



Thinking Process Profile of Senior High School Students in Physics Problem-Solving: Terms of Differences in Emotional Intelligence Levels and Gender

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Abstract

This literature study aims to obtain the thinking process profile of senior high school students in physics problem-solving based on differences in emotional intelligence levels and gender. In this study used literature study method with phenomenological analysis, functionalism analysis, and critical analysis. The sources used to compile this article include some literature on emotional intelligence, gender effect, thinking process, problem-solving, and several empirical study on students in physics problem-solving, especially in senior high school. The authors summed up the conclusions based on the results of the literature study as follows: (1) The profile of the thinking process is influenced by emotional intelligence level and gender; (2) Emotional intelligence is directly proportional to the thinking process of students in the process of solving physics problems; (3) Students who have high emotional intelligence are more likely to have high physics problem-solving skills; (4) Gender differences (male and female) in solving physics problems, generally, are still debatable, in which sense is it better? Then it further research needs that is valid and reliable to answer this question. (5) There is a strong tendency that the male gender is more resilient in dealing with and solving complex physics problems; (6) The gender of female students is superior in solving physics problems that require very high detail. The main implication of this article is to obtain the thinking process profile of senior high school students in physics problem-solving based on terms of differences in emotional intelligence levels and gender.

Kata Kunci: Emotional Intelligence; Gender; Physics Problem-Solving; Thinking Process

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INTRODUCTION

The growth and development of increasingly complex globalization encourage educational experts to think and strive to help young people become reliable problem solvers. To develop a student's problem-solving ability is not enough with cognitive thinking exercises, but it also needs to be balanced with emotional development through the problem-solving process. A student with high emotions does not easily collapse and give up despite facing various obstacles (Lukman, 2014). A student with high motivation and emotions is more focused on things to be resolved, is not easily tempted, and switched to other things. The student is not easily discouraged and can postpone desires that are not according to solve the problem (Gendolla, 2017).

Experts believe that humans' thinking skills and skills in the problem-solving process can be transferred to various areas of life. Therefore, good problem-solving can help someone better understand the information around them (Cook, 2012; Docktor, Strand, Mestre, & Ross, 2015; Hidayatullah, Ariyanto, Mubarok, & Yohannes, 2020; Klegeris, Bahniwal, & Hurren, 2013; Mafakheri, Malkhalifeh, Shahvarani, & Behzadi, 2013). Teenagers in solving problems prefer to fight muscles rather than sit together and talk about problems that occur. Emotional immaturity in adolescence results in problems being resolved inappropriately. When faced with emotional discomfort, not a few teenagers face it defensively to protect their weaknesses or even react in aggressive behavior such as fighting, fighting, fighting, and being annoying. The students in adolescence are still looking for their identity, want to experiment, have easy emotions, and lack control over their feelings.

Adolescence has been divided into three levels: early adolescence: 12-15 years, middle adolescents: 15-18 years, and late adolescence: 18-21 years

(Gunarsa & Yulia, 2008). So, the age of 15-18 years is the beginning of emotional turmoil and looking for an identity. High school students are generally in the age range of 15-18 years, so it would be better if emotions in high school had received attention so that they could control them in the next adolescence or even in adulthood.

The current generation experiences many emotional difficulties, which encourage psychologists to look for causes as well as solutions in overcoming emotional difficulties because they also appear to affect other factors, such as learning outcomes and solving physics problems. Emotion is the body's reaction to certain situations. Recent psychological developments mention the emotional intelligence factor. Emotional intelligence is the ability to recognize one's own emotions, the ability to manage and express one's own emotions, the ability to motivate oneself. This is in line with the opinion of Moayedid et al. (2014) stated that emotional intelligence is the ability of students to control emotions to manage stress in dealing with pressure in problem-solving.

Several studies have shown a relationship between emotional intelligence and physics learning outcomes of high school students. The results of Maulana's (2012) study showed a positive relationship between emotional intelligence and physics learning outcomes. This study also informs that educators must guide and motivate students to explore their emotional intelligence, and it is hoped that students can use their emotional intelligence to achieve the desired learning outcomes. This emotional intelligence strengthens students' mentality and will be helpful in their lives in the family, school, and social community.

According to Mahulae's (2013) study, revealed that there was a positive relationship between emotional

intelligence and learning motivation with the results of learning engineering physics students of competency in light vehicle engineering expertise. The results of the above studies indicate that emotional intelligence affects students' physics learning outcomes. In other words, students who have high emotional intelligence will get high physics learning outcomes as well as learning motivation affects student learning outcomes. Students who have high learning motivation will get high results.

The importance of this literature study is carried out because, in addition to cognitive factors, emotional intelligence also affects students' academic achievement in physics. As the research results conducted by Bodin & Winberg (2012) showed that students' emotional intelligence also affects their problem-solving skills in physics education. Such as the difficulties of adolescents in controlling and managing emotions.

In the other hand, there was few literature study to sum up several empirical studies on physics problem solving, especially in difference level of emotional intelligence and gender. Therefore, this study focuses on literature studies to obtain a profile of senior high school students' thinking processes in solving physics problems in terms of differences in the level of emotional intelligence and gender.

METHOD

This study used literature study method with phenomenological analysis, functionalism analysis, and critical analysis. The sources used to compile this article include some literature on emotional intelligence, gender effect, thinking process, problem-solving, and several empirical study on students in physics problem-solving, especially in senior high school. This literature includes journal articles, books, theses, online articles, and surveys. In this study used the last three years of empirical

studies in period of 2019-2021. The various sources of literature were analyzed, thus, the authors found about the profile of thinking process in senior high school students in physics problem-solving.

DISCUSSION

Thinking Process

A process is a series of actions or events that occur naturally. Thinking is a mental activity that connects the pieces of knowledge possessed. The thought process involves students' mental activities when receiving information, processing information, storing information, and recalling information if needed. The thought process profile is a complete and natural picture of a series of mental activities carried out by students when receiving information, processing information, storing information, and recalling information (Ackerman, 1992).

Emotional Intelligence

The word emotion comes from the French emotion, from the word *emouvoir*, which means joy. In addition, emotion also comes from the Latin *emovere* which means "outside" and *movere* which means "to move". Emotional intelligence is the student's ability to control emotions to manage stress in dealing with pressure in problem-solving in a certain way (Domínguez-García & Fernández-Berrocal, 2018).

Physics Problem-Solving

In essence, physics is a process and a product of the study of natural phenomena. The student's ability to organize and apply physics knowledge in a hierarchically well-structured manner also influences the problem-solving process. The trend of physics problem-solving research is still a cutting-edge topic, as seen from the many recent studies in the last three years.

Several studies of physics problem-solving in 2021, such as Cheng and Zhang (2021) used deep learning method based on physics informed neural network with resnet block for solving fluid flow problems. Fumia and da Silva (2021) utilized the conformal mapping as an aid for solving problems in physics. Lestari and Deta (Lestari & Deta, 2021) examined the correlation between physics problem-solving skill and metacognitive ability from collaboration of socratic dialogue-modeling instruction implementation. In addition, Murshed, Phang, and Bunyamin (2021) carried out study about transformation of multiple representation in real world physics problem solving. Moreover, Rezeki, Rokhmat, Gunawan, Makhrus, and Wahyudi (2021) implemented the causalitic-learning devices to improve creative thinking ability and problem-solving of students in physics.

In 2020, some research on solving physics problems have been carried out. For example, Álvarez, Torres, Gangoso, and Sanjosé (2020) conducted study about cognitive model to analyse physics and chemistry problem-solving skills, and mental representations implied in solving actions. Bancong and Song (2020) Exploring how students construct collaborative thought experiments during physics problem-solving activities. Naqiyah, Rosana, Sukardiyono, and Ernasari (2020) developed instruments to measure physics problem solving ability and nationalism of high school student. Burkholder, Miles, and Layden (2020) created a template for teaching and assessment of problem solving in introductory physics. Good, Marshman, Yerushalmi, and Singh (2020) examined the graduate teaching assistants' views of broken-into-parts physics problems, the preference for guidance overshadows development of self-reliance in problem solving. Furthermore, Lindfors, Bodin, & Simon (2020) used unpacking students'

epistemic cognition in a physics problem-solving environment.

On other hand, research on solving physics problems also carried out in 2019. Such as Balta and Asikainen (2019) examined the introductory students' attitudes and approaches to physics problem solving in major, achievement level and gender differences. Baum (2019) solved some "calculus-based" physics problems with trigonometry. Istiyono, Mustakim, Widiastuti, Suranto, and Mukti (2019) measured the physics problem-solving skills in female and male students by phystepross. Moreover, Lucas and Lewis (2019) conducted study about high school students' use of representations in physics problem solving.

Characteristics of Senior High School Students

High school students who are generally 16-18 years old. Based on Piaget's cognitive development stages, these students are already at the formal operation stage, where at this stage, students can handle hypothetical situations and abstract thinking processes. Thinking at this stage is more logical, solves problems, and thinks scientifically, which is included in higher-level thinking (Mubarak, Suprpto, & Adam, 2019; Ormord, 2008).

The Relationship between Emotional Intelligence and Gender in Problem-Solving

The general belief is that men are more likely to use logic and reason, while women tend to use feelings (emotions) in their daily life. A woman is more sensitive and easy to express her feelings. This belief encourages psychologists to research the emotions of men and women. There are differences in emotional intelligence in men and women that are found in the main factors. The research results by Sanchez et al.

(2008) suggest that if we want to look for emotional differences, we must return to childhood because these competencies are formed at this time. This statement is supported by studies conducted by David et al. (2013). Parker also conducted similar research, et al. (in (Parker et al., 2010)) found that emotional and social competence are strong predictors of academic success.

Several studies have shown a relationship between emotional intelligence and high school students' physics learning achievement. The results of the research by Kurniadi et al. (2013) show that in junior high school physics learning in Sampang, it is found that there is a difference in the effect of high and low levels of emotional intelligence on students' physics learning achievement. This means that if the student's emotional intelligence is high, then the physics learning achievement will also be even higher. Purwani's (2013) research results on high school learning show a positive relationship between emotional intelligence and academic achievement. Research carried out by Kvapil (2007) entitled the effect of emotional intelligence on academic achievement of high school students with poor student backgrounds, found a finding that supports the hypothesis that there is a relationship between emotional intelligence and academic achievement of students with poor backgrounds.

Some of the research above is reinforced by the results of research by Ekawati (2010), which concludes that there is a significant influence between intellectual intelligence (IQ) and emotional intelligence (EQ) on physics learning achievement. The results of these studies indicate a need to improve attitudes of emotional maturity and motivation, and to control or reduce self-anxiety, physical achievement in particular and academic achievement, in general, can be better. Attitudes towards physics lessons and physics learning

habits in these studies are self-motivating factors.

Based on the results of previous studies, the authors conclude that, in general, the emotional intelligence of girls is higher than the emotional intelligence of boys. This difference is due to differences in the treatment of parents towards their children in childhood.

Thinking Process Profiles, Emotional Intelligence, Gender, and Problem-Solving

The thinking process and emotional intelligence cannot be separated from each other in solving a problem. Both thought processes and emotional intelligence go hand in hand. There are five factors that support emotional intelligence, namely recognizing, managing and expressing, self-motivation, empathy, and building relationships. Problems faced by students are sometimes not easy to solve, so motivation and persistence are needed. This means that students in solving problems should not give up. In the process of solving problems, sometimes someone needs help or other people's opinions. The solution to the problem or the solution obtained is the result of collaboration between thought processes and emotional intelligence. Students in solving problems carry out a thought process, need persistence, motivation, and the ability to build relationships. Persistence, motivation, and the ability to build relationships are components of emotional intelligence. The process of thinking and emotional intelligence is an integral part of humans who are inseparable. The relationship between thought processes, emotional intelligence, and physics problem-solving can be illustrated in Figure 1.

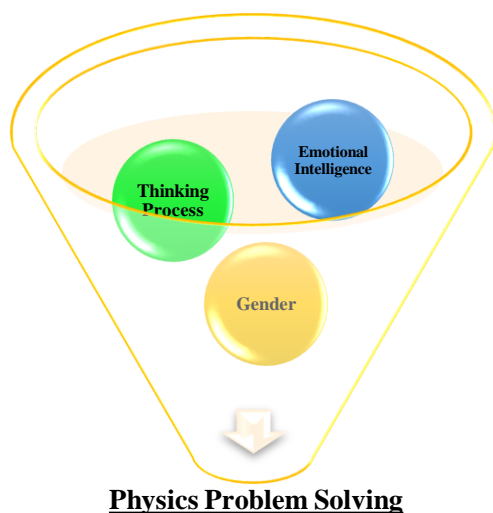


Figure 1 Linkage of Thought Processes, Emotional Intelligence, Gender, and Physics Problem-Solving

To find out, if a student is doing problem-solving activities, it is necessary to investigate it by the researcher. Researchers explore activities and thought patterns in solving these problems and what they will feel in their feelings with in-depth interviews so that students' thought processes in solving problems are known.

Research conducted by Rahardiani et al. (2010) concluded that there was a negative and significant relationship between adversity intelligence and the intensity of cheating in lessons. If the higher the adversity intelligence, the intensity of cheating in the lesson will be lower and vice versa. Students with high anxiety levels did not perform as well as students with low anxiety levels on some types of assignments. The tasks in Sarosan's research are those characterized by challenges, difficulties, and performance assessments within a certain time limit.

Further research conducted by Parker et al. (2010) concluded that emotional intelligence is a very strong predictor of academic success. The study also found that women have higher emotional

intelligence scores than men. Emotional intelligence and its influence on physics in particular encourage the authors to focus on research on the profile of high school students' thought processes in solving physics problems in terms of differences in emotional intelligence and gender.

This is in line with the results of research conducted by Aremu et al. (2006) suggest that there is a positive relationship between emotional intelligence and academic achievement. The results of Lucas's (2014) study suggest that a lot of literature and several findings indicate that women generally have a higher average score than men on physics problem-solving tests. Further research on the differences in emotional intelligence in men and women as a whole.

Based on the literature study conducted by researchers, it was found that (1) the profile of the thinking process is influenced by emotional intelligence and gender; (2) Emotional intelligence is directly proportional to the thinking process of students in the process of solving physics problems; (3) Students who have high emotional intelligence are more likely to have high physics problem-solving skills; (4) Gender differences (men and women) in solving physics problems, in general, are still debatable, in which sense is it better? So it needs further research that is valid and reliable to answer this question. (5) There is a strong tendency that male gender is more resilient in dealing with and solving complex physics problems; (6) The gender of female students is superior in solving physics problems that require very high detail.

This literature study is reinforced by the results of a preliminary study by researchers in the tenth grade of Senior High School 19 Surabaya through observations and interviews of students and teachers, namely: 1) male students speak more disrespectfully and make

class noise more often than women; 2) Female students are more diligent in taking notes and doing assignments given by the teacher than male students; 3) Female students are more careful when carrying out experiments in the laboratory and are more thorough and tidy in solving problems in the worksheet during the experiment; 4) Teachers find it easier to manage female students than male students in classroom and laboratory learning. Furthermore, there has been no research in the field of physics that specifically examines the thinking profile of high school students in solving physics problems in terms of differences in levels of emotional intelligence and gender, especially during the Covid-19 pandemic.

Implication of the Study

This article describes the profile of the thinking process of high school students in solving physics problems in terms of differences in the level of emotional intelligence and gender, so that it is expected to be useful as follows. (1) As a contribution to cognitive psychology theory, especially in the profile of students' thought processes in solving physics problems related to emotional intelligence and gender. (2) As a material for developing research related to the profiles of thought processes, emotional intelligence, and gender. (3) The results of this study on the profile of students' thought processes in solving physics problems related to emotional intelligence and gender can be used as consideration for designing learning or learning models by paying attention to students' emotional intelligence and gender.

CONCLUSION

The researcher summed up the conclusions based on the results of the literature study as follows. (1) The profile of the thought process is influenced by emotional intelligence and gender; (2)

Emotional intelligence is directly proportional to the thinking process of students in the process of solving physics problems; (3) Students who have high emotional intelligence are more likely to have high physics problem-solving skills; (4) Gender differences (men and women) in solving physics problems, in general, are still debatable, in which sense is it better? Then the needs further research is valid and reliable to answer this question. (5) There is a strong tendency that the male gender is more resilient in dealing with and solving complex physics problems; (6) The gender of female students is superior in solving physics problems that require very high detail. The main implication of this research is to obtain the thinking process profile of senior high school students in physics problem-solving: terms of differences in emotional intelligence levels and gender. The limitations of this literature study are still limited, and some research results. Further research can be carried out with a research structure in the form of a systemic review to obtain more valid and reliable conclusions. In addition, learning innovations can also improve the quality of senior high school students' physics problem-solving skills.

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