Analysis of students’ mathematics resilience abilities on linear program material

Laelasari\textsuperscript{1,2*}, Darhim\textsuperscript{1} and S Prabawanto\textsuperscript{1}

\textsuperscript{1}Departement of Mathematics Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
\textsuperscript{2}Departement of Mathematics Education, Universitas Swadaya Gunung Djati, Cirebon, Indonesia

Corresponding author’s email: lala.mathunswagati@gmail.com

Abstract. Many assumptions assume mathematical tasks are difficult, resulting in many students who feel a phobia or anxiety, or at least avoid involvement in any effort that may be required. This also happens among the students who follow lectures, especially the Linear Program. Students feel difficulty and easily give up in solving math problems. This study aims to analyze students' mathematics resilience abilities on Linear Program material. The research method used one group pretest-posttest design. Population in this research is all student of semester 3 of Unswagati Cirebon Mathematics Education Study Program. The sample of research was taken by purposive sampling technique as many as 54 students who have been able to teach the Linear Program. Instruments in this study the final value of student learning outcomes that have followed the Linear Program material and mathematical resilience questionnaire. The result of the research shows that there is a difference in mathematics resilience ability between a high and medium-high group, and there is the influence of mathematics resilience on student learning result on Linear Program material.

1. Introduction

Abstract mathematics concept is one of the many obstacles for students in studying mathematics (especially for students whose intellectual development has not reached a formal operation stage). Abstraction ability that is still weak often become an obstacle to learn mathematics, not only felt by the student even possible for the student of mathematics education (candidate of math teacher). Abstract Ability to learn to use approaches, models, strategies and media use as an alternative to learning.

Most students get low learning outcomes in the courses of the Linear Program. This low learning outcome is possible because in the lectures of the linear program, the delivery of a monotonous lecture marriage, the student faces many problems concerning systems of equations and linear inequalities. In solving the problem of a linear program requires a very long translation and description.

At the time of lectures are not a few students who feel stressed, worried. The results of the study [1] show that the level of psychological pressure is increasing in the university population, with many studies showing the negative impact of these difficulties on the student lecture experience at the university level.

Innovative learning is one solution to overcome student difficulties, a lecturer usually chooses and implements a particular learning approach and seeks to foster a positive attitude toward mathematics and mathematics learning. One of the positive attitudes which are the study material of this research is
mathematics resilience. Students with strong resilience will overcome barriers to learning math and be able to solve difficult math problems. The purpose of this research is to analyze the difference in mathematics resilience ability between high and medium-high ability students and to know the effect of mathematics resilience on student learning outcomes on linear program material.

Mathematics resilience [2,3] is a diligent or persistent attitude in the face of adversity, working or collaborative learning with peers, having language skills to express mathematical understanding, and mastering mathematical learning theory. While [4] defines resilience as the ability to respond adequately and successfully in the face of adversity, or exceed expectations during difficult times. From some experts’ opinions, it can be concluded that resilience is an individual's ability to overcome difficulties and successfully adapt to his environment, encompassing a series of dynamic nature, outcomes, or processes involving exposure to stress or misery, followed by successful adaptation.

Overall, global findings suggest that resilience in the university environment is positively associated with greater mental health, as well as successful transition and adjustment to academic life within the university academic environment. The development of mathematics resilience can be fostered for prospective teachers, in line with opinion [5] which suggests that the development of mathematical resilience can be supported and influenced by coaching. Some points to consider to foster the ability of mathematics resilience according to [6]. Individual factors include the individual's cognitive abilities, self-esteem, and individual social competition. Family factors include parental support, which is how parents treat and serve their children, and other family members who play an important role in the individual. The community factor includes the economic status in which the individual lives.

Factors affecting mathematical resiliency consist of believing that the ability of the brain can be grown, personal understanding of mathematical values, understanding how to work in mathematics and awareness of peer support, other adults [6]. Based on the opinion of experts, the mathematics resilience indicator that will be used in this research as follows: Demonstrate diligence, confidence, hard work and not easily give up facing problems, failures, and uncertainty; Demonstrate the desire to socialize, easy to assist, discuss with peers, and adapt to the environment; bring up new ideas/ways and find creative solutions to challenges; using the experience of failure to build self-motivation; have a curiosity, reflect, research and utilize various sources; have the ability to control themselves, aware of his feelings

Mathematics resilience was built to enable mathematics learners, and those involved in helping them, to act differently and thus prevent or diminish the formation of negativity towards mathematics [7]. It is supported by the statement [8] that individuals need to receive significant threats, such as severe difficulty or exposure to traumatic events, to establish resilience and adaptation quality should be good. Students who have developed mathematics resilience are better positioned to pursue studies in higher mathematics material for mathematics resilience have been considered essential for the success of primary mental illness prevention programs [9].

Study of resilience ability has occupied a prominent place in child development literature for several decades [10-12] with some recent focus is on the development and evaluation of rebuilding programs as a primary prevention tool. The results of the study [13] provide an important and practical theory of the implications of resilience ability that is further improving the ability of the academic and useful at work.

2. Methods
The method used in this research is experimental research with one group pretest-posttest design. The population consists of second-semester students of Swadaya Gunung Jati University of Cirebon, Mathematics Education Study Program, the academic year 2017-2018. The sample used is purposive sampling with consideration of students who get the same lectures and lecturers as many as 54 students.

Instruments used in the form of student learning outcomes be the final grades of linear programming courses and questionnaires of mathematics resilience validity that was validated before as many as 40 statements covering six indicators of mathematical resilience ability related to learner program Linear.
3. Results and Discussion

3.1. Differences in the ability of mathematical resilience between students who have the high ability of medium and low

Based on the results of statistical tests it is known that the value of Sig is 0.263>0.55, then the data obtained is homogeneous. The results of calculations using ANOVA with $\alpha = 5\%$ obtained $F_{\text{count}} = 11.523$, and obtained $F_{\text{table}} = 4.04$ $F_{\text{count}} < F_{\text{table}}$ then the hypothesis was rejected, meaning that there were differences in the ability of mathematical resilience between medium and low high groups. The higher the ability of students to influence the high ability of resilience. The results of these statements are supported by the Tukey HSD test, showing that there are significant differences between the three levels of resilience ability.

From the results of data analysis, it can be concluded that there are differences in the ability of mathematical resilience between medium and low high groups. This difference occurs because of several factors both originating from individual students themselves in the form of self-esteem, the ability to overcome problems, emotional regulation, and optimism. Factors that influence the ability of the outside resilience can be supported from family and the environment.

3.2. The effect of resilience on learning outcomes

The results of the analysis show that mathematical essences affect student learning outcomes, the magnitude of the correlation/relationship is 0.926 and the percentage of the effect of mathematical resilience on learning outcomes is 85.7%, while the rest is influenced by other variables. Another variable has a lot of influence, one of which is environmental factors, both at school and family, interest, motivation from the students themselves and others.

The magnitude of the effect produced can be known by using a regression test with a value of $= 74.444$ and $b = 0.767$ so that the regression equation $Y = 74.444 + 0.767x$

The value of $F_{\text{count}} = 17.659$, with a significant value of $0.000 < 0.05$, $H_0$ is rejected, and $H_1$ is accepted, meaning that there is an effect of mathematical resilience on student learning outcomes in the Linear Program subject. The ability of mathematical resilience can suppress the situation and to adapt and survive when receiving lecture material.

4. Conclusions

The result of this research is that there is a difference in mathematics resilience ability between the medium and low high group and the influence of mathematics resilience on student learning results in Linear Program Material.

5. References

[1] Byrd, D.R. and McKinney, K. J 2012 Individual, Interpersonal, and Institutional Level Factors Associated with the Mental Health of College Students Journal of American College Health 60 185-193

[2] Yeager, D., S. dan Dweck, C., S. Mindsets 2012 That Promote Resilience: When Students Believe That Personal Characteristics can Be Developed Journal Educational Psychologist 47(4) 302–314

[3] Newman, T 2004 What Works in Building Resilience? Policy and Research Unit

[4] Gilligan, R 2007 Adversity, Resilience and the Educational Progress of Young People in Public Care. Emotional and Behavioural Difficulties 12 135-145

[5] Johnston, W and Lee, C 2013 Children Overheard: Working to Increase Mathematical Resilience (Mti, ATM, Summer)

[6] Everall, R 2006 Creating a Future: A Study of Resilience in Suicidal Female Adolescent

[7] Lee, S., Johnstin, S., Wilder 2017 The Construct of Mathematical Resilience

[8] Masten, A. S, 2001 Ordinary Magic. Resilience Processes in Development Am Psychol 56(3) 227–238

[9] Skeffington, P. M., Rees, C. S., Kane, R 2013 The Primary Prevention of PTSD: a Systematic Review J Trauma Dissociation 14 404–422
[10] Masten, A. S. 2007 Resilience in developing systems: Progress and Promise as the Fourth Wave Rises. *Development and Psychopathology* 19: 921–930.

[11] O’Dougherty Wright, M., Masten, A. S., & Narayan, A. J. 2013 Resilience Processes in Development: Four Waves of Research on Positive Adaptation in the Context of Adversity. In S. Goldstein & R. B. Brooks (Eds.), *Handbook of Resilience in Children* 15–37.

[12] Richardson, G. E. 2002 The Metatheory of Resilience and Resiliency. *Journal of Clinical Psychology* 58: 307–321.

[13] Adam J. Vanhove, Mitchel N. Herian, Alycia L. U. Perez, Peter D. Harms, and Paul B. Lester 2016. The British Psychological Society *Journal of Occupational and Organizational Psychology* 89: 278–307.