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Research Article

Development of the students' mathematical self-efficacy in learning space analytic geometry

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ABSTRACT

Self-Efficacy is one of the factors that support the success of students in participating in the lecture process, but this is not paid much attention to, causing students to experience low grades and have not been able to develop themselves. This study was conducted to see the achievement self-efficacy of students who offer space analytic geometry courses and the achievement of the dimensions self-efficacy of students who offer space analytic geometry courses. The purpose of this study was to determine the achievement self-efficacy dimensions self-efficacy in learning space analytic geometry. The type of research used is descriptive quantitative and qualitative research. The subjects of this study consisted of 62 students for the 2020/2021 academic year who were selected from high, medium, and low ability levels. From the results of data analysis, it was found that: (1) the achievement of self-efficacy in learning space analytic geometry was included in the medium category, and (2) the achievement of each dimension of self-efficacy in learning space analytic geometry was also included in the medium category.

Keywords: mathematics; self-efficacy; learning space; analytic geometry

1. INTRODUCTION

The development of science and technology allows all parties to obtain information abundantly, quickly, and easily from various sources and various parts of the world. For this reason, humans are required to have the ability to obtain, select, manage and follow up on that information to be used in a dynamic, challenging, and competitive life. This all demands the ability to think creatively. Creative people see things from a different perspective. They push the limits of what they expect and take risks. According to Intel Teach Education (2007: 4) that creativity involves more than just getting an ordinary idea, it also includes being critical of their work, inviting criticism from others, and working constantly to refine technical knowledge and create better products.

Mathematics is a systematic method of thinking that is required to solve many difficulties in everyday life (Ersoy, 2003). Self-efficacy is one of the emotional elements influencing pupils' mathematical success (Masitoh & Fitriyani, 2018). Achievement in educational environments is remarkably impacted by self-efficacy beliefs (Hodges, 2008). Because they can think more clearly, are more driven to persevere in the face of challenges, have less arithmetic anxiety, and are more willing to study mathematics, students with higher self-efficacy are more successful in mathematics (Watson, 2015). Usodo (Hasanah, 2011) said that mathematics learning is currently still dominated by the development of cognition. As a result, students are less free to think informally; students are not given sufficient opportunity to think freely about mathematical ideas; and students become less confident in their ability to do the process of doing math, and worst of all, learning mathematics does not provide opportunities for the emergence of students' mathematical creative thinking in learning mathematics.

Furthermore, in recent years researchers have not only studied cognitive aspects but also affective aspects, including self-efficacy which is expected to improve students' mathematical abilities. Etymologically, self-efficacy consists of two words, namely "Self" which is defined as an element of personality structure, and "Efficacy" which is defined as self-assessment, whether it can do good or bad actions, stay wrong, can or cannot do something according to what it is. that is indicated (Alwisol, 2009). According to Bandura (1994), self-efficacy as human beliefs about self-efficacy affects the form of action they will choose to take, how much effort they will put into this activity, how long they will survive in the face of obstacles and failures and resilience. They follow a setback, in addition, (Bandura, 1997) also says that the perceptual ability to carry out tasks and achieve goals is defined as self-efficacy. Bandura also adds that this personal belief influences action, effort, persistence, joy over differences, and the tangible form of the goal.

Social cognitive theory is significantly impacted by self-efficacy views (Bandura, 2001). Self-efficacy, in the opinion of Bandura (1997) has served as the foundation for human conduct. While self-efficacy influences how people think, feel, motivate, and act, the outcomes of people's behavior mostly depend on their ideas about how effectively they can perform in particular circumstances (Bandura, 1995). An individual's assessment of his or her capacity to complete the tasks at hand is known as self-efficacy (Bandura, 1995; 1997; Schunk, 1991). It impacts people's thought processes and emotional reactions, as well as how much effort they put into a task, how long they will persevere when faced with challenges, and how resilient they will be in challenging circumstances (Phan, 2012; Özcan & Kültür, 2021).

Bandura (Feist, Jess, 2009), also defines self-efficacy as a person's belief in his ability to exercise some form of control over the person's own functioning and events in the environment. In addition, Bandura also views self-efficacy as the ability to cope with specific situations. Furthermore, (Bandura, 1997) suggests that self-efficacy is a major determinant of choice for individual development, persistence in using various difficulties, and patterns of thinking and emotional reactions they experience. In line with this, Bandura (1997) and Alwilsol (2010) suggest that there are four indicators of Self-Efficacy, namely: (a) performance experience; (b) the experiences of others; (c) aspects of direct/social support; and (d) psychological and affective aspects. Meanwhile, according to Schunk (2012:202), self-efficacy is a belief about what a person is capable of doing. Self-efficacy is not the same as what to do. The concept of self-efficacy relates to the judgments an individual makes about his or her ability to carry out behaviors that are appropriate to a particular situation or task. More Ormrod (2008:20) suggests that self-efficacy is a person's assessment of his own ability to carry out certain behaviors or achieve certain goals. This is supported by the opinion of Tentama (Leonard, 2013:57) who says that positive thinking makes individuals able to cultivate attention to positive things from various problems faced or in other aspects.

Bandura (1986) says that self-efficacy refers to three dimensions, namely magnitude, strength, and generality. More detail can be explained in the following section.

1.1 Dimension Magnitude

Dimension Magnitude refers to the level of difficulty that an individual believes can be solved.

1.2 Dimension Strength

Dimension strength refers to the strength or weakness of the individual's belief in the difficulty of the task that can be done. A person with self-efficacy weak meanwhile, people who have self-efficacy in competence will maintain their business despite experiencing difficulties.

1.3 Dimension Generality

Dimension generality shows whether beliefs will take place in a particular domain and apply in a variety of activities and situations.

Measurement of self-efficacy can be done through one of the dimensions above or a combination of the dimensions of magnitude and strength. Researchers generally explore beliefs by asking individuals about their actions and the strength of their confidence in achieving their goals and success in a situation. According to the definition given above, self-efficacy is the belief that a person has in his or her capacity to carry out the activities needed to creatively solve a mathematical problem. Space Analytic geometry is one of the lessons in the third semester Mathematics Education Study Program, FKIP University of Pattimura in Ambon, which has more students experiencing difficulties in taking learning with the discussion method and accompanied by assignments. This is presumably due to a lack of self-confidence, and poor mathematical thinking habits, causing low student learning outcomes in space analytic geometry learning. A large number of studies have been conducted on beliefs, attitudes and perceptions of mathematics and geometry. However, this is not the case with analytical geometry. To be more precise, there is no adequate research on this issue. Therefore, the subject of analytic geometry was chosen as the lesson.

This is in line with the results of observations made by researchers in classes taking analytic geometry courses showing that in the lecture process students have not been able to express ideas, think critically and creatively, have not been able to work together in solving the problems given, they tend to be passive, less enthusiastic and less confident in expressing their opinions when given the opportunity by the lecturer. Thus, in the lecture process, students must have high self-confidence to convey their ideas or ideas about learning mathematics. Similarly, Azak's research (Azak et al., 2012) found that students had difficulty in several concepts in geometrical analysis. According to (Ozkan et al., 2018), the reason for the difficulty is due to the students' daily life experiences, their previous knowledge, and the similarities between Analytical Geometry topics. In addition, the researcher stated that there was a bias among students. Students think that analytical geometry requires memorizing formulas. At this point, it is shown that students should learn the meaning of formulas and the way in which they are derived rather than just memorizing them(Olkun, 2002).

The purpose of this study was to determine the achievement self-efficacy dimensions self-efficacy in space analytic geometry learning. Measurement of self-efficacy can be done by giving questions to individuals either through questionnaires (questionnaires) or direct interviews and also through observations of these individuals related to the dimensions being measured. In this study, self-efficacy is seen as a person's confidence in his ability to carry out the necessary actions to solve mathematical problems effectively and successfully.

The indicators used to measure self-efficacy in the space analytic geometry course in this study are:

1) **Performance experience**, namely the ability based on performance on previous assessments/experiences.

2) **The experience of others** , namely evidence based on competence and comparison of information with the results achieved by others.
3) **The aspect of direct/social support,** which refers to direct feedback/words from the teacher or an older person.
4) **Psychological and affective aspects,** namely the assessment of one's abilities, strengths and weaknesses.

2. RESEARCH METHOD

The type of research used is descriptive quantitative and qualitative research is described self-efficacy of students in the Mathematics Education Study Program. Quantitative descriptions are carried out to describe the level or category of self-efficacy, while qualitative descriptions are a supporting part to provide a deeper picture of the self-efficacy. In this study, a class of students offered courses in space analytic geometry. The subjects in this study were 62 students of the Class of 2020/2021 who were selected from high, medium, low ability levels. The instrument used to measure self-efficacy in this study is self-efficacy consisting of 32 items developed by researchers and has met high standards of validity and reliability. There are two types of data in this study, namely quantitative data and qualitative data. Quantitative data was obtained through analysis of student answers on self-efficacy in learning space analytic geometry. This data was analyzed descriptively to support the completeness of quantitative data in answering research questions. The requirements to determine the achievement of self-efficacy are used in the following criteria.

Table 1. Classification Levels of Achievement Self-Efficacy Mathematical

Achievement Classification	Interpretation
$X < (\mu - 1{,}0s)$	Low
$(\mu - 1{,}0s) \leq X < (\mu + 1{,}0s)$	Medium
$(\mu + 1{,}0s) \leq X$	High

Source: Azwar (2016).
Information:
$\boldsymbol{\mu}$ = Theoretical mean
s = Standard Deviation

3. RESULTS AND DISCUSSION

3.1 Description of Students' Achievement Self-Efficacy in Learning Space Analytic Geometry

Data analysis to determine the achievement of self-efficacy will be carried out by utilizing scores from the data group of students who took the space analytic geometry course, as many as 62 students. Description of self-efficacy, including average score, standard deviation (SD), minimum and maximum. Achievement data self-efficacy can be summarized in **Table 2.**

Table 2. Achievement Self-Efficacy in Lectures on Space Analytic Geometry

N	Mean	SD	Minimum	Maximum	Range
62	83,478	7,273	68,35	98,92	30,57

Information:
Ideal maximum score = 152,32
SD = Standard Deviation

Based on **Table 2**, it can be said that the achievement of self-efficacy in space analytic geometry lectures is generally categorized as moderate. Furthermore, the achievement of self-efficacy according to its dimensions can be summarized in **Table 3**.

Table 3. Data Description of Achievement Self-Efficacy in Learning Space Analytic Geometry

Aspect	Item No.	Mean	Max ideal	Max.	Min.	SD	Range
Experience Performance	1-7	94.56	160.32	100.43	85.88	11.18	14.55
Experience of others	8-15	78.44	128.38	100.43	48.89	16.68	51.55
Aspects of social/verbal support	16-23	67.65	146.72	91.57	47.42	15.09	44.15
Psychological and affective aspects	24-32	83.03	137.25	100.43	56.54	17.33	43.89

Information:
SD: Standard deviation

Based on **Table 3**, it can be said that the average score of achievement of each dimension on self-efficacy in analytic geometry recovery is categorized as medium. Furthermore, the distribution of each dimension of self-efficacy is relatively the same. From Table 2 above, a graph can be presented as shown in **Figure 1**.

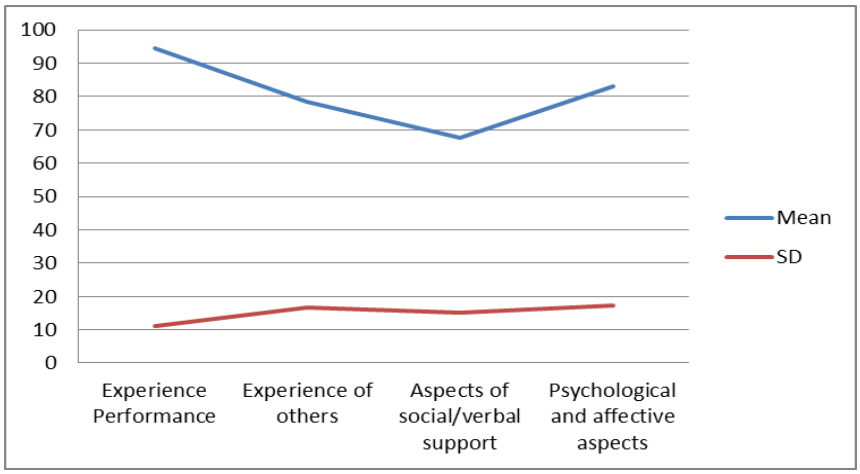

Figure 1. Graph of Achievement Self-Efficacy in Learning Space Analytic Geometry

Based on the **Figure 1**, it can be seen that the dimensions of performance experience and psychological and affective aspects have the same average tendency, while the social/verbal support aspects are in the moderate category.

3.2 Discussion

The results of this study indicate that the tendency to self-efficacy who attends space analytic geometry lectures is in the moderate category. This can be seen from the average achievement self-efficacy of students who take space analytic geometry courses. This means that students who offer courses in space analytic geometry have enough confidence in their ability to solve space analytic geometry problems. The results of this study are relevant to the results of (Suciati, 2017), that self-efficacy, self-regulation, and connectedness simultaneously affect student satisfaction with the learning program that is followed, and in line with the opinion of (Ormrod, 2008), that students who believe in their abilities to succeed have high self-efficacy. Meanwhile, for the achievement of each dimension self-efficacy, students who take space analytic geometry lectures also show the same results, which are in the medium category and the distribution of each dimension looks relatively the same. This is reinforced by the opinion of (Bandura, 1994) which says that self-efficacy as human beliefs about self-efficacy affects the form of action they will choose to take, how much effort they will put into this activity, for how long they will last. in the face of obstacles and failures, and their resilience follows setbacks. In line with this (Ormrod, 2008) suggests that self-efficacy is a person's assessment of his own ability to carry out certain behaviors or achieve certain goals. Next, Bandura (Linnenbrink & Pintrich, 2003) stated that the presence of the teacher is only as an individual who inspires or raises self-efficacy student.

The achievement of each dimension can be seen that the dimensions or aspects of Performance Experience have a standard deviation of 11.18 and a range of 14.55, for the dimensions/aspects of other people's experiences it has a standard deviation of 16.68 and a range of 51.55 and for the dimensions/aspects of the social/verbal support aspect it has a standard deviation of 15.09 and a range of 44.15 and the dimensions/aspects of psychological and affective aspects have a standard deviation of 17.33 and a range of 43.89. From these results, it can be seen that the achievement of the Self-Efficacy students in the Space Analytic Geometry course looks different from one aspect to another. This is supported by Zimmermann's opinion as summarized (Somakim, 2012) that the relationship between belief, motivation, and academic achievement in mathematics has a broad way of being studied(Alegre, 2014). It was found that self-efficacy appeared to be an influential factor in educational achievement and career choice compared to other variables such as the association of mathematical experience, perceptions, mathematical beliefs and self-regulations.

4. CONCLUSION

Based on the results of the research and discussion above, it can be concluded that the achievement self-efficacy of students' mathematical and the achievement of each dimension self-efficacy in learning space analytic geometry for students of the Mathematics Education Study Program is also included in the medium level category.

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AUTHOR'S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

REFERENCES

Alegre, A. A. (2014). Academic self-efficacy, self-regulated learning and academic performance in first-year university students. *Propósitos y Representacion*, *2*(1), 79–120. https://doi.org/10.20511/pyr2014.v2n

Alwilsol. (2010). *Personality Psychology* (Revised Ed). UMM Press.

Alwisol. (2009). *Personality Psychology* (Revised Ed). UMM Press.

Azak, A. Z., Takunyaci, M., & Münevver İlgun. (2012). Determination of University Students' Self-efficacy and Attitudes towards Analytic Geometry Course. *Procedia*, *55*, 28–31. https://doi.org/10.1016/j.sbspro.2012.09.473

Azwar. (2016). *Psychological Scale Preparation*. Learning Library.

Bandura, A. (1986). The Explanatory and Predictive Scope of Self-Efficacy Theory. *Journal of Social and Clinical Psychology*, *4*(3). https://doi.org/10.1521/jscp.1986.4.3.359

Bandura, A. (1994). Bandura Self-efficacy defined. In *Encyclopedia of Human Behavior*.

Bandura, A. (1995). *Self-efficacy in changing societies*. Cambridge University Press.

Bandura, A. (1997). Self-efficacy: the exercise of control. *Choice Reviews Online*, *35*(03). https://doi.org/10.5860/choice.35-1826

Bandura, A. (2001). Social Cognitive Theory: An Agentic Perspective. *Annual Review of Psychology*, *52*, 1–26. https://doi.org/10.1146/annurev.psych.52.1.1

Feist, Jess, & G. J. F. (2009). *Theories of Personality* (Seventh Ed). The McGraw−Hill Companies, Inc.

Hasanah, A. (2011). *High school students' mathematical critical and creative thinking skills through an intuition-based Contextual approach*. Indonesian Education University.

Hodges, C. B. (2008). Self-efficacy in the context of online learn_ing environments: A review of the literature and directions for research. *Performance Improvement Quarterly*, *20*(3–4), 7–25. https://doi.org/https://doi.org/10.1002/piq.20001

Leonard. (2013). The Role of Lateral and Positive Thingking Ability on Achievement Learning Education Evaluation. *Educational Horizon*, *32*(1), 54–63. https://doi.org/10.21831/cp.v5i1.1259

Linnenbrink, E. a, & Pintrich, P. R. (2003). The Role of Self-Efficacy Beliefs in Student Engagement and Learning in The Classroom Self-Efficacy, Engagement, and Learning A Definition of Self-efficacy. *Reading Writing Quarterly*, *19*(2), 119–137. https://doi.org/https://doi.org/10.1080/10573560308223

Olkun. (2002). *Visual Numerical Activities on the Axis of Invention: Shape, Measurement, Number and Mathematical Generalization*. Niğde Faculty of Education Journal.

Ormrod, J. (2008). Educational psychology: Developing learners. In *Educational psychology: Developing learners*.

Özcan, B., & Kültür, Y. Z. (2021). The Relationship Between Sources of Mathematics Self-Efficacy and Mathematics Test and Course Achievement in High School Seniors. *SAGE Open*, *11*(3). https://doi.org/10.1177/21582440211040124

Ozkan, A., Ozkan, E. M., & Karapıcak, S. (2018). On the Misconceptions of 10th Grade Students about Analytical Geometr. *The Educational Review*, *2*(8), 417–426. https://doi.org/10.26855/er.2018.08.00

Phan, H. P. (2012). Relations between informational sources, self-efficacy and academic achievement: A developmental approach. *Educational Psychology*, *32*(1), 81–105. https://doi.org/10.1080/01443410.2011.625612

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist*, *26*(3–4), 207–231. https://doi.org/10.1080/00461520.1991.9653133

Schunk, D. H. (2012). *Learning Theory An Educational Prespective* (Sixth Edit). Pearson.

Somakim. (2012). *Improving Critical Thinking Ability and Mathematics Self-Efficacy of First High School Students using Realistic Mathematics Approach* [Indonesian education university]. http://repository.upi.edu

Suciati, S. (2017). Interaction of Learning Readiness and Satisfaction With Services In Online Learning Postgraduate Programs. *Educational Horizon*, *36*(1), 70–80. https://doi.org/10.21831/cp.v36i1.12733

Watson, K. L. (2015). Examining The Effects of College Algebra on Students' Mathematical Dispositions. In *Brigham Young University BYU Scholars Archive*.