The Student's Self-Efficacy in Mathematics Learning as a Part of Non-Cognitive Mapping: A Case Study of MTS N 2 Pemalang

Imam Sayekti
Universitas Negeri Semarang,
Indonesia
mtsnpetarukan@kemenag.go.id

YL Sukestiyarno
Universitas Negeri Semarang,
Indonesia
sukestiyarno@mail.unnes.ac.id

Wardono
Universitas Negeri Semarang,
Indonesia
wardono@mail.unnes.ac.id

Dwijanto
Universitas Negeri Semarang,
Indonesia
dwijanto5@mail.unnes.ac.id

***Abstract*---Self-efficacy is a belief that illustrates the ability of the students to organize and use their potential in dealing with situations and problems. Students usually get difficult to manage their potential to solve the problems during learning process, especially in mathematics. Therefore, this study tries to analyse the junior high school students' self-efficacy as a basis for managing their non-cognitive aspects. The study was conducted in MTS N 2 Pemalang involving 174 students of 8th grade as the respondents. The data were collected using a Likert scale online questionnaire instrument that illustrates the attitude of initiation, persistence and action in the face of learning mathematics. The data obtained were tabulated and analysed using structural equation modelling (SEM) using SmartPLS 3.0. The analysis showed that the act of student initiation reached 68.44 ± 10.98%, while the attitude of persistence reached 69.14 ± 10.23%, and the action in utilizing self-potential was 72.50 ± 12.07%. The contribution of each aspect to self-efficacy is the aspect of initiation by 34.1%, persistence by 19.8% and action by 56.9%. This shows that students still have a low initiation action and are easily experiencing a decrease in interest in learning mathematics, but in terms of execution the action completes the task higher than other aspects. In addition, social environmental problems or peers also have a role in increasing self-efficacy. On average, the self-efficacy of 8th grade students of MTS N2 Pemalang has low self-efficacy.**

Keywords: mathematics, non-cognitive, self-efficacy, junior students

I. INTRODUCTION

Self-efficacy in students is a belief that illustrates the ability of students to manage and use their potential in dealing with their faced situations (1,2) It relates to students' beliefs about their ability to successfully taking over the tasks. It also main determinant in student's passion to complete the task, how much effort will be expended, and how much persistence will be displayed in pursuing the task in the face of the obstacles (3) The ability of self-efficacy is also influenced by, mindset, affective, and behaviour and task performance. Furthermore, students unconsciously have applied self-efficacy abilities to various learning in schools. The form of application of this ability has different manifestations depending on the type of subject, including mathematics.

Mathematics is often regarded as a complex, difficult, boring and unattractive subject (4). Findings related to self-efficacy have shown the achievement of classical understanding and completeness (5,6). Students in mathematics related to student performance in dealing with the form of assignments and the difficulty of the work being done. Specifically, self-efficacy towards mathematics can be distinguished based on measures of students' attitudes in assessing specific problems and completing assignments.

Thus, students' concerns in mathematics need special attention, especially related to self-efficacy abilities. That is because, self-efficacy in mathematics is considered a more important predictor of future performance related to mathematics, and a predictor of mathematics anxiety as well. Therefore, this study aims to identify and analyze student self-efficacy and the potential for development that can be done.

II. METHOD

This research is an exploratory observational study to look at the self-efficacy of students in dealing with mathematical problems. The study was conducted at MTS N 2 Pemalang involving all students from eighth grade, as many as 174 students. Data were collected using a Likert scale online questionnaire instrument that illustrates the attitude of initiation, persistence and action in the face of learning mathematics. The questionnaire used was a closed questionnaire and amounted to 30 items. Before being used, the questionnaire was tested on 36 students randomly in the same school, statement items that were declared invalid and reliable were then not used

in constructing the correlation modelling construction. The data obtained were tabulated and analysed using SPSS 23 for Windows and structurally equation modelling (SEM) using SmartPLS 3.8.

III. RESULT AND DISCUSSION

Response data obtained from students were then analysed using 2nd order path analysis. The correlation construct is built between the latent variables which include initiation, persistence and action variables where each latent variable is measured by 10 observational variables. Validation and reliability tests were conducted to determine the reliability of questionnaire statements in measuring student self-efficacy (Table 1).

Table 1. The value of the reflective indicator test for the validity and reliability of the instrument refers to four parameters

Laten Variable	Reliability Parameter			
	Cronbach 's Alpha*	Rho_A*	Composite reliable (CR)*	Average variance (AV)**
Initiation	0,764	0,817	0,822	0,440
Persistence	0,776	0,808	0,836	0,303
Action	0,854	0,873	0,884	0,440
Self-efficacy	0,904	0,933	0,916	0,303

*) the construct of path analysis is valid and reliable if the significance is above 0.700; **) The construct of path analysis is valid and reliable if the significance is above 0.400.

Cronbach's alpha for all variables was > 0.700, which indicates that each statement item on each variable is highly reliable. While Rho-A also shows values above 0.700, it means that each construct is able to be accurately reflected by its latent variable. Reliable Composite (CR) values above 0,700 indicate that each statement is consistent in measuring constructs. While the average variant (AV) is below 0.50 which shows the possibility of bias in calculating the variance of the statement value. However, in testing the validity and reliability, three of the four indicators of validity indicate that the overall construct used is feasible to use (Table 1). Although some observed variables have negative values (Figure 1). This illustrates that overall, the questionnaire statement was able to observe and illustrate the value of self-efficacy in students.

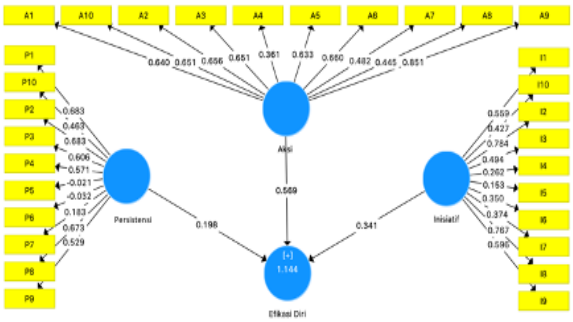

Figure 1. Testing the validity and reliability of the path analysis construct shows the negative value of the observation variable from the latency variable Persistence.

The loading factor value on the observed variable that has a negative value or below 0.700 indicates that the observation variable does not describe the construct being tested. So then the smallest observation variable is removed from the path analysis construct per latent variable. However, the value of several items of statement is retained in the construct because the three reflective indicator values are above 0.7 (very reliable) (Table 1). The remaining observed and latent variables were then tested for a hypothesis to obtain the effect and significance of the observed variables on self-efficacy (Table 2). In addition, the relationship construct as shown in Figure 1, shows an R2 of 1,000 or in other words, the construct constructed 100% illustrates the form of the relationship between students' self-efficacy and their 3 latent variables.

Table 2. Hypothesis test results that show the influence of latent variables on student self-efficacy

Latent variable	Self Efficacy			
	OS	Rata-rata	T-stat	p value
Initiation	0,310	0,318±0,045	6,924	0,000*
Persistence	0,337	0,329±0,043	7,858	0,000*
Action	0,443	0,425±0,044	10,095	0,000*

Note: asterisks (*) show a significant influence on the observed variables on self-efficacy.

Hypothesis testing shows that all latent variables have a significant influence on self-efficacy where T-stat> 0.196 (T-stat value with a confidence level of 0.05), and p = 0.000. The smallest influence among the three latent variables is the attitude of initiation, followed by persistence, while the variable that has the most influence is student action (Table 3).

Table 3. The level of achievement of students' self-efficacy value based on latent variables.

Latent variable	∑ Score	Average	%
Initiation	27,38±4,39	2,74±0,44	68.44±10,98
Persistent	27,66±4,09	2,77±0,41	69.14±10,23
Action	29,00±4,83	2,90±0,48	72.50±12,07

The lowest initiation score indicates that students do not have great interest and high enthusiasm in dealing with problems in learning mathematics. This is likely to have an impact on students' persistence in participating in learning activities and / or completing assignments. The attitude of persistence is also related to students' interest during learning, so that less persistence tends to make students become bored quickly and feel bored. This saturated attitude is illustrated by the number of students who have self-efficacy in the moderate category (Table 4), which is dominated by the moderate-low category (efficacy scores 55-65). The most dominant action attitude is shown by students in completing math assignments, or homework. High scores on action attitude are relevant to students' viewpoints who consider the assignment important because of fear of punishment from the teacher, besides students doing assignments at school rather than at home (Table 5). In other words, students do not use assignments as material for evaluation and understanding development, but rather because of concern for teacher anger. Thus, the actions that arise are not solely on the willingness to learn. This has an impact on the meaninglessness of the learning process so that students quickly forget what they have learned (7–10).

Table 4. Number and percentage of many students per group self-efficacy category

Category	Initiative (Ind/ %)	Persistence (Ind/ %)	Action (Ind/ %)
Low (<55)	22/ 12,64	22/ 12,64	11/ 6,32
Middle (56-75)	103/ 59,20	103/ 59,20	98/ 56,32
High (76-100)	49/ 28,13	49/ 28,16	65/ 37,36

Table 5. Student responses to mathematics lessons per group self-efficacy category

Statement	Student		
	Low	Moderate	High
Ease of students in understanding mathematical material	the majority of students who have low self-efficacy scores assume that mathematics is a confusing subject because of the many formulas and difficult to understand.	three of the four students assumed that students had difficulty memorizing complex formulas, but students also assumed that the mathematics teacher was able to convey the theory quite well	three out of four students who have high self-efficacy have a tendency to like mathematics and find it easy to do despite the complicated formulas.
Student interest in mathematics	As many as 100% of students in the low self-efficacy group dislike mathematics and find mathematics confusing	As many as 96.77% of students dislike mathematics because of difficulty memorizing formulas	50% of students like it even though mathematics is complicated, and the rest like it because they find it helpful to count quickly.
Submission of material in learning activities.	not yet, because mathematics is still difficult and mostly formulas	75% of students feel mathematics has been taught according to their expectations	As many as 50% of students like mathematics
Suggestions for improvement for the mathematics learning process	Students feel that there are too many formulas that need to be simplified or reduced, and taught slowly.	students feel too much material and learning too fast, and realize to learn more	all students agree that too much material and the learning process must be made more fun and easier to understand
Discipline of students in completing homework / assignments.	sometimes sometimes especially during class, other than that students prefer to do homework and assignments at school before class starts	sometimes and usually only during mathematics, the majority of students work on assignments a day or at night before a lesson	Often and at an intense frequency, all work is done at home

Self-efficacy of mathematics subject needs to be strengthened to be able to bring students more easily to accept related learning (11,12). It can also support students in learning mathematics because they are able to develop: 1) building understanding, logical reasoning, communication, and mathematical connections that are logical and systematic; 2) improve critical thinking skills; 3) students are more open and objective; 4) accustom high quality learning attitudes (13). The role of mathematics also has a large contribution and broad application in everyday life. Therefore, learning mathematics, needs to contain a learning process that accommodates students to learn to understand, implement, become useful and live in peace and harmony. This achievement can only be achieved with a high attitude of self-efficacy and a sense of pleasure in learning mathematics.

Expected competencies in mathematics learning consist of reasoning, connection, communication, and problem solving. By not ignoring other abilities, problem solving skills have an important role in the activities and use of mathematics learned by students (14,15). The activity referred to here is the activity of students both in finding solutions or in efforts to solve the problems they face. Therefore, through high self-efficacy towards mathematics, students are able to achieve their mathematics learning goals. Weaknesses or low self-efficacy scores can be a barrier for students in understanding students achieving these goals (5). It is necessary to improve quality not only in terms of students, but also the learning process, creativity and

the teacher's nature in delivering material and learning material that is easier to understand (16).

IV. CONCLUSION

Based on the results of the observations, a statistical analysis with the t test shows that all latent variables / attitudes influence self-efficacy, with the highest effect indicated on the attitude of action. Identification and analysis obtained that the attitude of self-efficacy in eighth grade students in MTS N 2 Pemalang are in the moderate category with the majority or around 59.38% initiation attitudes are still classified as moderate, as many as 59.38% students have persistence in the medium category, while the action reaches 56.24%. While the most dominant attitude of self-efficacy seen is action or willingness in completing assignments. Although based on interviews it shows that the fear of being angry with the teacher is actually more dominant in influencing action than liking and interest in mathematics.

REFERENCE

[1] Yağci E, Üstündağ T. Elementary School Teachers" Self-Efficacy Beliefs: A Turkish Case. Humanit Soc Sci J. 2009; 4(2):164–71.
[2] Nogueira J, Veiga F. Relationships as a basis of engagement? Self-efficacy and school engagement of pupils in school. Envol dos Alunos na Esc Perspetivas Int da Psicol e Educ Engagem Sch Int Perspect Psychol Educ. 2014; 373–85.
[3] Ran R, Huang Y, Yu J. The relationship between self-efficacy and academic achievement of junior high school students in the mainland Tibetan class/school. J Jiangsu Teach Univ Technol. 2012; 18(1): 78–83.
[4] Belbase S. Images, anxieties, and attitudes toward mathematics. Int J Educ Math Sci Technol. 2013; 1(4): 230–7.
[5] Caprara GV, Vecchione M, Alessandri G, Gerbino M, Barbaranelli C. The contribution of personality traits and self-efficacy beliefs to academic achievement: A longitudinal study. Br J Educ Psychol. 2011; 81(1): 78–96.
[6] Çalışkan S, Selçuk GS, Erol M. Instruction of problem solving strategies: Effects on physics achievement and self-efficacy beliefs. J Balt Sci Educ. 2012; 9(1): 20–34.
[7] James M, McCormick R. Teachers learning how to learn. Teach Teach Educ. 2009; 25(7): 973–82.
[8] Van Hover SD, van Hover SD. Teaching history in the old dominion. Meas Hist Cases StateLevel Test Across United States. 2009; 195.
[9] Dai DY, Gerbino KA, Daley MJ. Inquiry-based learning in China: Do teachers practice what they preach, and why? Front Educ China. 2011; 6(1): 139–57.
[10] Tan M. Mathematics and science teachers' beliefs and practices regarding the teaching of language in content learning. Lang Teach Res. 2011; 15(3): 325–42.
[11] Pimta S, Tayraukham S, Nuangchalerm P. Factors Influencing Mathematic Problem-Solving Ability of Sixth Grade Students. Online Submiss. 2009; 5(4): 381–5.
[12] Usher EL, Pajares F. Sources of self-efficacy in mathematics: A validation study. Contemp Educ Psychol. 2009; 34(1): 89–101.
[13] Pais A. An ideology critique of the use-value of mathematics. Educ Stud Math. 2013; 84(1): 15–34.
[14] Palinussa AL. Students' critical mathematical thinking skills and character: Experiments for junior high school students through realistic mathematics education culture-based. J Math Educ. 2013; 4(1): 75–94.
[15] Minarni A, Napitupulu E, Husein R. Mathematical understanding and representation ability of public junior high school in north sumatra. J Math Educ. 2016; 7(1): 43–56.
[16] Lazim MA, Osman MTA. Measuring teachers' beliefs about Mathematics: a fuzzy set approach. Int J Soc Sci. 2009; 4(1): 39–43.