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THE ANALYSIS OF THINKING STYLE AND CONFIDENCE LEVEL IN SOLVING PHYSICS PROBLEMS

Ria Rahayu✉[1], Saminan[2], and Mursal[3]

[1]Graduate Science Education, Syiah Kuala University Banda Aceh, Indonesia
[2]Physics Education, Teacher Training and Education Faculty, Syiah Kuala University Banda Aceh, Indonesia
[3]Physics Major, Mathematics and Science Faculty, Syiah Kuala University Banda Aceh, Indonesia

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Abstract

The ability to solve problems is a vital part to be developed for students in the teaching and learning process. The objective of this research was to identify different stages of ability in solving physics problems regarding thinking styles and confidence level and the correlation between the two variables and the ability to solve physics problems. A quantitative method with the cross-sectional design was used in this research. All of the second-grade students in natural science program of State Senior High School 5 Banda Aceh ware the population members while 30 students ware chosen as the samples by using random sampling technique. A test measuring the ability to solve physics problem and a questionnaire measuring thinking style and confidence level of the students ware used as the research instruments. The data that had been collected ware then analyzed by using one way ANOVA test. The results indicated that there was a significant difference in the ability to solve physics problems regarding thinking style and confidence level of the students. Moreover, it was also found that there was a correlation between the two variables and the ability to solve the physics problem
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✉Corresponding author:
Ria Rahayu
[1]Darussalam, Banda Aceh
Telp. (0651) 7410241 Postcode 23111
E-mail : rahayu_a94@ymail.com

INTRODUCTION

The students' ability in solving physics problems in Indonesia is not satisfying. Problem solving is the most important competence that have to be owned by the students as it is in the Indonesian Government Regulation Number 69 Year 2013 about Curriculum Structure SMA/MA (Saputi & Wilujeng, 2016). A lot of attempt have been done by the government and teachers, but our students ability in solving problem is still low. The low achievement is depicted in a study conducted by Trends International Mathematics and Science Study (TIMSS) over years and Indonesian students are always under the international standard (Novianawati, 2015). Difficulties in problem solving can also be seen from the result of national examination, like the one that happened in Senior High School 5 Banda Aceh, the average score for the national examination for phyiscs subject is low which is only 54,95 in 2015/2016 and in 2016/2017 it was only 30,96 (Education Department of Aceh Province, year 2016-2017).

From the observation, it was obtained that students have various ways in answering the questions. Some students would solve it by using logical competence, some others would do mathematical competence but not following a certain procedure, and some others would do procedural mathematical competence. The systematicity in problem solving is different from one another depending on the thinking style. Different thinking style make the information that is accepted by the learners are learned in different ways, too, and this resulting in their way to solve problems (Lestanti *et al*., 2015; Rosyida *et al*., 2016). There are four thinking style as developed by Anthony Gregorc in (DePorter & Hernacki, 2009:124) based on the brain domination. From the research conducted by Suriana *et al*., (2016) it showed that from the four thinking style type, those who use sequential abstract are better in comprehending concepts compared to random abstract, random concrete, and sequential concrete.

The process of problem solving is closely related to self-confidence. Based on the observation, it was found that there are a lot of students who are not confident in solving problems for physics subject. It can be seen when the teacher gave a chance for students to rewrite their answer on the board, moat of them admitted that they did not get the answer because they think that their answer is wrong and other friend's answer is correct. According to Kholiq *et al*., (2016) students who do not have knowledge and specific strategy in solving the problem that they are facing shows that they do not have independence and confidence in learning. Confidence gives huge impacts on students' behavious in the classroom and toward his/her achievement, so that it also impacts to the ability of problem solving (Ozturk & Guven, 2016). Furthermore, Ormrod (2008:22) also states that students with high confidence can achieve high achivement because it can involve higher cognitive level in thinking.

Based on the problems that have been elaborated above, it is very important to study in-depth to know more about the correlation between thinking style (random abstract, random concrete, sequential abstract, and sequential concrete) differences confidence level (high, medium, and low) toward their ability to solve physics problems. Besides, it can be used to see the relationship between thinking style differences and confidence level toward their ability to solve problems. This article is advantageous to add knowledge about individual characteristics concerning the between thinking style differences and confidence level in solving problem so that it can help teachers to plan and design learning activities.

METHODS

This research used quantitative method using cross-sectional design (Arikunto, 2006:9). The study was conducted at Senior High Scool 5 Banda Aceh in the odd semester year 2017/2018. The population was all students in second-grade natural science program which were 150 students. While the sample was second-grade of the first natural science program which were 30 students who were chosen using random sampling technique. The choosing process using random sampling technique because the population is homogenous, this is based on the formative test for physics subject in the even semester year 2016/2017.

This experiment did not give any treatments, so the data collection process was only done by distributing the test and with time allocation 2 x 45 minutes. The instrument used was questions about the students ability in solving physics problems, questionnaire on thinking style and self-confidence. The test

consisted of 5 essay questions to figure out the students ability in solving physics problems. The result is usable in giving score to five problem solving indicators on physics problems (Minnesota model) which is problem focus, physics description, plan the solution, execute the plans, and evaluate the answers. Later on, the questionnaire on thinking style and self-confidenceconsisted of 15 questions which was developed by John Le Tellier and adopted from Anthony Gregorc to identify the students thinking style. And there are 40 items for the questionnaire on self-confidence using Likert scale to identify the students' level of confidence.

The data analysis used in this study was statistical parametric analysis with the one-way analysis of variance (ANOVA). The statistical test was used to see the the average differences in more than two independent variable group (thinking skill and confidence level) toward one dependent variable (physics problems).

RESULTS AND DISCUSSION

Results on the Analysis of Students' Ability to Solve Physics Problems Regarding the Thinking Style

Based on the questionnaire of thinking style of 30 students, there are 13 students (43,3%) have random abstract style, 3 students (10%) have random concrete style, 5 students (16,7%) sequential abstract style, and 9 students (30%) sequential concrete style. To be clear, below is depicted the students' ability to solve physics problems regarding the thinking style in Figure 1.

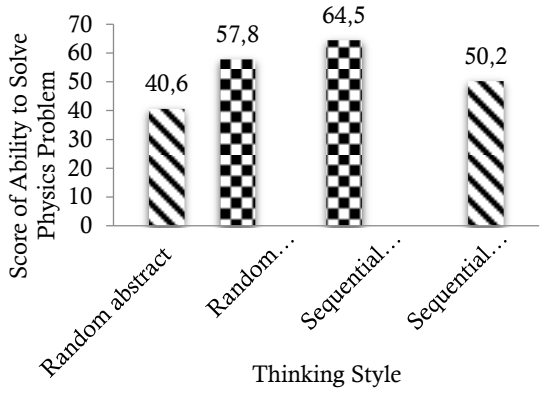

Figure 1. Ability to Solve Physics Problems Regarding the Thinking Style

Based on Figure 1, it can be seen that the students with thinking style of random abstract get the score 40.6 for problem solving and they are in "less" category; random concrete got score of 57.8 and they are in the category "enough"; sequential abstract gained 64.5 and in the category "enough", and sequential concrete got 50.2 in "less" category. Based on te result, it can be said that students with sequential abstract can solve physics problems better systematically and in detail. Students with sequential abstract can analyze information in detail and more successive elaboration. Besides, they can choose more solutive approach in problem solving, so that the problem solving process can be done sooner. This result is in line with several research results stating that sequential abstract students are better in problem solving because they can process information in more linear and regular ways. In addition, they are smart, logical, rational thinkers who have brilliant ideas (Setyawan & Rahman, 2013; Sutriningsih, 2015; Susanti *et al.*, 2017; Muliana *et al.*, 2017).

Based on the one-way ANOVA statistical test, it was obtained that $F_{count(36,166)} > F_{table(2,98)}$ which means that alternate hypothesis is accepted, this means that there are significant difference in students' ability in solving physics problems regarding the thinking style. The difference is caused by the various manners in processing information among students. According to Lestanti *et al.*, (2015) various information processing among students can affect students' success in problem solving. This is seen as a result of students' various thinking style which can help the process of reflection, interpretation, and finding out strategies for the problems that are faced.This result can be seen in problem solving which is done by the students with random abstract thinking style who process information in a rather irregular way. They also cannot sequene information and state problem solving purposes, this leads to misunderstanding in comprehending a certain question that bring about the mis-answering, afterward. Later, students with random concrete thinking style can understand a problem as a whole. This is can be seen through the approach that they use is already appropriate and detailed. Then, those with sequential concrete cannot fully develop their logic in solving problem which can be seen in their answers that contain measuring units and weighing units, they tend to put it in an interchanged way; however, regarding the

mathemathical explanation, they can do it systematically.

Further, it is clear that every student has certain characteristics in problem solving, whether in accepting information, observing, or process the information. Students with random abstract thinking style tend to solve problems irregularly, less systematic, not detailed, and less holistical. Those with random cocnrete tend to process information less structured and detailed. Those sequential abstract tend to process informatioin systematically, detailed and regular; while those who are sequential concrete tend to be systematic and irregular. This result is in line with the finding from Bancong (2014) that states that students with random abstract are tend to be less irregular and incomplete in processing information, students with random concrete can process the information completely but they usually state irregularly. Students with sequential abstract can do detailed and systematic while students with sequential cocnrete are detailed but not holistical.

Analysis on Ability to Solve Physics Problem Regarding the Self-confidence

Based on the questionnaire, from 30 students there are 13 students (43,3%) with low confidence with score 38,7. Medium confidence was obtained by 8 students (26,7%) with score 57,8. High confidence was gained by 9 students (30%) with score 77,3. To be concise, results on the students' ability to solve physics problem regarding the self-confidence can be seen in the following Figure 2.

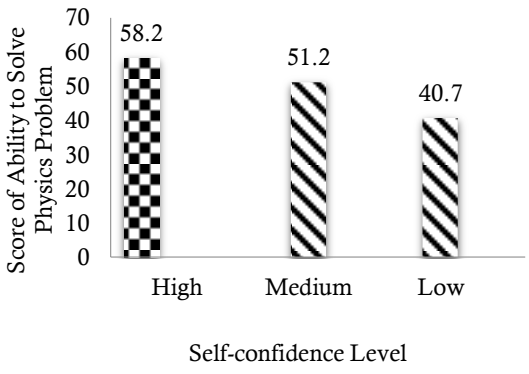

Figure 2. Ability to Solve Physics Problem Regarding the Self-confidence

Based on the analysis above, it is obtained that students with higher self-confidence can solve problems better. This is because their strong willingness, so that they try as hard as possible to settle the problems and to get the result as they expect. Besides, in solving problems, students with high self-confidence also involved their cognitive ability to achieve the expected purposes. This result is inn line with some reseacrh results stating that the higher the self-confidence is, the better the ability in solving problem is. This is as a consequence of the students with higher self-confidence tend to struggle for their intention toward the achievement that they expect so that they will get successful in learning (Fitriani, 2016; Srimadevi & Saraladevi, 2016; Surya *et al*., 2017).

From one way ANOVA $F_{count(44,954)} > F_{table(3,35)}$ which means that alternate hypothesis is accepted, this means that there are significant difference in students' ability in solving physics problems regarding thier self-confidence. There are differences in their ability to solve physics problems regarding the self-confidence because cognitive factors which are related to belief in self ability, affective factors which are related to motivation, and psychomotoric factors which are related to willingness and efforts. These three factors are indicator components from self-confidence that all students should own. This is can be seen that a students with medium self-confidence is already doing problem solving although there is a propensity to be incorrect, while those with low self-confidence are not doing any of it. On the medium level of self-confidence, although there are difficult questions, they still try to find easier questions to finish. On the low level of self-confidence, once they failed in doing easy questions, they will completely stop trying for a little harder questions because they belief they are not able to do it and they surrendered. Based on the result, it can be seen that not all students have all of those three factors in growing their self-confidence; this is what caused their ability in solving physics problems is influenced by their self-confidence.

This result is in line with the finding of Jatisunda (2017) stating that the accurate self-confidence is an important thing in doing tasks. Higher self-confidence eases students in doing tasks and it can increase their achievements. Besides, Susilo *et al*., (2012) urges that with self-confidence, students will be more motivated and

are fond of a certain subject so that the learning achievement can incline eventually.

Analysis on the Relationship between Thinking Style and Confidence Level in Solving Physics Problems

Thinking style and self-confidence have positive correlation in students' ability in solving physics problems. Based on the result, there are 13 students with random abstract who are in "less" category in solving physics problems, 11 of them are low confident, one of them is medium, and one of them is high. There are 3 students with random concrete who are in "enough" category in solving physics problems, two of them have medium confidence, and one of them is high. There are 5 students with sequential abstract who are in "enough" category in solving physics problems, all of them have high confidence. There are 9 students with random concrete who are in "less" category in solving physics problems, five of them have medium confidence, two of them is high, and the other two are low.

Based on the analysis, it can be concluded that there are positive correlation between self confidence and thinking style in the students ability in solving physics problems. This is because students who have a good sense of confidence will try to achieve the desired goal in learning by involving the ability to think. This is what caused students with sequential abstract to have higher confidence in solving physics problems with category "enough". On the contrary, students with random abstract has the lowest self confidence in solving physics problems with category "less". This is also as stated by Ormrod (2008:22) who states that students with high self-confidence can reach awesome level in learning achievement because they are negaged to think in the cognitive process so that they can increase their leraning, pay more attention, organize, and elaborate information. Several previous studies have also shown that there are positive correlation between thinking style and self-confidence toward learning achievements. This is possible because a students with high self-confidence can control his/her way of learning which influences the results attained (Masarmi *et al.*, 2015; Alanood *et al.*, 2014).

From the elaboration above, it can be claimed that psychological factors such as thinking style in receiving and processing information—including cognitive aspects, affective aspects, and psychomotoric aspects in the level of self-confidence—influence students ability in solving physics problems. Then, it can be said that teachers can design a learning strategy which best suits the each thinking style and help student increase their confidence. One of these strategies by using the scientific approach which have 5 steps in it, they are observing, questioning, inquiring, applying, and communicating. This is because the fact thatstudents with random abstract thinking style can easily receive information through observation, students with random concrete thinking style can easily receive information through applying, students with sequential abstract thinking style can easily receive information through inquiring, and students with sequential abstract thinking style can easily receive information through communicating. As it is stated by DePorter & Hernacki (2009:130-135) that students with random abstract will understand easier if the teaching material is given through visualization, random concrete through direct experience, sequential abstract through inquiry, and sequential concrete through verbal explanation. This result is in line with some other research result stating that scientific approach can increase students ability in thinking and their self-confidence in problem solving (Mustakim, 2015; Sari *et al.*, 2015; Nahdliyati *et al.*, 2016).

Briefly, the result obtained from this research outlines that students with sequential thinking style is more appropppriate in mathematical problem solving because they tend to process information in more detailed and systematic which the common characteristics in physics problems that involve counting. Later, students with random thinking style is more appropriate in solving social problems. This is as stated by DePorter & Hernacki (2009:36-38) that sequential thinkers are dominated by left brain hemisphere making them become more regular, logical, linear, and rational. Meanwhile, thinkers are dominated by left brain hemisphere making them become more irregular, intuitive, and holitical.

CONCLUSION

There are significant differences in the students' ability to solve physics problems regarding the students' thinking style (random

abstract, random concrete, sequential abstract, and sequential concrete) and confidence level (high, medium, and low); and there is a positive correlation between thinking style and confidence level toward the students' ability in solving physics problems in students at second-grade natural science program at Senior High School 5 Banda Aceh.

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