Analysis of students' mathematical resilience ability on linear program material through blended learning

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Abstract. Resilience states an individual's ability to survive and can adapt to stressful situations. The growth of mathematical resilience in each requires minimal intelligence at an average level; this is because mathematical resilience is closely related to the ability to understand and convey something through the right language, reading ability, and non-verbal communication. This study aims to analyze differences in learning outcomes between students who are lecturing using blended learning models and conventional, analyzing students' mathematical resilience abilities both as a whole and based on high and low ability levels in the Linear Program subject. The population of this research activity includes fourth-semester students, Mathematics Education Study Program, Unswagati Cirebon Teaching Education Faculty 2017-2018 academic year. The sample of the study is class A and B of 46 students. The study design used a quasi-experimental type with a non-equivalent control group. The research design chosen was a static group comparison experimental design involving two groups. The results showed that the ability of mathematical resilience by using blended learning, both overall and upper and lower groups had a significant increase.

1. Introduction
Every individual's reaction to various challenges or problems in life turns out to be different. The difference between these reactions turns out to be caused by different perspectives on existing problems. One factor that influences that difference is resilience. The transition of someone from high school then entering the campus or becoming a student can cause stress for individuals. Individuals who have high neuroticism are sensitive to stress [1]. Stress conditions describe a personality that has attributes including high energy levels, a sense of optimism and positive emotions, curiosity, and the ability to release and conceptualize problems [2].

Entering college brings changes in individual lives. Usually, changes are experienced most often in the first year of college when entering college. This is related to adjustment, which is a problem that must be faced by individuals when entering the world of college. Stressors exist in students (who enter college after graduating from high school), namely: changes in lifestyle, values, some courses are taken, problems of friendship, love, shame, and jealousy. Competition among high students is one of the stressors for students. Stress experienced by students gives a negative impact on physical and psychological conditions. These impacts can be physiological, emotional, cognitive, interpersonal, and...
organizational relationships. To overcome this problem, every student must be able to become resilient, namely, to be able to rise, stand on suffering, and improve the disappointment they face.

Stress on mathematics education students can come from both academic and non-academic. Stress that comes from academics such as busy class schedules, accumulated assignments, many exam materials, low-grade point average (GPA), and other academic problems. While the stress that comes from non-academic are financial problems, family problems, interpersonal, and intrapersonal.

An abstract mathematical concept is one of the many obstacles for students in learning mathematics (especially for students whose intellectual development has not yet reached the formal operation stage). The ability of abstraction that is still weak is often a barrier to learning mathematics, not only felt by students even possible for mathematics education students (prospective math teachers). Abstraction ability can be realized through the application of realistic mathematical approaches and the use of media as intermediaries in learning.

Most mathematics education students obtain low learning outcomes in the Linear Program course. The low learning outcomes are possible because in the linear program lectures, the delivery of monotonous lecture material, students face many problems relating to the system of linear equations and inequalities. In solving a linear program, questions require a very long description and description. Conceptual understanding in mathematics is difficult to describe as knowledge of the principles underlying mathematics [3].

The results of the study show the negative impact of these difficulties on the lecture experience. The problem suffered by students lately, according to Arehart and Treichel (2002) is caused by a lack of ability in solving bad social problems, cognitive distortions, and family conflicts [4]. According to a national survey conducted by the American College Health Association in 2012, around 30% of students showed depression, with an additional 50% reporting experiencing many events.

Innovative learning is one solution to overcome student difficulties; a lecturer usually chooses and implements learning using certain approaches and models and strives to foster a positive attitude towards mathematics and learning mathematics. One of the positive attitudes, which are the study material of this research is mathematical resilience. Students who have strong resilience will overcome obstacles in learning mathematics and can solve difficult math problems.

Interviews conducted with ten students stated that there were some difficulties faced by how many students adapted to the college environment so that it needed adjustments to deal with the difficulties experienced. The difficulties expressed by some students are that it is difficult to follow a tight lecture schedule, easily disappointed when the plan is different than expected.

Characteristics of individuals who have resilience are individuals who have independence, namely the ability to distance themselves emotionally and from the source of problems in one's life. Independence involves the ability to maintain a balance between being honest with yourself and caring for others. Independent people are not ambiguous and have optimism in the future. The results of the study found that the factors that influence self-resilience (resilience) are gender, age, race, education, level of trauma, social support, past and present life pressures [5].

The results of the lecture analysis in the previous semester students experienced difficulties and obstacles in learning or solving the questions given, they were not motivated to ask other sources or peers who were more understanding or even to lecturers, whether in lectures or outside lectures but avoid the young task according to them is difficult and abstract. So, the student prefers to copy his friend's work without understanding it first. Therefore students must be able to develop mathematical resilience. Learning mathematics often causes anxiety, along with several studies by Bonano et al. (2007) describing students learning mathematics with fear. Therefore a lecturer must be able to choose and implement certain mathematical learning approaches besides they try to help students to overcome difficulties to achieve mathematical abilities, and they also try to develop positive attitudes towards mathematics and mathematics learning [6].

Positive attitudes include diligence and resilience in facing challenges or difficulties in learning mathematics, which is called mathematical resilience [7]. Mathematical resilience is needed when students use mathematics, thinking, behaving mathematically, and not just getting grades or passing
course. Students who have strong resilience in addition to having the mathematical abilities needed to answer all the questions given during the exam, also have mathematical skills needed outside of lectures and wish to apply them in life whenever needed. Lecturers strive to build mathematical resilience in students will encourage collaborative work where learners support each other in learning, use the power of assessment to learn and enable students to understand their rights and responsibilities in the learning process and support them in knowing when and where must be included in their learning efforts.

An innovative learning model is one solution to overcome the difficulties of the student. A lecturer usually chooses and implements certain learning approaches and seeks to foster a positive attitude towards mathematics and learning mathematics. One positive attitude that is the material of the study from this study is mathematical resilience. Students who have strong resilience will overcome obstacles in learning mathematics and can solve difficult math problems. One solution offered is the use of the blended learning model. The implementation of the blended learning model is deemed appropriate to face Indonesia's challenges in the 21st century. The blended learning model is expected to be very appropriate when applied to Educational Institutions and Education Personnel. As a higher education institution that has a mission to produce prospective educators who can face this challenge, it is necessary to equip teachers and prospective teachers to be skilled in using and utilizing technology, information and communication. Teachers must have pedagogical skills, are skilled in delivering teaching materials, mastery of technology, and materials in the learning process.

Standards for the 21st century or digital age lectures relate to the application of technology in learning. Lecturers must be able to prepare their students to live in the digital age, one of which is to use their knowledge of lecture material. The focus of lectures to improve student academic performance in a blended learning environment [8-10]. Technology-based lectures are expected to facilitate experiences learned by advanced students, creativity, and innovation in face-to-face and virtual situations through the application of a blended learning model through a realistic approach in lectures.

This study aims to analyze the differences in learning outcomes between students who study using conventional blended learning models, analyzing students' mathematical resilience abilities both overall and based on high and low ability levels in the Linear Program subject.

1.1 Mathematical Resilience
Mathematical resilience is a diligent or persistent attitude in facing difficulties, working, or collaborative learning with peers, having language skills to express mathematical understanding and mastering mathematical learning theories [11,12]. Resilience is the ability to respond adequately and successfully in facing difficulties, or exceeding expectations during difficult times. From some experts' opinions, it can be concluded that resilience is the ability of individuals to overcome difficulties and successfully adapt to their environment, including a series of traits, results, or dynamic processes involving exposure to stress or misery, followed by successful adaptations. Every person has a different barrier to resilience ability [13].

Overall, global findings show that resilience in the student environment is positively related to greater mental health, as well as successful transitions and adjustments to academic life in the university's academic environment. Development of mathematical resilience can be fostered for prospective teachers; this is by the opinion of [7] that the development of mathematical resilience can be supported and influenced through coaching. Some things must be considered to foster the ability of mathematical resilience, according to [14].

a. Individual Factor
   Individual factors include individual cognitive abilities, self-esteem, and social competition that individuals have. Family factors include support from parents, which is how parents treat and serve their children, and other family members who play an important role in the individual.

b. Community Factor
   Community factors include the economic status in which the individual lives.
The factors that influence mathematical resilience 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 [14]. Factors that influence mathematical resilience consist of believing that brain abilities can be grown, personal understanding of mathematical values, understanding how to work in mathematics and awareness of peer support, other adults (Everall, 2006). Based on the opinions of experts, indicators of mathematical resilience used include, (a) show perseverance, confidence/confidence, work hard and do not easily give up facing problems, failures, and uncertainties, (b) demonstrate the desire to socialize, easily provide assistance, discuss with their peers, and adapt to their environment, (c) bring up new ideas/ways and find creative solutions to challenges, (d) using a failure experience to build self-motivation, (e) have a curiosity, reflect, research and utilize various sources, (f) having the ability to control themselves, aware of their feelings.

Mathematical resilience is built to allow to prevent or reduce the formation of negativity towards mathematics [15]. This is supported by the statement [16] that individuals need to receive significant threats, such as severe difficulties or exposure to traumatic events, to form resilience and good adaptation qualities. Students who have developed mathematical resilience are better off continuing their studies in mathematics to a higher level, and mathematical resilience has been considered important for the success of the primary prevention of mental disorders [17]. Resilience requires attention from behavior, personality, and dynamic interactions between individuals and the surrounding environment, which are relatively neglected in personality psychology and difficult to learn [18].

Studies of resilience ability have occupied an important place in the children's development literature for decades [16,19,20]. The results of [18] study provide an important and practical theory of the implications of the ability to resilience, which is to increase academic ability and be useful at work. Increasing the ability of resilience can provide a feasible way to prevent negative psychosocial effects [22]. Resilience ability is a good process in facing difficulties [23]. Increasing the ability of resilience must focus more on intervention [24]. Continuous effort will have the ability to resilience [24,25] increasing resilience capabilities is one of the prerequisites for other ability constructs [26].

1.2 Blended Learning

The blended learning terminology was originally used to describe courses that tried to combine face-to-face learning with online learning. When the term blended learning becomes popular, more and more combinations are referred to as blended learning. However, the notion of blended learning based learning is learning, which combines the strategy of delivering learning using face-to-face activities (offline) and computer-based learning (online), through the internet and mobile learning. The definition of Blended learning according to [26] includes, (a) combining various learning media modalities, (b) combining various learning methods, learning theory, and pedagogical dimensions, (c) combining online learning with face-to-face (face-to-face learning). The blended learning model is a combination of the characteristics of traditional learning and electronic learning or e-learning. Web-based learning can be combined with Kerres and Witt's face-to-face learning [26] Face-to-face learning or web-based courses or on-site learning is learning to use web learning resources face-to-face between learners and learners conducted in the classroom [27,28] Web-based learning is said to be meaningful because one of the four important components in building a learning culture with the use of learning models with the web is that learners are demanded independently in learning with various appropriate approaches so that students can direct, motivate, organize themselves in lectures.

Blended learning represents clear advantages for creating learning experiences that provide the right time learning for each. Blended learning is a truly universal and global boundary that brings groups of learners together across different cultures and time zones. The blended learning model includes several forms of learning tools, such as real-time collaboration software, online web-based programs, and electronics that support performance systems in task learning environments, as well as system management knowledge. The Blended learning model contains various activity activities,
including face-to-face learning, e-learning, and independent learning activities. Blended learning as a mixture of traditional instructor-led learning models, synchronous online learning, asynchronous independent learning, and task-based structured training from a lecturer. The purpose of blended learning is to combine face-to-face classroom learning experiences with online learning experiences. Overall, the blended learning model refers to integration or mixtures called e-learning, tools, and assignment techniques with traditional face-to-face teaching.

The interaction that occurs in the blended learning model is learning that combines the advantages of face-to-face lectures and the advantages of online learning. The blended learning model can create a positive learning environment for interactions between students and students with educators without being limited by space and time. Interactions can occur in teaching 'synchronously' (at the same time) or 'asynchronously' (at times different). The blended learning model of teaching material is prepared by lecturers to be able to be accessed by students online through media that have text, graphics, animation, simulation, audio, and video. Provided convenience for 'discussion groups' so that interactions between students, students, and educators occur anytime and anywhere verbally or in writing. The lecture environment involves different instructions, which provide a different path learning about student needs [29-32]. Blended learning is designed in various ways ranging from adding online and face-to-face activities to lectures [33-35].

Blended learning has six elements that must be fulfilled including face-to-face learning, independent learning, application in learning through problem-based learning, tutorial activities in which students actively convey problems faced, collaboration, and evaluation of blended learning based learning based on processes and results that can be done through evaluating student learning performance evaluations based on portfolios.

2. Methods
The design used in this study is the experimental design of the pretest-posttest-control group design. Grouping is divided into two groups, namely the experimental group and the control group. The quasi-experimental research was conducted because each subject in this study was not randomly conducted. The grouping of subjects has been formed by the authority of the upper and lower groups concerned where the research is conducted in groups of study groups or based on each existing class. Based on the time, the data collection is concurrent, namely the collection of data qualitatively and quantitatively.

The research population is the fourth-semester students of Mathematics Education Study Program 2017-2018 academic year. The research sample consisted of class A as many as 22 and class B totaling 24 students. Class A is an experimental class, and class B is the control class. The study design used a quasi-experimental type with a non-equivalent control group. The chosen research design is a static group comparison experimental design involving two groups. The first group is the experimental group as a group that is treated with blended learning lectures and control groups with conventional learning.

Research instruments include data collection done by the following stages or methods; observation, tests, and interviews. Observation activities are carried out in a structured and unstructured manner. Early stage observations are carried out to obtain data about the background and qualifications of students to be observed — research instruments in the form of tests and non-tests. Test-shaped instruments consist of initial mathematical knowledge, mathematical representation abilities. Non-test instruments are in the form of mathematical resilience questionnaire, a set of lecturer lecture designs. The type of questionnaire used in this study is a closed questionnaire that uses alternative answers so that the respondent only chooses one answer that suits his wishes. The scale used in measuring each variable in this study is a Likert scale.

3. Results and Discussion
The results of the analysis of the Levene test for homogeneous data homogeneity obtained a value of p-value of 0.011 were <0.05 means that there is a statistically significant or significant difference at
the probability of 0.05. Based on the results of the analysis, it can be concluded that there are differences in learning outcomes between students whose lectures use blended learning and conventional learning models. The results of this study by the opinion of [25] state three main reasons why the blended learning model was chosen in higher education, among others because of: increased pedagogy; increased access and flexibility; and increased cost-effectiveness. Six reasons for using the blended learning model, which is rich in teaching, access to knowledge, social interaction, institutional personalities, cost-effectiveness, and ease of revision [25].

Blended learning in this research activity acts as media literacy. Media literacy about information literacy and digital literacy Koltay [36]. Media literacy is a set of perspectives that we actively use to expose ourselves to the media to interpret the meaning of the messages we face and the ability to achieve messages in various forms or multi-dimensions [37]. The most important media literacy benefit is to make students become understanding, knowledgeable, able to analyze, assess, and able to critically argue for information or media messages that they obtain, namely through internet media. Media literacy activities are expected to have at least seven skills, namely the ability to analyze, evaluate, group, study inductively, and deductively, carry out synthesis and abstraction [38]. Blended learning creates a more flexible educational model, and the personalized trajectory of learning [39, 40] through this model offers the opportunity to serve students achieving real personal instruction. [37, 41]

The simple regression test results in the ability of overall mathematical resilience of learning outcomes obtained a correlation value of 0.861. This value can be interpreted that the relationship between the two research variables, namely learning outcomes and the mathematical resilience ability of the category is strong. The R Square value obtained is 74.1% which can be interpreted that the ability of mathematical resilience has a contribution of 74.1% on student learning outcomes and the other 25.9% is influenced by other factors beyond the ability of mathematical resilience. Other factors that influence the form of motivation or interest of students in lecture activities. The F test results obtained by the Sig. = 0.000, which means <significant criteria (0.05), thus the regression equation model based on research data is significant, meaning that the linear regression model meets the linearity criteria. The regression equation model obtained by the regression equation: Y = 14,482 + 0.580 X₁. Overall the ability of mathematical resilience influences students on the learning outcomes of students who study in Blended learning.

The relationship between the two research variables, namely learning outcomes and the ability of mathematical resilience is in a strong category. Obtained a determination coefficient value of 21.7% which can be interpreted that the ability of mathematical resilience has a contribution of 21.7% on student learning outcomes and 78.3% is influenced by other factors beyond the ability of mathematical resilience. For the F test, the Sig. value is obtained. = 0.000, which means <significant criteria (0.05), thus the regression equation model based on research data is significant, meaning that the linear regression model meets the linearity criteria. Regression equation model obtained Y = 55,651 + 0,239 X₁. In group students, the ability of mathematical resilience affects the learning outcomes of students whose learning using blended learning is only 21.7%. This is possible for many factors, one of them is the upper group students, who have the high ability before they have had the resilience, namely the ability to mathematically resilience in attending lectures because they have high self-confidence, and high cognitive abilities as well.

The ability of mathematical resilience of lower class students has an effect on the learning outcomes of students whose learning using blended learning is 70%, and the other 30% is influenced by other factors beyond the ability of mathematical resilience. The correlation value is 0.837, and the regression model meets the linearity criteria, and the regression equation model is Y = 29.399 + 0.385 X₁.

Another factor that influences learning outcomes is 30% because of the influence of the student environment itself, both from friends and motivation and interests from themselves, and the use of learning models, namely blended learning. Students have an attitude to adjust to the environment; can face uncertainty, problem, and challenges; solve problems logically and flexibly; looking for creative
solutions to challenges; curious and learn from experience; have the ability to control themselves; aware of his feelings of having a strong and easy social network to provide assistance.

4. Conclusions

The conclusion of this study is that there are differences in learning outcomes between students whose lectures use blended learning and conventional learning models, the ability of students' mathematical resilience as a whole has an influence of 74.1% on student learning outcomes and 25.9% influenced by factors others are beyond the ability of mathematical resilience. The ability of mathematical resilience of upper group students has an influence of 21.7% on student learning outcomes, and the other 78.3% is influenced by other factors beyond the ability of mathematical resilience. The ability of mathematical resilience of lower group students influences 70% contribution to student learning outcomes, and the other 30% is influenced by other factors beyond the ability of mathematical resilience.

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