Microsoft Excel VBA on mathematical resilience of primary school teacher education students

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Abstract. This research is motivated by the low student mathematical resilience. The purpose of this study is to look at the achievement of mathematical resilience of students who obtain learning using Microsoft Excel VBA with those using conventional learning. This study uses a quasi-experimental method with a non-equivalent pretest and posttest control group design. The subjects of this study were 70 second semester elementary school teacher candidates at IKIP Siliwangi. The instruments in this study used non-tests in the form of questionnaires and interviews. The results show that, 1) the achievement of mathematical resilience of students who get learning using Microsoft Excel VBA is better than those using conventional learning; 2) students who learn with Microsoft Excel VBA tend to be able to overcome difficulties if given difficult math problems, anxiety and fear in working on math problems are reduced, and more confident in expressing mathematical opinions/ideas; 3) mathematical resilience is not an instant thing to change so it needs environmental support so that students' mathematical resilience becomes better.

1. Introduction
Education plays a major role in developing and improving the quality and ability of human resources. In the world of education, especially education in schools, mathematics becomes one of the important subjects because mathematics is a universal science that underlies the development of modern technology and various scientific disciplines and can develop the power of human thought [1]. And to master the technology in the future requires a strong mastery of mathematics from an early age [2]. This is the reason why mathematics is a subject taught from elementary to tertiary level.

Learning mathematics in elementary schools is the basis for the application of mathematical concepts at the next level [3]. Therefore, it is the teacher's job to provide students with knowledge about mathematical concepts so that later these mathematical concepts can be applied to the next level and in everyday life. So that mathematical concepts in elementary schools can be applied properly, the key to the success of students in understanding mathematical material begins when becoming a student. Elementary school teacher students are required to have good mathematical skills and can make a good impression and change the image of mathematics which is a difficult subject into interesting and fun mathematics.

Not only mathematical thinking ability that must be possessed by elementary school students but a positive attitude towards mathematics also needs to be sharpened and developed in students. The positive attitude students will use if the student becomes a teacher. The positive attitude students get while studying in college is expected to be transmitted to their students later so that not only their students like mathematics but can also improve their learning achievement.
One of the attitudes that prospective teacher students must have is mathematical resilience. According to Grotenberg [4] "Resilience is the ability of a person to judge, overcome, and improve themselves or change themselves from adversity or misery in life because every person is surely experiencing difficulties or problems and no one lives in the world without a problem or difficulty ". In line with the opinion of previous experts, according to Lee and Johnston Wilder [5] states that resilience is a formidable attitude to overcome anxiety, fear in facing challenges and difficulties, requires hard work and good language skills. Mathematical resilience is a positive attitude to overcome anxiety, fear in facing challenges, and difficulties in learning mathematics until finding a solution.

Furthermore, Adolphs and Damasio [6] said that students who have resilience attitudes are: adaptive or able to adjust to the environment; can face uncertainties, problems, and challenges; solving problems logically adjust to the environment; can face uncertainties, problems, and challenges; solve problems logically and flexibly; look for creative solutions to challenges, be curious and learn from experience having the ability to control yourself; aware of his feelings; have a strong social network and easily provide assistance. Students with good mathematical resilience will be tough and can overcome obstacles in learning mathematics and be able to solve difficult mathematical problems.

Johnston-Wilder and Lee [6] suggested that mathematical resilience has four factors: a) believing that the ability of the brain can be grown; b) personal understanding of mathematical values; c) understanding how to work in mathematics; and d) awareness of peer support, other adults, ICT, internet, and others. The development of mathematical resilience requires a learning approach that enables the above attitude to grow and create a positive mathematical classroom atmosphere so students can overcome obstacles in achieving mathematical concepts. The indicators of mathematical resilience according to Sumarmo [7] are: a) perseverance, confidence / confidence, working hard and hard to give up in facing problems, failures, and uncertainties; b) shows the desire to socialize, have a helping spirit, discuss with peers, and adapt to the surrounding environment; c) bring up new ideas / thoughts and look for creative solutions with challenges; d) failure is used as an experience to build self-motivation; e) have a curiosity, reflect, research, and utilize various sources; f) have language skills, self-control, aware of their feelings.

However, based on the experience of researchers in the field, the mathematical resilience of students especially elementary school teacher candidates is still low. This is in line with the opinion [8] which states that student mathematical resilience is still low. The experience of researchers, students in mathematics courses still feel anxious and afraid if given math problems to be done. Students are afraid to start and lack confidence when expressing their ideas and opinions and easily give up if working on mathematical problems which he thinks are difficult.

A pleasant learning atmosphere and the delivery of innovative teachers or lecturers while learning and followed by the use of technology in the classroom can help students or students overcome difficulties in mathematics [9]. Visual Basic for Application (VBA) is a programming language that is applied in Microsoft Excel applications [10]. Microsoft VBA Excel functions to simplify workmanship, save time, and optimize if something goes wrong. Besides, VBA can also be a tool in the teaching and learning process, especially in the field of mathematics education, because it utilizes Microsoft Excel in the data processing. Things that can be applied in learning especially mathematics using VBA Microsoft excel [11], the first picture can be an interactive image, students become active and fun to learn mathematics because students understand better than without using ICT, secondly, there is not much cost to make props, and third, that the use of Microsoft Excel Software can be accessed by computer users. Learning by using Microsoft Excel VBA can create a positive classroom atmosphere so students can overcome obstacles in achieving mathematical concepts.

2. Method
The method in this study is quasi-experimental. In quasi-experimental subjects are not randomly grouped, but researchers accept the state of makeshift subjects. A quasi-experimental design with non-equivalent pretest and posttest control group design, both groups received pretest and posttest, but only the experimental group was given treatment [12]. Learning in the experimental class is aided by Microsoft Excel VBA while learning in the control class uses conventional learning. The research design is as follows Table 1 [13]:

```markdown
| Method  | Description |
|---------|-------------|
| Quasi-experimental | Subjects are not randomly grouped, but researchers accept the state of makeshift subjects. |
| Pretest and Posttest | Both groups received pretest and posttest, but only the experimental group was given treatment. |
| Experimental class | Learning is aided by Microsoft Excel VBA. |
| Control class | Learning uses conventional learning. |
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Table 1. Nonrandomized pretest-posttest control group design research design

| Class    | Pretest | Treatment | Posttest |
|----------|---------|-----------|----------|
| Experiment | O       | X₁        | O        |
| Control   | O       | X₂        | O        |

Information:
O : Pretest or posttest mathematical resilience
X₁ : Learning by using Microsoft Excel VBA
X₂ : Conventional learning

The population in this study were all semester 2 elementary school teacher students in Cimahi City, West Java, Indonesia. While the sample in this study was 70 second semester elementary school teacher students at IKIP Siliwangi. The instrument used was non-test. Non-test instruments used were questionnaires and interviews. The questionnaire instrument uses four answer choices namely SS (strongly agree), S (agree), TS (disagree), and STS (strongly disagree). This research was conducted by distributing questionnaires through Google forms to elementary school teacher students to analyze mathematical resilience. The number of statements used in the questionnaire is 20 items.

3. Result and Discussion
Here is a descriptive summary of the overall mathematical resilience score can be seen in Table 2.

Table 2. Recapitulation of Mathematical Resilience Scores

| Aspect            | Statistic | Learning using Microsoft Excel VBA (N = 35) | Conventional learning (N = 35) |
|-------------------|-----------|---------------------------------------------|--------------------------------|
|                   |           | Pretest | Posttest | Pretest | Posttest |
| Mathematical Resilience |     \(\bar{x}\) | 56,51   | 60,34    | 56,66   | 59,14    |
|                   | %         | 70,63   | 75,42    | 70,82   | 73,92    |
|                   | Sd        | 4,49    | 6,31     | 7,26    | 5,23     |

Ideal maximum score = 80

Based on Table 2 above shows that the average score of the mathematical resilience pretest of the experimental class was 56.51 and the control class showed 56.66. It can be seen that the average mathematical resilience pretest score is almost the same. While the average post-test scores of mathematical resilience in classes learning using Microsoft Excel VBA are better than conventional learning classes.

Furthermore, the pretest and posttest mathematical resilience scores of the two classes were tested for normality to see whether the data were normally distributed or not. The normality test used is the Kolmogorov-Smirnov test. If the data are normally distributed then proceed with the homogeneity test and if the data are not normally distributed then proceed with the Mann-Whitney test. The final test is the average difference test to see the difference between the two classes [14]. The following is a recapitulation of mathematical resilience pretest scores which can be seen in Table 3.
### Table 3. Recapitulation of Mathematical Resilience Pretest Score

| Class     | Statistical Test Results | Interpretation                                                                 |
|-----------|--------------------------|-------------------------------------------------------------------------------|
|           | Normality | Homogeneity | Mann Whitney |                                                        |
| Experiment | 0.013    |              |             | There is no difference in the initial mathematical resilience score of students who study using Microsoft Excel VBA with those who use conventional learning |
| Control   | 0.060    |              | 0.654       |                                                          |

Based on Table 3, it appears that the pretest scores of the two classes are not normally distributed. This can be seen in the experimental class score is 0.013 and the control class is 0.060, where the value does not meet the criteria Sig. > 0.05. Because one class is not normally distributed, it is followed by Mann Whitney's non-parametric test. The mathematical resilience pretest score in the Mann Whitney test is Sig. (2-tailed) Sig. 0.654 > 0.05. In accordance with the testing criteria, $H_0$ is accepted, meaning that there is no difference in the initial mathematical resilience score of students whose learning uses Microsoft Excel VBA with those using conventional learning.

Furthermore, testing is done as before for the posttest scores in both classes. The following table recapitulation of mathematical resilience post-test scores can be seen in Table 4.

### Table 4. Recapitulation of Mathematical Resilience Posttest Score

| Class     | Statistical Test Results | Information                                                                 |
|-----------|--------------------------|-------------------------------------------------------------------------------|
|           | Normality | Homogeneity | T test |                                                        |
| Experiment | 0.044    |              |        | Achievement of mathematical resilience scores of students whose learning using Microsoft Excel VBA is better than those using conventional learning |
| Control   | 0.200    |              | 0.100  |                                                          |

Based on Table 4, it can be seen that the posttest score in one class is not normally distributed. This can be seen in the experimental class score is 0.044 and the control class is 0.200, where the value of one of the classes does not meet the Sig criteria. > 0.05. Because one class is not normally distributed, it is continued with Mann Whitney's non-parametric test. Posttest mathematical resilience scores in the Mann Whitney Sig test. (2-tailed) is 0.750. Sig. Value must be divided in half because by using IBM SPSS Statistics 25 software where the Sig. conducted to see the two-party test. While that is used in this test to side with one party as the research hypothesis. According to [15], "The significant display of SPSS is for two-tailed (2-tailed) tests, because we will do a one-tailed (1-tailed) hypothesis test so the Sig. (2-tailed) must be halved ". Therefore the mean difference test in the mathematical resilience posttest score is $\frac{0.100}{2} = 0.05$. This value does not meet the criteria Sig. (1-tailed) > 0.05 then $H_0$ is rejected, which means the achievement of a mathematical resilience score between classes where learning using Microsoft Excel VBA is better than using conventional learning.

From the recapitulation results of the mathematical resilience, the post-test shows that the mathematical resilience score in the experimental class is that learning using Microsoft Excel VBA is better than the control class learning with conventional learning. This is consistent with interviews with several students who stated that learning mathematics using VBA Microsoft Excel is very helpful in understanding mathematical material, especially building space. In addition, students who learn with Microsoft Excel VBA tend to be able to overcome difficulties if given difficult geometrical problems, anxiety, and fear in working on math problems are reduced and are more confident in expressing...
mathematical opinions/ideas. This is in accordance with the opinion of [16], conveying the messages he knows, both messages in the form of concepts, formulas, and strategies for solving a mathematical problem are highly needed by students. However, from the results of Table 2, it shows that the average mathematical resilience pretest scores in the two classes are not a very significant increase when viewed from the post-test mathematical resilience score. According to [8], mathematical resilience is not an instant thing to change. This is because mathematical resilience is a problem related to resilience in mathematics, which arises from within the individual himself. It is the environment that facilitates the development of mathematical endurance which must be carried out continuously for students' mathematical endurance consistently. This is in accordance with the opinion [17], mathematical resilience is very dependent on individual factors and the environment and interaction between students and other students.

4. Conclusion
Based on the results and discussion above, it can be concluded that the achievement of mathematical resilience of students who get learning using Microsoft Excel VBA is better than those using conventional learning. Students who learn with Microsoft Excel VBA tend to be able to overcome difficulties if given difficult math problems, anxiety, and fear in working on math problems are reduced and are more confident in expressing mathematical opinions/ideas. Mathematical resilience is not an instant thing to change so it needs environmental support so that students' mathematical resilience becomes better.

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