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Preferences of Vocational High School (SMK) Students at The Main Branches of Mathematics

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Abstract

This study uses a quantitative approach, testing the hypothesis through the chi-square distribution by applying the goodness of fit testing method. In a real sense, the fit test is a hypothesis testing by comparing the observed frequency with the expected frequency. Regarding good of fit, a distribution of observational data, the calculation is based on the average value and observational data. Furthermore, hypothesis testing is carried out to determine whether the frequency distribution of the observed results is in accordance with the expected frequency distribution. Based on the suitability test procedure using the chi-square distribution, that there are differences between Vocational High School (SMK) students towards the main branches of mathematics. Students do not perceive that all major branches of mathematics are the same. It is possible that some branches have major mathematics that are difficult to learn, so students prefer to choose other things that are learned to master or easier.

Keywords: goodness of fit testing, Mathematics main branches, Preference

INTRODUCTION

Mathematics as a basic science is used as a tool for solving problems of everyday life, including science and technology. Mathematics has many advantages: its language and rules are well defined, its reasoning is clear and systematic, and its structure is very strong. With mathematics a real problem can be made in a model whose structure is clear and precise.

Mathematics is taught in schools with the aim of equipping students with the ability to think logically, analytically, systematically, critically, and creatively. So far, most students – in this case students – do not understand the benefits of studying mathematics. Not infrequently they feel that learning mathematical concepts such as geometry, algebra or calculus is less useful (Andriani, 2015). In fact, without realizing it, what is taught is not only concepts but a systematic, logical, critical and analytical way of reasoning that is being honed. According to Prastyo (2011), the way of mathematical reasoning is the goal in getting used to math problems and not just memorizing formulas to pass the exam and after passing it is then forgotten.

Mathematical concepts such as functions, limits, integrals and so on, are nothing more than the conceptual tools or weapons of the human mind to dissect the quantitative enigma of reality. Calculus is a basic material that really needs to be mastered well by every student, so that students have a critical, logical and

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systematic scientific mindset, are able to design simple mathematical models, and are skilled in standard mathematical techniques supported by reasoning concepts, formulas and right methods (Heri, 2005).

Geometry can be viewed as a deductive system, so geometry can also be called a deductive science. In geometry that starts with the notion of bases, definitions and postulates, theorems can be derived logically and so on. Understanding the base, definition and postulates that determine the type of geometry (Budiyono, 2020).

Van de Walle (1994) reveals five reasons why geometry is so important to study. First, geometry helps humans have a complete appreciation of their world. Second, geometric exploration can help develop problem solving skills. Third, geometry plays a major role in other areas of mathematics. Fourth, geometry is used by many people in their daily life. Fifth, geometry is enigmatic and fun.

Meanwhile, according to Usiskin (1995) gives three reasons why geometry needs to be taught. First, geometry is the only thing that can relate mathematics to the physical form of the real world. Second, geometry is the only thing that allows ideas from other fields of mathematics to be drawn. Third, geometry can provide a non-single example of a mathematical system. While Kennedy and Tipps (1994) provide three reasons why geometry needs to be studied. First, geometry increases children's understanding of their world. Second, reasoning and communication are two things that are inherent in learning geometry. Third, many topics and skills depend on students' spatial understanding.

So far there is no definite definition of algebra so what we can do is identify characteristics or issues related to algebra. When we hear the word 'algebra' at school, the majority of things that come to our mind are variables, equations, or inequalities (Wijaya, 2016).

Considering the wide scope of algebra which is more than just a variable should make us expand the objectives of learning algebra. Algebra learning should be aimed at developing students' abilities in: (1) understanding patterns, relations, and functions; (2) representing and analyzing mathematical situations using symbols and algebraic procedures; (3) using mathematical models to express and understand quantitative relations; and (4) analyzing change in various contexts (NCTM, 2010).

Trigonometry mathematics covers how a problem in real life is converted into a mathematical model so that it is possible to obtain a mathematical sentence form which then with mathematical techniques based on the appropriate formulation can be carried out a calculation in order to get a solution to the problem at hand (Nasaruddin, 2013).

Logarithms are mathematical material that is considered difficult for students (Lestari & Prahmana, 2018), so to make it easier for students to understand logarithmic material, meaningful teaching and learning activities are needed and a good understanding of the prerequisite

material (Widowati, 2013: 266). Students must be able to master the concepts and properties of logarithms before studying logarithmic functions (Sinaga et al, 2014: 53).

Based on the background, this study aims to provide a description the difference preferences of students at the Vocational High School (SMK) level towards the main branches of mathematics. the main branches of mathematics are arithmetic, algebra, logarithm, geometry, trigonometry, and calculus.

METHOD

This study uses a quantitative approach, testing the hypothesis through the chi-square distribution by applying the goodness of fit testing method. The goodness of fit test is also called the goodness of fit test. In a real sense, the goodness of fit test is a hypothesis testing by comparing the observed frequency with the expected frequency. Regarding the goodness of fit of a frequency distribution of observations, the calculation is based on the average value and the frequency of observations. Furthermore, hypothesis testing is carried out to determine whether the frequency distribution of the observed results is in accordance with the expected frequency distribution.

The chi-squared value is calculated by applying the following formula below.

$$x^2 = \sum_{I=1}^{n} \frac{(n_{ij} - e_{ij})^2}{e_{ij}}$$

Where x^2 is the chi-squared value calculated, nij is the frequency obtained from observations in row i and column j (certain cells). While e_{ij} is the expected frequency of row i and column j.

RESULT AND DISCUSSION

The following is an image that provides a simple overview of the simple order and construction of the main mathematical fields. Figure 1 included in WW Sawyer's book, Mathematician Delight.

Geometry can be defined as a branch of mathematics that studies points, lines, planes and objects in space and their properties, sizes and relationships with each other. So, geometry can be seen as a study that studies physical space (Budiyono, 2020).

Freudenthal (1977) described algebra as: "It is the kind of algebra the Babylonians started with. Was their algebra not algebra, because their symbolism was not smooth enough? Are 'length' and 'width' much worse than 'x' and 'y' if you can give clear recipes for solving quadratic equations in such terms? Is it not algebra if the sum of the first 10 squares is laid down in a numerical formula that allows one to extend the result to any n? This ability to describe relations and solving procedures, and the techniques involved in a general way, is in my view of algebra such an important feature of algebraic thinking that I am willing to extend the name 'algebra' to it, as long as no other name is proposed, and as far as I know no other name has been put forward."

In general, Freudenthal argues that algebra is not only limited to symbols or variables. He begins his description of algebra by revisiting one of the well-known

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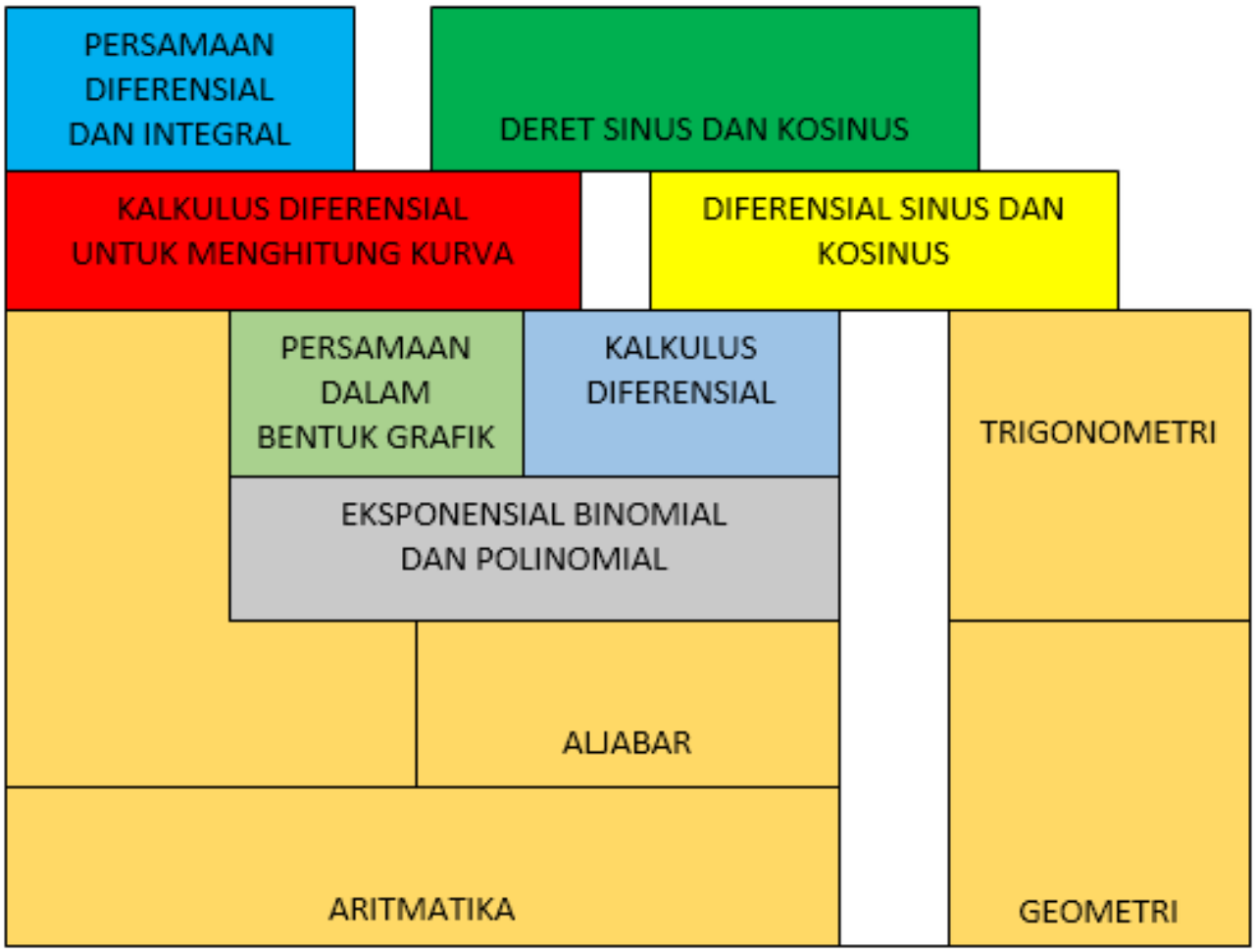

Figure 1. Mathematical Building Structure

features of algebra, namely variables. Freudenthal underlined that variables are more than symbols in the form of letters. Finally, Freudenthal ends his description by emphasizing that algebra also includes 'relationships'. He emphasized that relations are one of the important elements of algebraic thinking.

Trigonometry (from the Greek trigonome = three angles and metrome = measure) is a branch of mathematics dealing with the angles of triangles and trigonometric functions such as sine, cosine, tangent.

This research was conducted on 300 student respondents who were randomly selected. In essence, respondents are asked to answer questions about the main areas that they like to study or are interested in doing deepening. After all respondents answered, their answers were recorded and then displayed in the table 1 below.

Table 1. Variant Frequency Distribution of The Main Branches of Mathematical

Mathematical Varians	**Arithmetic**	**Algebra**	**Logarithm**	**Geometry**	**Trigonometry**	**Calculus**
Number of student respondents who chose	90	62	35	47	56	10

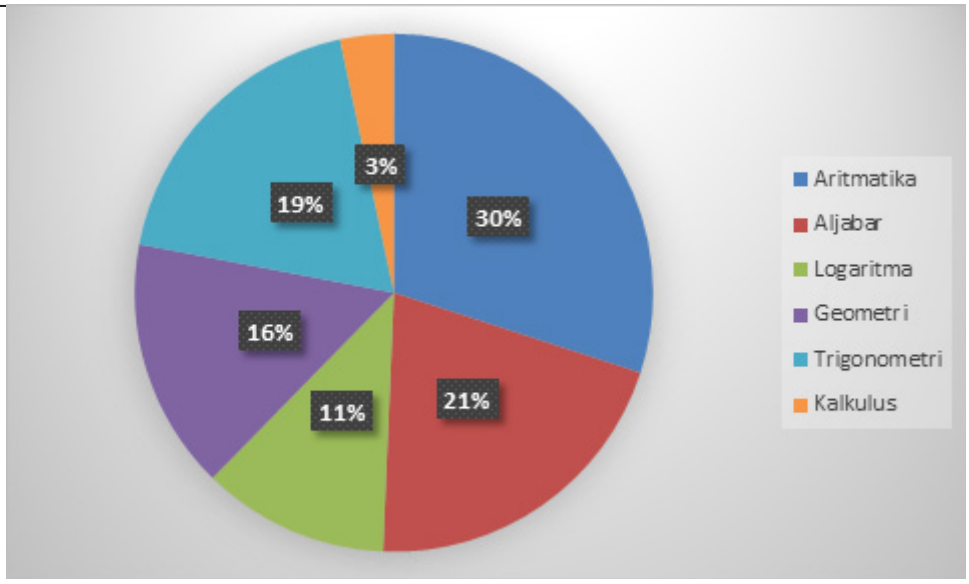

Figure 2. Graph of Respondents' Answer Percentage

Based on Figure 2. There is a description that out of 300 students, as much as 30% prefer to study the main mathematics field of arithmetic. Meanwhile, from the total number of respondents, the lowest percentage of students in choosing the main field of mathematics in calculus.

The students who were the respondents in this study were divided into 5 majors or study programs including: automotive, weaving, finishing, garment, and computer study programs (see figure 3).

Meanwhile, according to gender or gender, students who became respondents consisted of 192 male students and 108 female students (see figure 4).

Through a series of testing procedures applied in this study, the hypothesis can be answered by the following mechanism:

Formulating the null hypothesis and alternative hypothesis, for this study, the null hypothesis states that the students' preferences for each variant of the main mathematics field are the same. While

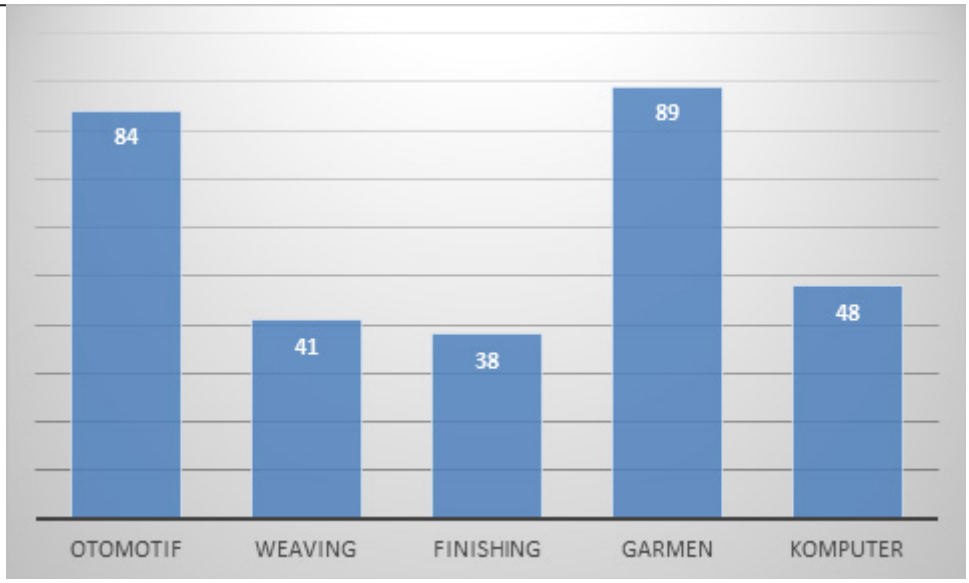

Figure 3. Graph of Respondents by Major

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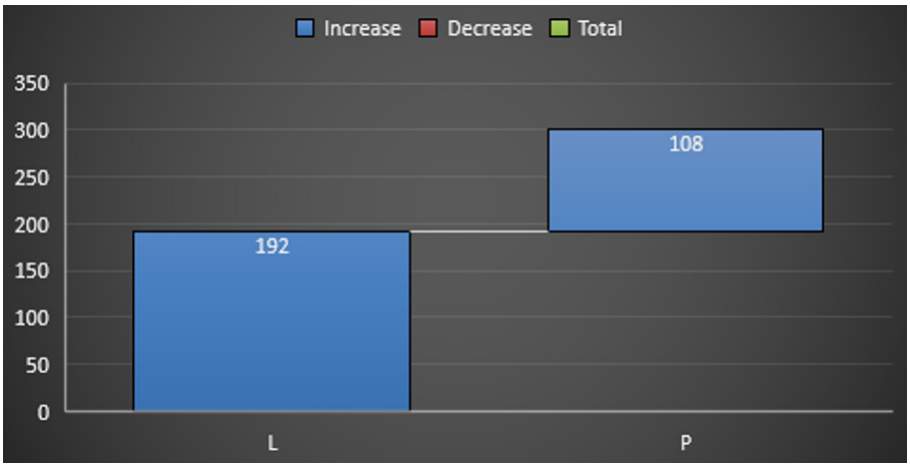

Figure 4. Graph of Respondents by Gender

the alternative hypothesis states that the students' preferences for each variant of the main mathematics field are different. Symbolically, the null and alternative hypothesis formulas in this study are formulated as follows:

H0 : students have the same preference for each variant of the main mathematics field

H1 : students have different preferences for each of the major math variants

Determining a certain level of significance, in this study, the applied significance level is 0.5%.

Formulating the test criteria, from the description of this study, the number of variants of the main mathematical fields is 6 (six). Thus, the degrees of freedom applied are 5 (6 – 1). Thus, the chi-squared value in the table for a significance level of 0.5% and degrees of freedom 5 is 16,750. Therefore, the test criteria applied are that the null hypothesis is accepted if $X^2 \leq$ 16,750. While the null hypothesis will be rejected if $X^2 > 1$ 6,750.

To calculate the chi-squared value, previously, a table regarding the actual number of respondents and the expected number of respondents for each variant of the main mathematics field must be displayed. This study tested the truth of the null hypothesis which states that students have the same preference for each variant of the main mathematics field. Therefore, the expected number of respondents for each field variant is 50. This value is derived from the division between the number of respondents and the number of variants in the main mathematics field. The frequency distribution tables that can be displayed related to this research in table 2.

Table 2. Number of Actual Respondents and Number of Expected Respondents

Mathematical Varians	Arithmetic	Algebra	Logarithm	Geometry	Trigonometry	Calculus
Number of student respondents who chose	90	62	35	47	56	10
Expected amount	50	50	50	50	50	50

Next is the calculation for the chi-squared value. The magnitude of the chi-squared value is:

$$x^2 = \sum_{I=1}^{n} \frac{(n_{ij} - e_{ij})^2}{e_{ij}}$$

$$\frac{(90-50)^2}{50} + \frac{(62-50)^2}{50} + \frac{(35-50)^2}{50} + \frac{(47-50)^2}{50} +$$
$$\frac{(56-50)^2}{50} + \frac{(10-50)^2}{50} =$$
$$\frac{1600}{50} + \frac{144}{50} + \frac{225}{50} + \frac{9}{50} + \frac{36}{50} + \frac{1600}{50} =$$
$$32 + 2,88 + 4,2 + 0,18 + 0,72 + 32 = 72,88$$

Formulating conclusions, from the calculations that have been carried out, the chi-squared value is 72.28. The value is greater than the value in the table. Thus, the null hypothesis which states that students' preferences for each major mathematics variant are equally rejected. While the alternative hypothesis which states that students' preferences for each variant of the main mathematics field is different is accepted.

CONCLUSION

Based on the goodness of fit testing procedure that uses the chi-square distribution, it can be concluded that there are differences in the preferences of Vocational High School (SMK) students towards the main branches of mathematics. Students do not perceive that all major areas of mathematics are the same. It is possible that certain fields in the fields of mathematics contain material that students find difficult, so students prefer other fields that students tend to master or are easier. Further research is needed that deepens this research, especially regarding why students are more likely to choose certain fields in mathematics to study..

REFERENCES

Andriani, Parhaini. (2015). Penalaran Aljabar dalam Pembelajaran Matematika. Jurnal Beta, 8(1), 1-13.

Budiyono. (2020). Dasar-dasar Geometri Suatu Pengantar Mempelajari Geometri. 1-16.

Freudenthal, H. (1977). What is algebra and what has it been in history? Archive for history of exact sciences, 16(3), 189-200.

Heri, Robertus. (2005). Buku Ajar Kalkulus I. Proyek SP4 Jurusan Matematika FMIPA Universitas Dipnegoro.

Kennedy, Leonard M. dan Tipss, Steve. (1994). Guiding Children's Learning of Mathematics (2rd Ed.). Belmont: Wodsworth Publishing Company.

Lestari, R.M., & Prahmana, R.C.I. (2018). Desain Pembelajaran Logaritma Untuk Siswa SMA Kelas X. Jurnal GANTANG, 3(1), 31-39.

Nasaruddin. (2013). Pembelajaran Trigonometri Berorientasi Filosofi Konstruktivistik. Jurnal Al-Khwarizmi, 1(1), 1-16.

NCTM. (2010). Principles and Standard for School Mathematics. Reston: Author.

Sinaga, B., Sinambela, P.N.J.M., Sitanggang, A. K., Hutapea, T. A., Sinaga, L. P., Manullang, S., Simanjorang, M., & Bayuzetra, Y. T. (2014). Buku Guru Matematika. Jakarta: Kementerian Pendidikan dan Kebudayaan.

Soedadiatmodjo. Matematika I untuk sekolah teknologi. Dikmenjur Depdikbud RIhttp://thariecetea. blogspot.com/2010/11/

Usiskin, Zalman. (1995). What Should not be in the algebra and geometry curricula of average college: bound students?, Mathematics Teacher, 8(2), 156-164.

Van de Walle, John A. (1994). Elementary School Mathematics. New York: Longman.

Widowati, S. (2013). Pengembangan Buku Kerja Materi Eksponen Bercirikan RME untuk Siswa SMK Teknik. Jurnal Pendidikan Sains, 1(3), 265-273.

DOI : http://doi.org/10.35719/mass.v3i1.64

Wijaya, Ariyadi. (2016). Aljabar: Tantangan Beserta Pembelajarannya. Jurnal GANTANG: Pendidikan Matematika, 1(10), 1-14.

BRIEF PROFILE

Endro Tri Susdarwono was born in Pemalang, graduated from Bachelor of Mathematics and Natural Sciences University of DR. Soetomo Surabaya, Bachelor of Law, University of Semarang, Master of Political Science, Diponegoro University and has studied at the Defense University Defense Economics Study Program, now active as a Lecturer in the Communication Studies Program at the University of Peradaban.