Contextual approach using VBA learning media to improve students’ mathematical displacement and disposition ability

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Abstract. The main problems of the research were the lack of reasoning ability and mathematical disposition of students to the learning of mathematics in high school students in Cimahi – West Java. The lack of mathematical reasoning ability in students was caused by the process of learning. The teachers did not train the students to do the problems of reasoning ability. The students still depended on each other. Sometimes, one of patience teacher was still guiding his students. In addition, the basic ability aspects of students also affected the ability the mathematics skill. Furthermore, the learning process with contextual approach aided by VBA Learning Media (Visual Basic Application for Excel) gave the positive influence to the students’ mathematical disposition. The students are directly involved in learning process. The population of the study was all of the high school students in Cimahi. The samples were the students of SMA Negeri 4 Cimahi class XIA and XIB. There were both of tested and non-tested instruments. The test instrument was a description test of mathematical reasoning ability. The non-test instruments were questionnaire-scale attitudes about students' mathematical dispositions. This instrument was used to obtain data about students' mathematical reasoning and disposition of mathematics learning with contextual approach supported by VBA (Visual Basic Application for Excel) and by conventional learning. The data processed in this study was from the post-test score. These scores appeared from both of the experimental class group and the control class group. Then, performing data was processed by using SPSS 22 and Microsoft Excel. The data was analyzed using t-test statistic. The final result of this study concluded the achievement and improvement of reasoning ability and mathematical disposition of students whose learning with contextual approach supported by learning media of VBA (Visual Basic Application for Excel) was better than students who got conventional learning.

1. Introduction
Education has an important role to prepare qualified human resources and to compete in the development of science. The education should be encouraged as well as possible. This can be achieved through a timely education in order to realize the learning objectives, which are implemented in the form of the learning process which is the implementation of the school curriculum through teaching activities. Mathematics is an important part that cannot be separated from human life. In the world of education, mathematics is often encountered in other subjects. Thus, mathematics is called an applied science. One of the goals of learning mathematics is to educate the life of the nation. Things to consider in math lessons are interest and willingness, and hard work in thinking.
According to Mathematics is one of those lessons closely related to real life. No little things and problems around we need the science of mathematics. Depdiknas [3] says, Mathematics has an important role in developing the human mind power so that mathematics becomes the foundation for the development of modern technology. Mathematics equips students to have logical, analytical, systematic, critical, and cooperative skills. Therefore, mathematics lessons should be given to all students for every level of education, from elementary to university level.

NCTM [9] recommends some general-purpose students of mathematics learning: 1) learning about mathematical values, understanding evolution and its role in society and science; 2) Have a high confidence, believe in the ability of mathematical thinking owned and sensitive to the situation and problems; 3) Being a problem solver, being a productive citizen and experienced in solving various problems; 4) Communicating mathematically, learning about symbols, symbols, and mathematical rules; 5) Mathematical reasoning is to make the conjecture, evidence and construct arguments mathematically.

The results of TIMSS and PISA over the past few years indicate that students' mathematics learning outcomes in Indonesia, especially about mathematical reasoning, are still low and are in positions below Malaysia and Singapore [10]. The facts encountered by researchers also showed the results of learning mathematics that is less satisfactory. Through the results of preliminary observations and interviews with mathematics teachers in SMAN 4 Cimahi obtained information that there are still many students who have not met the minimum completeness criteria (KKM) established by the school that is 66.5. Associated with the ability of mathematical reasoning that became the focus of research, researchers also get information from mathematics subject teachers that the ability of mathematical reasoning students SMAN 4 Cimahi also still low.

Based on the problems above, one of the objectives is how to overcome the problems faced by high school students who generally do not solve the problem of mathematics in the material opportunities. Another objective is solving the problem by providing an overview or by using a contextual approach in the form of examples. It improves the reasoning ability of high school students. This approach is very practical, fun and not boring because it focuses more on the real world of students. Thus, in learning the concept of mathematics more easily understood. It is also easier for the teacher to link the material taught to the real world of the students. Depdiknas in Hutagaol [7] says, there are seven main components in learning with contextual approach, 1. Constructivism 2. Questioning (ask) 3. Inquiry (find) 4. Learning community (learning community) 5. Modelling (modelling) 6. Reflection 7. Authentic Assessment

Keep in mind that Visual is more influential than listening and reading, this statement is in line with Hidayatullah [6]. De Porter's research results, humans are able to absorb a material as much as 70% of the work done, 50% of what is heard and seen, while from what he saw only 30%, then he heard only 20%, and from 10% read. Therefore, the basic knowledge of opportunity for high school required props that are able to describe the ICT-assisted mathematics associated with using VBA in Excel aimed at high school students able to make conclusions without having to memorize the formula of opportunity. In addition, the researchers also looked at the mathematical disposition of students.

2. Review of Literature
2.1. Mathematical reasoning abilities
The reasoning is a process or way of thinking of a person in taking a conclusion of knowledge, thinking activities that have certain characteristics to find the truth, and think reason has certain characteristics. Baroody in Bernard [2] says, reasoning is an essential tool for mathematics and the activities of everyday life. It means that students when learning math needs reasoning to spark ideas so that students understand the correct mathematical concepts.
The indicators of mathematical reasoning ability in Soemarmo [13] are: a) Drawing the conclusions of analogies, generalizations, and construct conjectures; B) Draw logical conclusions based on inference rules, check the validity of arguments, and construct valid arguments; C) Establish direct proof, and by mathematical induction. Where items a and b are reasoning capabilities by inductive step and item c is deductive reasoning ability. So with the learning of reasoning ability, students can be able to solve problems without having to memorize the mathematical concepts that become the students’ burden.

2.2. Mathematical Disposition
According to Hendriana & Sumarmo [4], mathematical dispositions are attitudes that show: a) confidence; b) flexible; c) persistent, tenacious performing mathematical tasks; d) interest, curiosity; e) monitor, reflect on their own appearance and reasoning; f) passion for learning mathematics; g) implements mathematics to other situations; h) appreciate the role of mathematics; i) rape and metacognition; j) share with others. Polking in Herlina [5] argues that mathematical dispositions show: (1) confidence in using mathematics, solving problems; (2) flexibility in investigating mathematical ideas and seeking alternative methods of problem-solving; (3) diligently doing math tasks; (4) interest, curiosity in mathematics; (5) tend to monitor; (6) assessing mathematical applications to other situations; (7) appreciation (appreciation).

2.3. Contextual Approach
The contextual approach according to Trianto in Nuriadin [10] the main component of the contextual approach is constructivism; questioning, finding (inquiry), learning community, modeling, reflection, and actual assessment. The indicators can be used for teaching and learning in the classroom. The system of contextual learning includes the following eight [1] components: (1) meaningful associations (2) meaningful work (3) self-regulated learning (4) Working together (5) Critical and creative thinking (6) individuals to grow (7) reaching high standard (8) authentic assessment.

The principles of contextual learning according to Sanjaya [12] are (1) Constructivism, constructivism is the process of building or composing new knowledge in the cognitive structure of students based on experience, application of the principle of constructivism in contextual learning approach, students are encouraged to be able to construct their own knowledge through real experience; (2) Inquiry, the second principle in the contextual approach is the inquiry, that is, the learning process is based on the search and discovery through the process of thinking systematically. knowledge is not a number of facts the result of remembering, but the result of the process of finding itself; (3) Questioning, learning is essentially asking questions and answering questions, questioning can be viewed as a reflection of every individual's curiosity while answering questions reflects one's ability to think; (4) community learning, problem cannot be solved alone but requires the help of others. the concept of a learning community in a contextual approach suggests that learning outcomes be obtained through cooperation with others; (5) modelling (modelling), referred to as the modelling principle is the learning process by demonstrating something as an example that every student can imitate; (6) reflection is the process of settling the learned experience done by reordering the events or learning events that have been passed; (7) authentic assessment the process by which teachers collect information about student learning progress. authentic assessment is done in an integrated manner with the learning process. this assessment is done continuously during the learning activities take place. therefore, the pressure is directed to the learning process rather than to the learning outcomes.

2.4. VBA Helped Language Learning (Visual Basic Application for Excel)
Visual Basic Application For Excel is a programming language that gives commands needed in Microsoft Excel to speed up the operation automatically. In accordance with Winarno [15] that VBA (Visual Basic Application) or macros are functions and program commands in MS Office (including Excel) stored in the old Visual Basic, or Visual Basic before the .NET framework version is present. With VBA, a work in Office can be optimized. Microsoft Excel is generally used by most people in numerical processing because of the many mathematical functions that can be associated with Statistics, Economics, Engineering and more. But not limited to that alone, the fact that VBA in Excel can be utilized more usefulness. As for the usage of the props making using VBA in Excel first, the drawing
can be an interactive image, the students become active and fun to learn math because the students are more understanding than without using ICT, the second is not much big cost to make the props, And thirdly, that the use of Microsoft Excel Software is accessible for computer users.

3. Experimental Method
This study was designed in the form of experimental design with pre-test-post-test control group design that aims to examine the role of learning with the contextual approach to reasoning ability and mathematical disposition of high school students. The sample is randomly assigned to the experiment class and control class. The students’ mathematical reasoning test is structured to refer to the characteristics of mathematical reasoning ability and good test preparation guidelines. Similarly, the preparation of students’ mathematical disposition instruments is prepared on the basis of indicators on the student's mathematical disposition. The data will be analyzed by using statistical test t and test with statistic $\chi^2$ (for association test between variables).

Before the treatment is done, students are given an initial test of students' mathematical reasoning abilities. Furthermore, learning in the experimental and control classes begin at the end of the treatment will be done the final test to see the development of students' mathematical reasoning abilities. Then to find out the mathematical disposition of students conducted mathematical disposition tests of students by giving a questionnaire of the mathematical disposition of students in both classes. Thus the research design is as follows [11]:

\[
\begin{array}{c|c|c}
A & X & 0 \\
0 & 0 & 0
\end{array}
\]

Where:
A : Classroom random sampling
0 : Pretest = Posttest the ability of mathematical reasoning
X : Learning with Contextual Approach

The populations in this study were all of the high school students of class XI in Cimahi – West Java. The sample subjects were selected by one school at random based on school qualification. Of the three levels of existing classes in high school in Cimahi that is class X, XI, and XII then selected class XI with consideration in the first semester there is a subject of opportunity that will be used in research. Sampling in this study was randomly assigned to a class, in a random sampling technique of each sampling unit as a population element obtaining equal opportunity to be a sample or to represent a population.

The data in this study was collected through the mathematical reasoning skills test, the scale of mathematical disposition of the students. Data on mathematical reasoning ability were collected through pre-test and post-test, mathematical disposition data of the students was collected by dispersion of mathematical disposition scale after treatment. For the test data of the students' mathematical disposition the two groups were processed with the help of Microsoft Excel software. Furthermore, the test results data (preliminary and final tests) of both groups were processed using Microsoft Excel and SPSS 22 software assistance with the following steps:
1) Testing the normality of sample data.
2) Test the Homogeneity of Variance.
3) Average Difference Test.
4) N-Gain Test
5) Chi Square Test and Contingency Coefficient.
4. Results and Discussion
At the beginning of the study, the researchers conducted a second class observation which is a sample based on the average of classes in four classes XI and taken 2 classes. They got pre-test before doing learning and teaching activities.

| Class       | Average (X) | Standard Deviation (S) |
|-------------|-------------|------------------------|
| Control     | 4.49        | 0.78                   |
| Experiment  | 4.26        | 0.84                   |

Maximum Score Index = 20

From the pre-test result, it is found that the control grade 4.49 and the experimental class 4.26 shows that the control class is higher than the experimental class and for the standard deviation that the control class with the value of 0.78 and the experimental class with the value of 0.84 means that the scattering of student grades in the experimental class is more diffuse against the average grade than the control class.

But it can be seen from Table 1 that the mean values of the two classes are not too far away, and the small average values will be used as experimental classes and other classes are the control classes. It gives the information to make a decision to determine whether there is a difference in average or not.

| Class       | Kolmogorov-Smirnov* | Shapiro-Wilk |
|-------------|---------------------|--------------|
| Value       | Statistic | Df | Sig. | Statistic | Df | Sig. |
| Control     | ,306      | 41 | ,000 | ,828      | 41 | ,000 |
| Experiment  | ,260      | 41 | ,000 | ,867      | 41 | ,000 |

* Lilliefors Significance Correction

The first stage, the normality test of whether the two classes are normal data or not, seen from the value of sig Control 0.000 and sig experiments 0.000, the value of sig taken from the Kolmogorov-Smirnov normality test [11]. It turns out the two classes are not normal because the sig value is less than 0.05. This means that both data is continued with the test difference of nonparametric mean that Mann-Whitney test.

| Avg. Test  | Value  |
|------------|--------|
| Mann-Whitney U | 698,000 |
| Wilcoxon W   | 1559,000 |
| Z           | -1,415 |
| Asymp. Sig. (2-tailed) | .157 |

Obtained a Mann-Whitney 698,000 value and a two-sig value to see the presence or absence of average difference and obtained sig0.157 value means greater than 0.05 means there is no average difference between the control class and experimental class during pre-test or test early. After that, they continue the activities by doing the post-test or final test after learning and teaching in class control and experiment class. From these results can be from the average grade and standard deviation of the two classes.
Table 4. Description of Control and Experiment Classes during Post-test

| Class        | Average ($X$) | Standard Deviation ($S$) |
|--------------|---------------|--------------------------|
| Control      | 11.71         | 2.59                     |
| Experiment   | 12.85         | 2.81                     |

Maximum Score Index = 20

The Post-test shows that both classes have an increase in the average value of post-test. It means that there is an increase in the results of each student at the time before doing student learning compared to after learning. For the control class having an average grade of 11.71 and for the experimental class of 12.85 means that the average value of the experimental class is higher than the average value of the control class and the experimental class. And for the standard deviation for the control class 2.59 and the experimental class 2.81 means that each student’s data for the experimental class is greater than the control class against the average grade of each class. It can be said that the spread of control class data is closer to the control class average than the experimental class. And to see the decision whether the experimental class that is learning mathematics with Visual Basic For Excel is better than the class that uses the usual way.

The first stage is the second-class normality test using Kolmogorov-Smirnov and adapted sig value for the control class 0.015 and sig for the experimental 0.000 class means that the sig value is less than 0.05 or it.

Table 5. Normality Test of Post Control Class and Experiment

| Class                            | Kolmogorov-Smirnov | Shapiro-Wilk |
|----------------------------------|--------------------|--------------|
|                                  | Statistic df Sig. | Statistic df Sig. |
| Posttest Control Class           | ,155 41 ,015      | ,955 41 ,101  |
| Postest Experimental Class       | ,195 41 ,000      | ,894 41 ,001  |

It can be said that the control class and the experimental class are abnormal data. If the second is not normal to the second stage, test the difference in the mean of two nonparametric classes using Mann-Whitney test.

Table 6. Average Test of Experiment Class and Post-test Control

| Avg. Test          | Value     |
|--------------------|-----------|
| Mann-Whitney U     | 613,500   |
| Wilcoxon W         | 1474,500  |
| Z                  | -2.131    |
| Asymp. Sig. (2-tailed) | .033    |

The table shows that if there is an average difference between the experiment class and the post-test controls where the Mann-Whitney test value is 613,500 with the sig value. 0.033. Because to see that the experimental class is better than the control class it is done by a one-party test by means of a value $\frac{0.033}{2} = 0.0165 < 0.05$ [14]. It means that there is an average difference between the experimental class and the control class and it is also known that the average of the experimental class is higher than that of the control class means that the learning class uses ICT to improve the ability of reasoning High school students are better than the class that is learning in the usual way.

As for the improvement of students for each class can be seen from the value of gain useful for the improvement of student work before learning or pre-test with after learning or post-test.
From the average gain value of the control class 0.47 while the experimental class of 0.54 means that the gain value for the experimental class is higher than the control class although the standard deviation of the control class is smaller than the experimental class means that the gain value for the control class is more closer to the mean than the experimental class.

### Table 7. Description of control and experiment gains during Pre-test

| Class          | Average ($X$) | Standard Deviation ($S$) |
|----------------|---------------|--------------------------|
| Control        | 0.47          | 0.15                     |
| Experiment     | 0.54          | 0.18                     |

### Table 8. Test of gain class Normality of Experiment Class and Control Class

| Class                  | Kolmogorov-Smirnov Statistic | Shapiro-Wilk Statistic |
|------------------------|-----------------------------|------------------------|
| Postest Control Class  | 0.104                       | 0.966                  |
| Postest Experimental Class | 0.157                     | 0.012                  |

Normality test using Kolmogorov-Smirnov test, where for sig value control class 0.200 > 0.05 mean data of control class is normal data. While the experimental sig of 0.012 < 0.05 means that the experimental class data is not normal. Since there is one abnormal then proceed with Mann-Whitney Test.

### Table 9. Difference Test Average gain of Control and Experiment Class

| Avg. Test          | Value |
|--------------------|-------|
| Mann-Whitney U     | 608,000 |
| Wilcoxon W         | 1469,000 |
| Z                  | -2.161 |
| Asymp. Sig. (2-tailed) | 0.031 |

Mann-Whitney 608,000 test value and sig value 0.031, to see better the Mann-Whitney test for sig 0.031/2 = 0.0155 < 0.05 means that the gain for the experimental class is better than the control class.

### Table 10. Ability of reasoning and disposition

| Disposition | Low | Medium | High | Total |
|-------------|-----|--------|------|-------|
| Experiment  |     |        |      |       |
| Low         | 1   | 7      | 0    | 8     |
| Medium      | 8   | 14     | 7    | 29    |
| High        | 0   | 3      | 1    | 4     |
| Total       | 9   | 24     | 8    | 41    |

For reasoning abilities, there is 1 student who has low disposition questionnaire and low reasoning ability also, for medium questionnaire and disposition ability there are 14 students possibility for the group is no relationship and there is one student who has high disposition questionnaire and high reasoning ability. But there is also a low reasoning capability but this moderate disposition questionnaire is not consistent that students with low reasoning abilities are also in a low disposition, as well as a group of high reasoning abilities there are 3 students who state that the moderate disposition questionnaire is high.
Table 11. Chi-Square test for reasoning and disposition reasoning associations

| Test of the Association | Value  | df  | Asymp. Sig. (2-sided) |
|-------------------------|--------|-----|-----------------------|
| Pearson Chi-Square      | 5.417  | 4   | 0.247                 |
| Likelihood Ratio        | 7.722  | 4   | 0.102                 |
| Linear-by-Linear        | 0.735  | 1   | 0.391                 |
| Association             |        |     |                       |
| N of Valid Cases        | 41     |     |                       |

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is 78
b. The result of the association between reasoning ability and disposition can be seen from Pearson Chi-Square test has value 5.417 with sig value of two parties 0.247> 0.05 meaning there is no association between reasoning ability and disposition.
c. During classroom surveys, mathematics class XI classes on Opportunities and Statistics. The difficulties encountered by students are about understanding, calculating and applying into examples of opportunities such as enumeration, permutations, and combinations. With the problems faced by students, it is necessary is to improve students’ reasoning abilities between the material opportunities in the example of daily life that can be analogous and provide some examples to get conclusions as well as from some sense to prove the notion of opportunities with the ICT-assisted contextual approach as a tool of mathematics Opportunities. The software used to create props is Microsoft Excel with the help of Visual Basic Application for Excel.

Figure 1. Opportunity one dice

Figure 2. Game one dice and currency

Students are given a sense of opportunity with some basic examples such as selecting a sample of the eyes of the dice mentioned by the student towards the whole which will be randomized several times and the student will make the conclusions of the ICT-assisted props.

Figure 3. Combination and permutation with the concept of a worm and
Figure 4. The game determines the number of numbers to explain permutations and combinations.

Students' understanding of the meaning of combinations and permutations is given some sample images of the button concept so that students blindly declare to distinguish combinations and permutations after which the students will be given an opportunity to try the truth and then given an application game of combinations and permutations by determining many numbers.

Figure 5. Teacher's explanation of opportunities using ICT

5. Conclusion

Based on the results of the discussion it can be concluded that Contextual Approach aided Application of Excel VBA Learning Media can Improve the Ability of Reasoning and Math Disposition of High School Students.

Mathematics learning does not always explain using ICT. ICT is only a tool to provide examples of drawing props and is explained on the basis of student conclusions from the observation of a sample image from ICT. This gives students more active and fun learning math.

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