learning process is an active process because knowledge is formed in the learning subject so it is necessary to create an atmosphere that allows interaction between learning subjects (Reedal, 2010; Schunk, 2012). As for according to Sumarli *et al.* (2017) physics learning becomes more effective if it can train various skills that provide direct experience for students in constructing their own knowledge.

The creative thinking skills in solving physics problems with temperature and heat material provides different patterns of creative thinking skills. This pattern obtained based on the answers to the questions given and interviews with selected students based on each category of creative thinking skills. According on four indicators of creative thinking skills, students

with very high, high, and moderate categories are dominant on indicators of fluency and flexibility. Meanwhile, students in the low category were only dominant in the fluency indicator.

Students with very high creative thinking skills in solving problems tend to begin by understanding the problem then answering questions by linking to their knowledge. Students develop it based on reasoning and daily experience, the result of these thoughts is that students conclude answers to the questions given, then communicated the answers.

Students with very high criteria for creative thinking skills claim to have no difficulty in answering questions with fluency and flexibility indicators because they understand theory and it is often done in everyday life. Students also answer by their own thoughts. However, students have difficulty answering questions of originality. Students also have difficulty answering elaboration question. Students with very high creative thinking patterns shown in Figure 3.

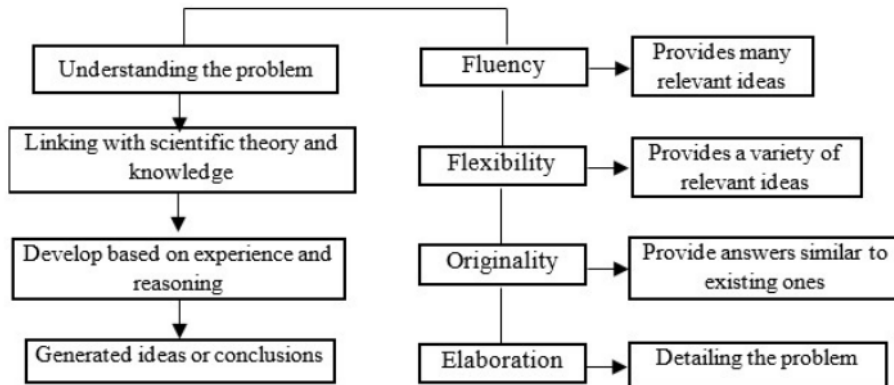


Figure 3. Very High Creative Thinking Patterns

Students with high categories are almost the same as students with very high categories. However, high category students develop their knowledge based only on daily experiences. Similar to the very high category, students with high creative thinking skills

also claim to have no difficulty answering questions with flexibility and fluency indicators, and find it difficult for originality and elaboration questions. Students with high creative thinking patterns shown in Figure 4.

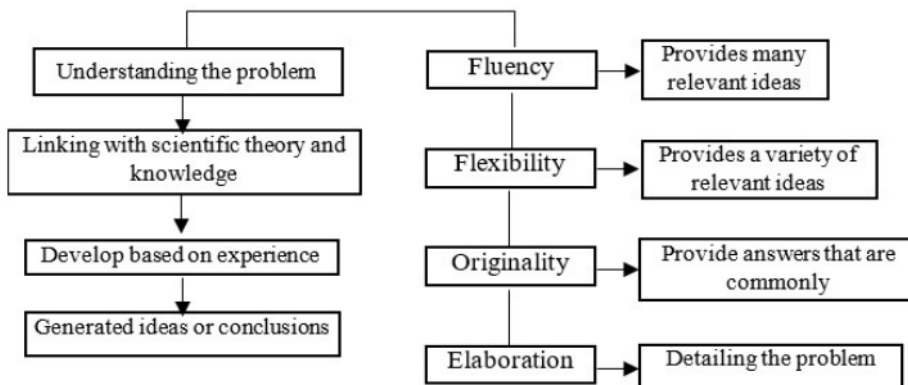


Figure 4. High Creative Thinking Patterns

Students with medium category are almost the same as high category. However, students in answering questions only related to their knowledge and did not link to scientific theory. Similar to the very high and high categories, students with moderate

creative thinking skills also admitted that they had no difficulty in answering questions with indicators of flexibility and fluency, and found difficulties with originality and elaboration questions. Students with medium creative thinking patterns shown in Figure 5.

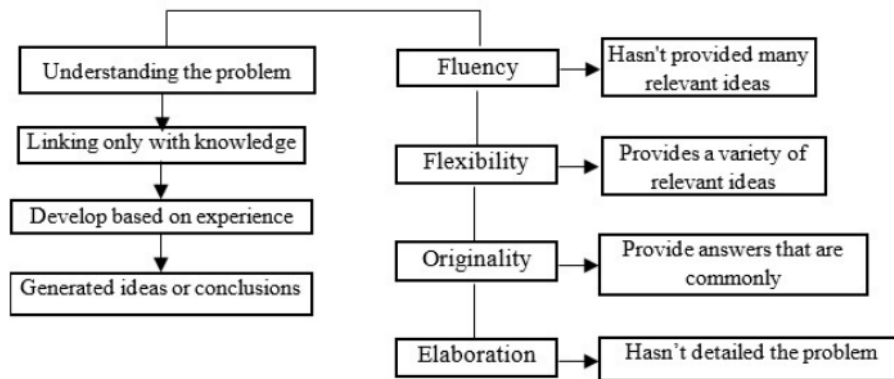


Figure 5. Medium Creative Thinking Patterns

Students with a low category are almost the same as the medium category. However, students answer questions only based on their reasoning, not based on scientific evidence and phenomena. Students with low creative thinking skill admit that they have a little difficulty in answering questions with the fluency indicator because students only associate problems with their knowledge. Students also have difficulty answering flexibility questions because they do not

understand the concepts. Moreover, students that answered originality questions also have difficulty giving different examples from existing examples because they were still confused about the concept of physics. Students also have difficulty answering elaboration questions because they do not understand the theory, formulas, and the application. Students with low creative thinking patterns shown in Figure 6.

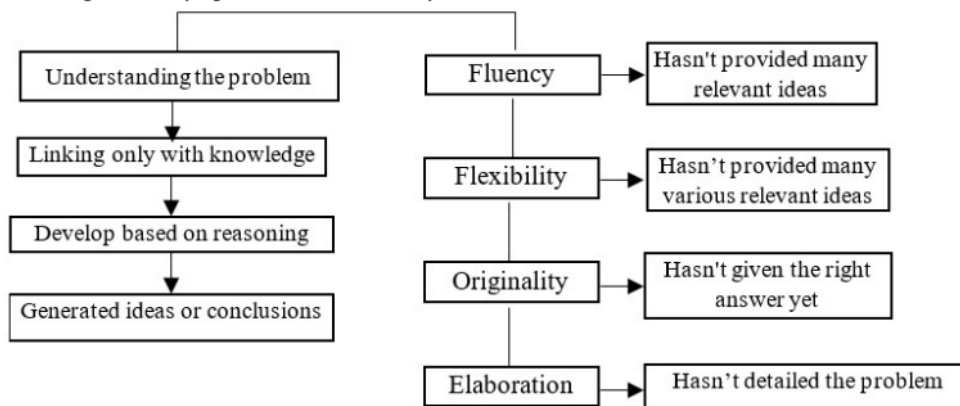


Figure 6. Low Creative Thinking Patterns

The creative thinking patterns in this research indicated that the students' initial knowledge and experiences in daily life have an effect in shaping student's creative thinking patterns. The results of interviews with selected students showed that both students with very high, high, medium, and low creative thinking skills are liked mind mapping learning. The students thought that mind mapping made them more excited. According to them, with student's mind mapping, it becomes easier to relearn the material that they has taught. However, students considered that the limited time given to make mind

mapping during class hours results in the mind mapping being made less than optimal. According to Maharani *et al.* (2015) through mind mapping, student activities in learning can be more flexible to develop their mindset and creativity.

This research also analyzed student's learning interest through a mind mapping-based CPS learning model. According to Wahyudin *et al.* (2010) learning interest is an intrinsic factor that can affect a person's learning outcomes. Someone who is interested a subject, tends to be serious in learning something.

Student's learning interest data obtained by analyzing the student interest in learning questionnaire sheet given at the end of the learning process. Analysis of student learning interest is based on a questionnaire containing 8 questions containing 4 indicators, there are sense of preference, impressed, attention, and involvement. The average percentage of interest obtained is 79.17% in a good category,

which means that the mind mapping-based CPS learning model can provide interest in learning physics. The highest learning interest obtained from the indicator of interest. This shows that student's interest in learning tends to motivated by student's interest in participating in learning and in gaining new experiences. The percentage of student's learning interest shown in Figure 7.

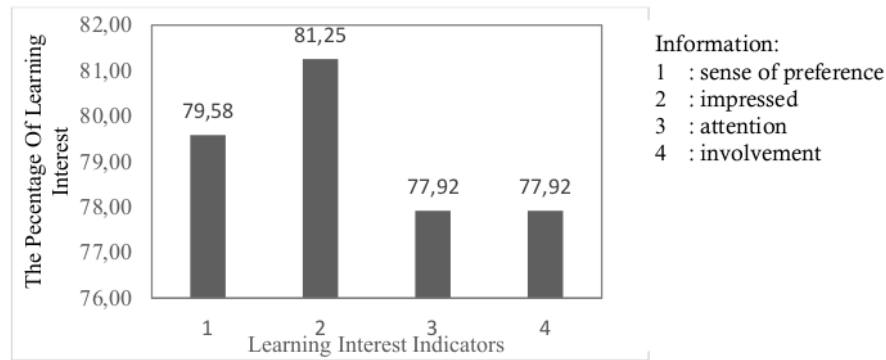


Figure 7. The Percentage of Student's Learning Interest

Learning with the mind mapping-based CPS model can give students interest in learning. In line with Hartantia *et al.* (2013) that CPS encourages students to be able to solve problems in a creative way that can attract attention, willingness, and pleasure of students to study the Moreover, Vitulli & Giles (2016) wrote that mind mapping helps students organize ideas effectively. According to Pandley, through mind mapping learning activities are more interesting, students are also more diligent in learning and dealing with assignments, are resilient in facing difficulties, like to find and solve various problems, work independently, and can defend their opinions (Fatmawati, 2014).

According to Buzan (2013) mind maps are an easy way to provide imagination and help to remember. In line with Fatmasari (2016) that through mind maps students can be creative based on what they want in concept making. Research by Saputro *et al.* (2017) showed that mind mapping can improved student learning outcomes and activeness. The increase in learning outcomes and student activeness evidenced by the increase in the average score of students in the learning process. The activeness of students in this case related to student's interest in learning in learning with mind mapping. In line with Slameto (2010) that interest can be expressed through

a statement indicating that students prefer something, or it can be manifested through participation in an activity.

This research also discusses the correlation between interest in learning and the creative thinking skills after given a mind mapping-based CPS learning model using pearson product moment correlation analysis. This correlation used the results of the student learning interest questionnaire and the posttest results of the creative thinking skills for each indicator in the form of essay test. The results of the correlation analysis shown in Table 1.

The analysis of the correlation showed that there is a positive relationship between interest in learning and each indicator of the ability to think creatively. This shows that students with high creative thinking skills also have high interest in learning. However, there is a different level of correlation. Student interest in fluency and flexibility indicators shows a medium level of correlation, the originality indicator shows the level of a strong correlation, and the elaboration indicator shows the level of a very strong correlation. The significance test results showed that there is a significant correlation between learning interest and four indicators of creative thinking skills.

Table 1. The Correlation of Learning Interest and the Creative Thinking Skills

Description	Creative Thinking Skill Indicators			
	Fluency	Flexibility	Originality	Elaboration
Correlation Coeff.	0.537	0.526	0.698	0.810
Correlation Level	Medium	Medium	Strong	Very Strong
Determination Coeff.	0.288	0.276	0.487	0.656
t_{count}	3.365	3.271	5.156	7.313
t_{table}	2.040	2.040	2.040	2.040
Decision	Significant	Significant	Significant	Significant

Correlation analysis continued by calculating the coefficient of determination. The results of the calculation of the coefficient of determination show there are other factors besides student's learning interest that affect creative thinking skills for each indicator. These results indicate that student's learning interest does not have a major influence on indicators of fluency and flexibility.

Knowledge or cognitive abilities also show that students with very high creative thinking abilities have a higher average score than other students. These students are also more active in learning than the others student. This is in line with Chang (2013) that intelligence, knowledge, motivation, social environment, cultural context, and personality are some of the factors that can influence the development of creativity. Munandar (2012) revealed several factors that affect student's creative thinking skills including internal factors which include genetics, gender, health, interests, motivation, learning styles, and personality. Meanwhile, external factors include the macro environment (culture, society) and the microenvironment (family, school, peers).

Tajali & Zandi (2010) founded that work skills and creative thinking have to do partly with innate creativity, some with learning and some with learning environments. According to Munandar (2012) a person is required to think and discover something new through environmental conditions and consider personal aspects. The process of creative thinking in the form of discovering new concepts, principles and ideas requires conducive conditions with wide opportunities.

The implications obtained from the results of this research are that student's creative thinking skills on the originality and elaboration indicators are the lowest compared to other indicators. Therefore, it is necessary to do learning that can train student's abilities to provide ideas or answers that are rarely given by most people and train students to develop, add or detail an object, idea, or situation. Therefore,

it is necessary to do learning that can better train student's skill to provide ideas or answers that are rarely given by most people and train students to better develop, add or detail an object, idea, or situation. This is so that students with low creative thinking skills have creative thinking patterns like students with very high creative thinking skills who are able to solve problems well.

CONCLUSION

Based on the results of research and discussion, it can be concluded that the mind mapping-based CPS learning model can improve four indicators of creative thinking skills which tend to be motivated by the activeness of students constructing their own knowledge in providing ideas or solving given problems. Moreover, creative thinking patterns for each different category where students in solving problems tend to start with understanding the problem, linking scientific theory with their own knowledge, and then developing based on experience and reasoning. Furthermore, the student's learning interest is in good criteria, and there is a positive and significant relationship between student's interest in learning and the four indicators of creative thinking skills.

This research is limited to measuring the creative thinking skills and student's learning interest about temperature and heat, so it needs to applied in other physics materials in order to get results about student's creative thinking skills and learning interest. As for further research, it can develop learning modules that can develop and improve student's creative thinking skills and interest in learning. Moreover, there are difficulties in analyzing creative thinking skills and student interest in learning based on the mind mapping created by students. Therefore, for further research, an appropriate instrument needed to analyze this.

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