

The relationship between achievement motivation, metacognitive awareness, attitudes and problem-solving abilities in students

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Suggested Citation:

Yunus, M, Setyosari, P, Utaya, S, Kuswandi, D, Amirullah, & Rusdi, M. (2021). The relationship between achievement motivation, metacognitive awareness, attitudes and problem-solving abilities in students. *Cypriot Journal of Educational Science*. 16(1), 32-45. <https://doi.org/10.18844/cjes.v16i1.5506>

Received from October 20, 2020; revised from November 17, 2020; accepted from December 14, 2020.

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Abstract

Achievement motivation, metacognitive awareness, and students' attitudes related to problem-solving abilities are less sensitive due to the limited effect of civic education in higher education. Therefore, the purpose of this research is to determine the relationship between the above-mentioned variables in students. The correlational method is used to determine the relationship between variables with data obtained from 148 students from three universities in Indonesia. The instruments used were questionnaires and test descriptions. The data obtained were analysed using the multiple regression analysis. The results showed that problem-solving abilities had a positive relationship with the following aspects: achievement motivation, metacognitive awareness, students' attitudes towards learning, and simultaneously, achievement motivation, metacognitive awareness and attitudes. This research confirms that civic education lecturers need to pay attention to achievement motivation, metacognitive awareness and attitudes of students related to learning strategies in improving the ability to solve problems. It is recommended that lecturers examine other variables that might affect the problem-solving ability, including collaborative learning models, and other models that demand student participation.

Keywords: Achievement motivation, metacognitive awareness, student attitudes, problem-solving ability

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1. Introduction

In this 21st century, it is important for every individual to possess problem-solving abilities because it relates to all areas of human life (Danju & Uzunboylu, 2016; Haryono et al., 2017). Problem-solving is a collaborative approach to discovering and implementing complex new solutions for dilemma (Manassis, 2012). However, to acquire this paradigm, change is needed in order to improve problem-solving abilities (Kivunja, 2014). Students' ability to solve problems is not optimal if it is not supported by adequate infrastructure (Cumhur & Sarikaya, 2020). Therefore, this rationale provides an understanding associated with the problem in the field of civic education. On the contrary, achievement motivation is among the several factors that tend to influence problem-solving abilities.

Achievement motivation is an individual's struggle in getting something that is desired, such as physical satisfaction, praise and appreciation from others (McClelland, 1985; Yunus et al., 2020). Achievement motivation is a psychological phenomenon that is very diverse and complex, and sometimes theories conflict and support one another (DeCaro et al., 2015). Achievement motivation is the characteristics of students to achieve the maximum level of excellence and satisfaction towards the mastery of a skill (Singh, 2011). Similarly, achievement motivation is one of the factors that influence their abilities in a particular field of study with positive learning outcomes.

According to this research, it was concluded that it influences and contributes to the improvement of reading skills (Astuti et al., 2018) and students' academic achievement (Kaur, 2013; Zhu & Leung, 2011). The results of the study also reveal that there is a relationship between achievement motivation and mathematical problem-solving abilities (DeCaro et al., 2015). Therefore, mathematical abilities are predicted to contribute to achievement motivation (Sings et al., 2002); in fact, it significantly correlates with entrepreneurial performances (Collins et al., 2004). Achievement motivation and citizenship problem-solving abilities have not been found in the research results; therefore, one's focus on the investigation is directed towards the relationship between achievement motivation and citizenship problem-solving.

Another important factor that affects problem-solving is metacognitive awareness, which is defined as an individual's awareness of personal knowledge. In addition, the knowledge possessed by the person is managed by planning, controlling and modifying. Students' high or low metacognitive awareness affects their learning ability (Jayapraba & Kanmani, 2013). Generally, a person with high metacognitive awareness has a higher learning outcome. This is supported by the results from studies conducted in various fields. Academic achievement in students with low and high metacognitive awareness differs (Baltaci et al., 2016; Sawhney & Bansal, 2015). This is similar to the study conducted by Akman and Alagoz (2018) said that there is metacognitive awareness with participation in the discussion. Several research works carried out in other fields have shown metacognitive awareness.

Yıldırım and Nur Ersozlu, (2013) reported that metacognitive awareness has a significant relationship with the level of mathematical ability. Its development aids students in solving mathematical problems (Rahman & Hassan, 2017). According to the results from studies conducted by Bars and Oral (2017), it was reported that the perceptions of any prospective teacher concerning metacognitive awareness are used to predict the level of problem-solving abilities. On the contrary, it has been discovered that there are no findings related to the relationship between metacognitive awareness and problem-solving of citizenship.

The attitude of students towards learning activities is an important factor in achieving learning outcomes. Problem-solving ability is an aspect that always relates to students' attitudes towards

learning (Sen, 2013). Problem-solving also requires a variety of scaffolding (Kim & Hannafin, 2011). According to a research study that was carried out in Croatia, it was stated that students and teachers consider civic education as a supplementary course, compared to other subjects such as language and mathematics (Pirsl et al., 2007); this also occurred in Indonesia. However, it was concluded in several studies that students' attitudes have a positive relationship with problem-solving abilities. This ability is dependent on their attitudes towards learning in certain fields.

Therefore, students' attitudes towards learning are positively related. Conversely, the results from some researches based on students' attitudes towards learning reported that age tends to affect it because it was discovered that young students are more positive about learning (Pirsl et al., 2007). Tosten et al. (2017) state that the democratic attitude of parents has a relationship with the ability of students to solve problems. It has also been discovered from previous studies that a positive relationship exists between students' attitudes towards history courses because they derive a sense of pride in their nation (Andrews et al., 2010). Conversely, students' attitudes towards learning strategies are related to problem-solving abilities (Tsai & Tang, 2017).

Ozbek and Susam, (2017) reported that there were differences in the attitudes of prospective teachers towards Civics based on their specialisation and ethnicity. Students' attitudes towards learning mathematics contributed to the achievement and problem-solving abilities. In addition, those with a good attitude towards mathematics have better problem-solving abilities (Mohd & Mahmood, 2011). It was also discovered that female students have better problem-solving abilities in mathematics than their male counterparts (Arslan et al., 2014). In accordance with the review from the studies carried out on the relationship between problem-solving abilities and students' attitudes towards learning, no research has been conducted in the field of civic education. Based on this fact, studies in accordance with the influence of students' attitudes towards learning in order to solve civic problems need to be carried out.

The purpose of this study was to determine the relationship between achievement motivation, metacognitive awareness and attitudes towards problem-solving abilities in students. Specifically, the research objectives are as follows: (1) knowing the relationship between achievement motivation and citizenship problem-solving abilities, (2) knowing the relationship between metacognitive awareness and citizenship problem-solving abilities, (3) knowing the relationship between student attitudes towards learning and citizenship problem-solving abilities and (4) determining whether achievement motivation, metacognitive awareness and student attitudes towards learning simultaneously affect problem-solving abilities. In accordance with the purposes and research questions, the following hypotheses were developed:

- H₁. There is a positive relationship between achievement motivation and civic problem-solving ability.
- H₂. There is a positive relationship between metacognitive awareness and civic problem-solving ability.
- H₃ There is a relationship between students' attitudes towards learning and problem-solving ability in civic education.
- H₄. There is an interaction between achievement motivation, metacognitive awareness, students' attitudes towards learning and problem-solving ability in civic education.

2. Methods

2.1. Research design

This research employed a correlational design, where the relationships between variables are investigated without manipulation (Fraenkel et al., 2012). The correlation technique is a multiple regression design, which determined the relationship between criterion variables and a combination of two or more predictor variables (Gall et al., 2002). In this study, there are three predictor variables, namely achievement motivation (X_1), metacognitive awareness (X_2) and students' attitudes towards learning (X_3). The predictable variable is the problem-solving ability (Y). The multiple regression design of the three predictors is shown in Figure 1.

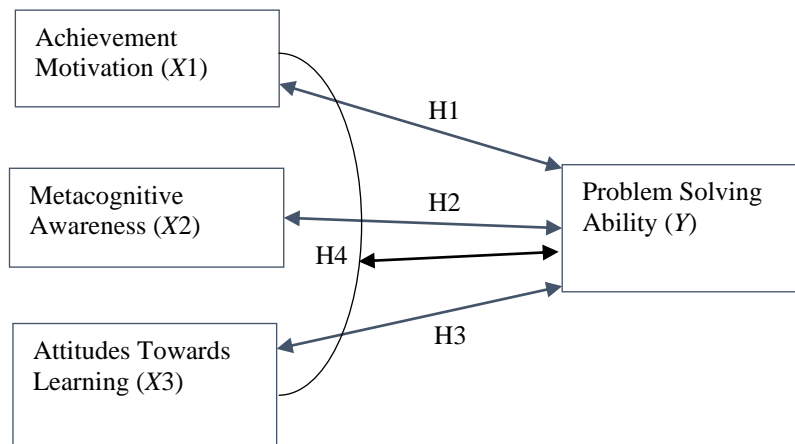


Figure 1. Research design

2.2. Research sample

The research sample consisted of 148 students from three universities in Indonesia. The sample consisted of students who took the Civics course in the odd semester of the 2019/2020 academic year. Sampling was carried out among regional clusters, namely the University of Syiah Kuala representing the island of Sumatra, State University of Malang representing the island of Java, and STKIP Muhammadiyah Bone representing the island of Sulawesi. The sampling technique was carried out by a random sampling method to determine which class met the requirements for the implementation of the learning process by measuring the problem-solving ability in Civics. The classes that were sampled already represent students at universities in Indonesia. The characteristics of the sample are mostly students in the junior or second-year category who have just entered the third semester. They already have previous experience with other general subjects in the first and second semesters. Out of the 148 students, 81 were females and 67 were males.

2.3. Research instruments and procedures

The instrument employed for data collection was essay tests to measure problem-solving abilities. The data for achievement motivation were obtained using a questionnaire sourced from McClelland's

(1985) study, with some modifications, and in addition it had 14 statement items with five alternative answers. The statement items were developed based on the project assignments carried out by the students, and they were divided into four indicators, namely hard work, competitiveness, success and fear of failure. Subsequently, they are further developed into two forms, such as positive and negative statements. The questionnaire instrument was used after testing the validity of the 14 items, and they were all declared valid because the t -count value was greater than that of the t table ($N = 148$), where $df = (N-2) = 0,159$. The results from the reliability test for all items were reliable because the alpha value of the reliability statistics table reached 0.671, which is greater than 0.600.

The metacognitive awareness data were obtained using an inventory developed by Schraw and Dennison (1994). This instrument consists of 25 statement items with four indicators, namely planning, monitoring, evaluating and revising. The instrument is in the form of an attitude scale consisting of the following four alternative answers, namely 1) very incorrect, 2) incorrect, 3) correct and 4) very correct. All statements were developed into positive sentences. The validity and reliability tests were declared valid and reliable because all items have a t -count value above 0.159 and an alpha value above 0.600.

In addition, data on the students' attitudes towards learning civic education was obtained using a Likert scale that was developed independently with adaptations to the instruments created by Wong and Fong (2014). This instrument consists of 26 statement items with three aspects, namely design, implementation and collaboration. All statement items were developed into positive sentences; however, the alternative answer choices consist of four categories: 1) strongly disagree, 2) disagree, 3) agree and 4) strongly agree. Therefore, out of the 26 items, 24 were declared valid and reliable with a t -count value higher than 0.159 and an alpha value greater than 0.600, conversely two items were not included for further processing.

The data collection procedures were carried out before and after the learning process. The achievement motivation and metacognitive awareness data were obtained before the learning process. Meanwhile, data on students' attitudes towards learning and problem-solving ability were obtained after the learning process.

2.4. Data analysis

The data analysis employed the multiple regression method. According to Riduwan (2016), it is an analysis tool used to assess the effect of two or more independent variables on one dependent variable. In this research, the first independent variable (X_1) is achievement motivation, while the second (X_2) is metacognitive awareness and the third (X_3) is the attitude towards learning civic education using the online project-based collaborative model. In addition, the dependent variable (Y) is the problem-solving ability of civic education. The Statistical Product and Service Solution (SPSS) programme version 23.0 was used to conduct the multiple regression analysis.

The data analysis that was conducted using multiple regression techniques started with the requirements test, such as normality, multicollinearity, heteroscedasticity and autocorrelation analyses. The results from the test show that the data fulfilled the requirements for conducting the regression analysis. The normality test is carried out in two ways, namely the normality probability plot and the Kolmogorov–Smirnov analysis. Assuming that the probability plot data (points) shows diagonal lines, the regression model is stated to be normally distributed (Ghozali, 2011). Furthermore,

when the results from the SPSS test show that the points exactly follow the diagonal line, it implies that the normality of the data is verified. This is also shown by the Kolmogorov–Smirnov test in which the sig value is 0.200 and greater than 0.05; therefore, the research data are normally distributed. The multicollinearity test also shows that the research data are free from symptoms. In accordance with the SPSS test in the coefficients table, the tolerance and VIF column of the three predictor variables are greater than 0.100, while the VIF value of all predictor variables is smaller than 10.00. The results from the heteroscedasticity test also show that the data are properly distributed; however, the points spread up and down to zero on the Y-axis. These data also have no autocorrelation symptoms because Durbin Watson’s value in the model summary table of 1,800 is between the values of du and $(4-du)$, which is calculated as $du (1.772) < 1.824 < 4-du (2.227)$. According to Ghazali (2011), autocorrelation symptoms do not occur assuming that the Durbin Watson’s value is between $(du \text{ value})$ to $(4-du)$.

3. Result

3.1. Description of the relationships between variables

The relationship between variables as a whole is presented in Table 1.

Table 1. The relationship between variables
Correlations

		Achievement Motivation	Metacognitive awareness	Student attitudes of learning	Problem-solving ability
Achievement Motivation	Pearson’s correlation	1	0.407**	0.293**	0.459**
	Sig. (two-tailed)		0.000	0.000	0.000
	<i>N</i>	148	148	148	148
Metacognitive awareness	Pearson’s correlation	0.407**	1	0.291**	0.601**
	Sig. (two-tailed)	0.000		0.000	0.000
	<i>N</i>	148	148	148	148
Student attitudes of learning	Pearson’s correlation	0.293**	0.291**	1	0.556**
	Sig. (two-tailed)	0.000	0.000		0.000
	<i>N</i>	148	148	148	148
Problem-solving ability	Pearson’s correlation	0.459**	0.601**	0.556**	1
	Sig. (two-tailed)	0.000	0.000	0.000	
	<i>N</i>	148	148	148	148

**Correlation is significant at the 0.01 level (two-tailed).

Table 1 shows the description of the existence of a significant relationship between variables based on Pearson’s correlation analysis. The p -value < 0.05 is the relationship between achievement motivation with metacognitive awareness, student attitudes towards learning, problem-solving abilities and metacognitive. However, the relationship between student attitudes towards learning and metacognitive awareness is insignificant because p -value > 0.05 .

3.2. Contribution of predictor variables towards problem-solving abilities

The contributions of the three predictor variables are stated in column $R^2 \times 100\%$ of the model summary table. Further details are shown in Table 2.

Table 2. The contribution of predictor variables towards problem-solving abilities simultaneously

Model summary ^b			
Model	R	R square	Adjusted R square
1	0.738 ^a	0.545	0.536

^aPredictors (Constant), attitudes towards learning, metacognitive awareness and achievement motivation.
^bDependent variable problem-solving abilities.

Table 2 shows the value of $R^2 = 0.545$. R^2 value: $0.545 \times 100\% = 54.5\%$. Therefore, the contribution made by achievement motivation, metacognitive awareness and student attitudes towards learning is 54.5%; however, the remaining 45.5% is influenced by other factors.

3.3. The relationship between predictor variables and problem-solving abilities

Achievement motivation, metacognitive awareness, student attitudes and problem-solving abilities have a relationship as stated in the coefficients in Table 3.

Table 3. Relationship between achievement motivation, metacognitive awareness and students' attitudes towards problem-solving abilities

		Co-efficients ^a				
		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	8.853	5.638		1.570	0.119
	Achievement motivation	0.258	0.091	0.177	2.824	0.005
	Metacognitive awareness	0.348	0.052	0.418	6.661	0.000
	Student attitudes of learning	0.388	0.061	0.382	6.373	0.000

^aDependent variable: problem-solving abilities.

The relationship between predictor variables and problem-solving abilities is stated in the coefficients in Table 3 in the sig. column. In order to verify this condition, when the sig. value is less than 0.05, then it is stated to have a relationship or influence. Based on the sig. value in Table 3, it can be concluded that 1) achievement motivation has a positive relationship with problem-solving abilities, when the sig. value is 0.005. 2) Metacognitive awareness has a positive relationship with

problem-solving abilities, when the sig. value is 0.000. 3) Students' attitudes towards learning also have a relationship with problem-solving abilities, when the sig. value is 0.000.

3.4. Simultaneous relationship between predictor variables and problem-solving abilities

The simultaneous relationship is the joint influence between the following variables: achievement motivation, metacognitive awareness and students' attitudes towards problem-solving abilities. The analysis of variance (ANOVA) verifies whether there is a relationship or influence between the variables (Table 4).

Table 4. Simultaneous relationship ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3,953.893	3	1,317.964	57.505	0.000 ^b
	Residual	3,300.378	144	22.919		
	Total	7,254.270	147			

^a Dependent variable problem-solving ability.

^b Predictors (Constant), attitudes towards learning, metacognitive awareness and achievement motivation.

The *F*-test value of the ANOVA table is 0.05, which is used to determine the simultaneous relationship among the variables. Based on Table 4, it is evident that a simultaneous influence exists between attitudes towards learning, metacognitive awareness and achievement motivation towards problem-solving abilities; however, this is due to the sig. value of $0.000 < 0.05$.

In accordance with the formulation of the problem and hypothesis, the results from the research and a review of the hypothesis are shown in Figure 2.

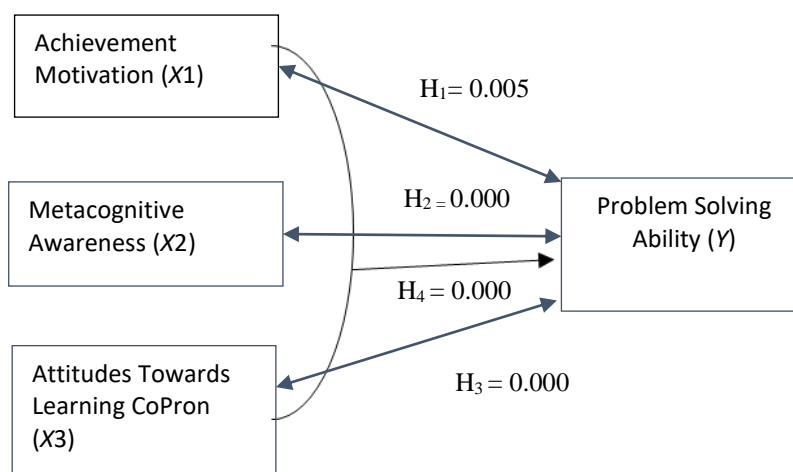


Figure 2. Review of hypotheses

4. Discussion

In accordance with the purpose of this research, the achievement motivation has a relationship with problem-solving abilities. Secondly, metacognitive awareness has an influence on problem-solving abilities. Thirdly, student attitudes in accordance with the implementation of online project-based collaborative learning also have an influence on problem-solving abilities. Fourthly, the three predictor variables simultaneously affect problem-solving abilities. Based on these discoveries, each of the variables is partially discussed.

It was discovered that achievement motivation has a relationship with problem-solving abilities of civic education, and this is stated by the result from the sig. value 0.005. This is in accordance with the provisions that when the sig. value is not more than 0.05, the hypothesis is not rejected (Kadir, 2016). Based on the hypothesis proposed (H1), achievement motivation and civic education problem-solving abilities have a positive correlation. Therefore, it was concluded that achievement motivation is positively related to the ability to solve civic education problems. This discovery is supported by previous research which stated that students with good problem-solving abilities were discovered to be in groups of undergraduates who had a high achievement motivation (Vollmer & Kaufmann, 1975). Subsequently, the results from other studies which support this discovery reported that achievement motivation and problem-solving in mathematics are related (Sings et al., 2002). Problem-solving abilities in adolescents who have a relationship with intrinsically high motivation with a healthy and appropriate humour style (Nayir, 2017; Ridha et al., 2019). Intrinsic motivation, extrinsic motivation has a positive relationship with self-regulated learning (El-Adl & Alkharusi, 2020)

The second discovery stated that a relationship exists between metacognitive awareness and problem-solving ability of civic education, and it is observed in the sig. value of 0.000, which is smaller than 0.05. This implies that the hypothesis is accepted. These discoveries are also supported by previous research which states that metacognitive strategies are positively related to problem-solving performance (Eslami Sharbabaki, 2013). The higher the metacognition of students, the better their problem-solving ability in mathematics (Izzati & Mahmudi, 2018).

Subsequently, the results from other studies stated that students in the problem-solving groups usually exhibit metacognitive feelings (Nielsen et al., 2009). Therefore, it significantly predicts the level of problem-solving ability (Yildirim & Nur Ersozlu, 2013). In addition, it was stated by other discoveries that efforts to develop metacognitive awareness levels are effective with problem-based learning (Tosun & Senocak, 2013).

Thirdly, students' attitudes in accordance with the implementation of online project-based collaborative learning have a relationship with problem-solving abilities, and this is evident in the results from the sig. value of 0.000, which is smaller than 0.05. This also implies that the hypothesis was accepted. Based on the result from another research, it was stated that students' positive attitudes towards learning were effectively obtained through problem-based strategies (Demirel & Dağyar, 2016; Safiah et al., 2020). Furthermore, students' positive attitude towards mathematics strongly correlates with problem-solving abilities (Marchis, 2013).

In addition, students' attitudes towards learning are significantly correlated to algebraic problem-solving abilities (Julius et al., 2018; Salehudin, Sarimin, et al., 2020). This implies that problem-solving learning in science subjects is positively responded to by students (Akinoglu & Tandogan, 2007). Therefore, problem-solving learning is effective in positively influencing the attitudes of students with weak scientific abilities in chemistry (Tosun & Senocak, 2013). Subsequently, it significantly increases understanding, performance and attitudes during mathematics classes (Albay, 2019). There is a relationship between attitude and social problem-solving skills (Ozkan & Aksoy, 2017; Salehudin, Hamid, et al., 2020).

Fourthly, the independent variables, such as achievement motivation, metacognitive awareness and student attitudes towards learning simultaneously, have a relationship with problem-solving abilities in civic education. The results from the ANOVA test showed a sig. value of 0.000 ($p < 0.05$), while the amount of contribution by these variables was 54.5%. This discovery is also supported by the research carried out by Ariyati and Royanto, (2018), which stated that problem-solving abilities is getting better in students affected by positive attitudes and metacognitive strategies. Metacognitive skills and students' motivation are positively correlated to problem-solving abilities in chemical balance (Muna et al., 2017). Metacognitive awareness through problem-solving skills tend to affect mathematical achievements (Rahman & Hassan, 2017).

5. Conclusion

The conclusion of this research is as follows: 1) achievement motivation has a relationship with problem-solving abilities in the field of civic. This influence is caused by hard work, the desire to succeed and the fear of not succeeding in students. 2) Metacognitive awareness also has a positive relationship with problem-solving abilities in the field of civic. This is due to the fact that some students are highly knowledgeable in the aspects of designing, supervising and evaluating. 3) Students' attitudes based on the implementation of learning also have a positive relationship with the problem-solving abilities in civic education. This is because students tend to participate and cooperate in online project-based collaborative learning processes, thereby responding positively. 4) Achievement motivation, metacognitive awareness and student attitudes towards learning have a simultaneous relationship with problem-solving abilities in civic education. This is due to the fact that variables, such as achievement motivation, metacognitive awareness and student attitudes largely (54.5%) contribute to problem-solving abilities.

6. Recommendations

These discoveries have certain implications on the teaching processes involved in civic education, such as the need for the lecturers or instructors to pay attention to achievement motivation, metacognitive awareness and students' attitudes towards learning, particularly in solving civic problems. This consideration is important because of the huge influence by the three predictor variables. However, this study is limited to students in the Faculty of Social Sciences, subsequent research studies are suggested to 1) expand the sample to students in other disciplines, such as non-social majors; 2) compare the effectiveness of online project-based collaborative learning with other models of problem-solving skills; and 3) use other variables that tend to influence the problem-solving ability in civic education possibly.

Acknowledgements

Thank you to the chancellor of Universitas Syiah Kuala Banda Aceh, who helped me to continue my studies in the doctoral programme; Mr. Muhammad Mujtaba Habibi, the coordinator of the Pancasila and Citizenship Education Subject at Universitas Negeri Malang; which has helped researchers in completing this research.

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