THE ANALYSIS OF ERROR IN ANSWERING MATHEMATICS QUESTION IN V CLASS OF SD/MI IN YOGYAKARTA CITY

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ABSTRACT

Mathematic is one of subjects studied in all education levels and is one of subject examined nationally. In the school year of 2012/2013, the result of Mathematics in national examination in elementary school or Islamic elementary school in Yogyakarta, the average values is in the lowest place compared to other subjects: Science and Indonesian Language.

This research includes into the field research. The data analysis uses qualitative method. The data are taken from the result of tests done by the students including question aspects of geometry and numbers. The result shows that there are three types of mistakes made by students of class V of Elementary School or Islamic Elementary School in solving Mathematics problems. Type 1: error concept, including error in understanding the question, Type 2: error in arithmetic calculations, and Type 3: procedural error, writing errors include Mathematics notation, the unit of measure usage errors, and the efficiency of error calculation. In this research, the error of type-3 did not contribute to the perceived value of the test is obtained. The average test score is 50,97.

The most common error is an error of type 1. In the aspect of geometry, this type of error occured more than numbers on this aspect. The error of type 3 is also often happened, especially the use of unit of measurement errors and the writing errors of Mathematics notation.

Keywords: *Mathematics errors, Elementary School or Islamic Elementary School*

INTRODUCTION

The result of survey from the TIMSS (Trends in International Mathematics and Science Study) shows that the mathematics achievement scores average of Indonesian eighth graders were significantly below the international average. In 2003, Indonesia ranked 35th out of 46 countries, with a score of 411 (the international average score is 467). In 2007, it ranked 36th out of 49 countries, with a score of 397 (the international average score is 500)[1]. In 2011, itranked 38th out of 42 countries, with a score of 386[2].

Mathematics is one subject that is given in almost all levels of education, from SD/MI even to

1 Puspendik, Survei Internasional TIMSS, http://litbang.kemdikbud.go.id/index.php/survei-internasional-timss, diakses 10 Desember 2012.

2 Kompas, Prestasi Sains dan Matematika Indonesia Menurun, http://edukasi.kompas.com/read/2012/12/14/09005434, diposting 14 Desember 2012, diakses 20 Desember 2013.

university. Mathematics is very useful and its learners can use it as assistance in studying a variety of other disciplines. Therefore it can be said that every person requires knowledge of mathematics in various forms according to his needs. The role of mathematics is high to the development of science and technology.

Currently mathematics becomes one subject of tested nationally course. In 2013, UAN results for mathematics in SD/MI in province level reach the average value of 7.0. It is lower than other subjects; they are Indonesian Languages 8.15 and IPA 7.48. When it is looked from the deployment of its value, the value of mathematics UAN has a very large variance between students who are good and who are less intelligent. From the 50.211 participants of UAN, 946 students received 10 grades for Mathematics while for Indonesian Language are 46 and for IPA are 24[3].

The data shows that there are many students who have low score in Mathematicsin UAN. The success of VI grade students answer UAN's questions is inseparable from the ability of students to understand the material of Mathematics in the class before. In accordance with SKL (Competency Standards of Graduation) of 2013, almost all of the UAN material has been given to the class under VI class. So, it is very appropriate to be identified, what is the fault of the students while working on mathematicsquestions. From this identification, it can be decided what policy should be done by the teacher to correct the fault.

The reason why the grade taken is fifth grade is because in class V, students have acquired almost all mathematical material for SD/MI. In answering mathematics questions, the mistakes made in the upper classes are caused by the mistakes made in the lower classes. So by taking V class, it can be seen what are the calculation concepts which do not yet mastered by students from class I to class V.

Based on KTSP 2006 curriculum and curriculum 2006, 2013, basically the MATHEMATICS material learned by students of SD/MI from class I-VI:

- Numbers, numbers operations, and its implementation
- Geometry. It includes Planes and Solids
- Statistics and data presentation

Statistics and data presentation are learned in VI class. So, in this research, the analysis will be performed on the number and geometry material.

Learning Mathematics in Schools

The term mathematics is derived from Latin *mathematica*which is derived from the Greek *mathematike* which means "relating to learning". The term have the root word *mathema*which means knowledge or science[4]. The term *mathematike*is also closely related to the word*mathein* which means learning (thinking). So, etymologically, mathematics means the knowledge gained by means of reasoning[5].

Mathematics is a product of human intellectual thought. The intellectual thought itself could have come from the mere thought issue and also from of the issues related to real everyday life. Mathematical objects are socio-cultural-humanist. It means that mathematics is the property of all mankind. No matter how primitive a society is, mathematics is part of its culture. Mathematics is born from the long process of human history. Due to the fact that, mathematical concepts are

3 http://www.pengumumanun.com/2013/06/rekap-hasil-kelulusan-un-sd-yogya.html
4 Erman Suherman, dkk, *Strategi Pembelajaran* …, hlm. 15-18.
5 Ibid., hlm. 18-19.

universal in its characteristic[6].

There is controversy in the study of mathematics related to whether mathematics should be taught using cognitive approach, constructivist, or practices and counting[7]. Related to the controversy, Andrew Noyes (2007), in Ariyadi, said[8]: *banyak siswa cenderung dilatih untuk melakukan perhitungan matematika daripada dididik untuk berfikir matematis*(children are trained to do mathematical calculations rather than being educated to think mathematically). Looking at these statements, there is the tendency as if there are conflicting positions between 'trained in performing the calculations' with 'educated to think mathematically'. The word 'trained' more emphasis on 'know-how', which means learn to know how to do something. While the word 'educated' more emphasis on the 'know why', which place more emphasis on understanding why some things happen.

Ways and approaches in mathematics learning is strongly influenced by the views of teachers towards the learning of mathematics. There are four kinds of views about the position and role of mathematics, they are[9]:

1. Mathematics as a way of thinking. This view originated from the character of mathematicswhich is logical and systematic in organizing ideas, analyzing information, and drawing conclusions.
2. Mathematics as an understanding of *pola* and *hubungan* (patterns and relationships). The emphasis on this relationship is necessary for students to realize that the concept they are learning has similarities and differences with the concept that has been/ever learned.
3. Mathematics as a tool(*matematika sebagai suatu alat*). This view is influenced by aspects of the application and the history of mathematics concepts.
4. Mathematics as a language/communication tool. Because mathematics is the language of symbols, so, mathematics is the universal language.

Mathematical skill of students is not only seen from mere arithmetic skills. *Mathematics Learning Study Committee*in *National Academy of Sciences* reveals that mathematical skills are based on the five elements, they are[10]:

1. Comprehension (Understanding): the understanding of mathematical concepts.
2. Calculation (Computing): the ability to perform mathematical procedures such as addition, subtraction, multiplication, and division numbers carefully, efficiently, and accurately.
3. The using (Applying): the ability to solve mathematical problems by using the right strategies, procedures, and formulas.
4. Stating the reason (Reasoning): the ability to explain or prove the settlement or the concept of a mathematical problem.
5. Captivate (Engaging): look at mathematics positively as something useful.

In mathematics learning, there is no the best way of learning and teaching. Each individual people has his own way and style of learning and teaching. Each learning approaches have their own characteristics. The approaches in mathematics learning include:

Constructivism approach

6 Sumardyono, *Karakteristik Matematika dan Implikasinya terhadap Pembelajaran Matematika*, (Yogyakarta: PPPG Matematika, 2004), hlm. 8.
7 John W. Santock, *Psikologi* …, hlm. 111.
8 Ariyadi Wijaya, *Pendidikan Matematika Realistik,* (Yogyakarta: Graha Ilmu, 2012), hlm. 5-8.
9 Ariyadi Wijaya, *Pendidikan*…,hlm. 6-7.
10 J. Kilpatrick & J. Swafford, Editors, *Helping Children Learn Mathematicsis*, (Washington, DC: National Academy Press, 2002), p. 9.

In learning mathematics by using constructivism approach, teachers do not teach students how to solve problems, but he encourages students to fnd their own way for fnishing it. When students give the answer, the teacher does not directly say right or wrong, but he encouragesother students to give agree or disagree opinion over that. In constructivism approach, the teacher acts as a facilitator[11].

Santrock, an expert of educational psychologists, provides some mathematical learning principles of constructivism approach[12]:

1. Make the mathematics becomes realistic and interesting. Give the teaching of mathematics by involving a variety of interesting realistic problems.
2. Consider the knowledge that students have before.
3. Make the learning of mathematics that develop social interaction. Learning activities should provide opportunities for students to work together and improve communication skills.

With constructivism learning approach, students not only memorize the formula used and can answer mathematical questions, but they also can understand the concepts/mathematical formulas correctly.

Problem Solving Approach

Problem solving is an important mandate in mathematics curriculum. By problem solving, mathematical skills aspects such as the application of the rules, the discovery of patterns, generalizing, and the communication of mathematics can be developed better.

Not all mathematical questions can be categorized as the problem solving question. If a question is given to the student and the student immediately know how to answer it, it does not include question on the type of problem solving one. It could be a question becomes a “problem” for a student, but not for the others[13].

According to Polya, problem solving solution consists of four steps, they are: understanding the problem, planning a solution, solving the problem according to plan, and checking back on the results obtained and the steps that have been made.

There are various strategies that can be used to resolve the problem solving, they are: working backwards, doing/acting, using a table or a list, creating a picture/diagram, estimating or guessing and then checking, fnding and using patterns, or a combination of these strategies[14].

Open-Ended Approach

Mathematicsquestion which is designed to have a variety of answers, is called as open-ended problem. The purpose of open-ended learning is to develop a creative activities and mathematical mindset so that spurred higher level thinking abilities[15]. The use of open-ended in mathematics learning provide some goodness, including[16]:

1. Students are more actively participate and have the opportunity to express their ideas.
2. Students have more opportunities to use their knowledge and skills in a comprehensive manner.
3. More experience, give reason (reasoning).

11 Erman Suherman, dkk, *Strategi* …, hlm. 74-81.
12 John W. Santrock, *Psikologi Pendidikan* …, hlm. 113-114.
13 Endang Sulistyowati dan Luluk Mauluah, *Matematika I dan Pembelajarannya*, (Yogyakarta: Grass Media, 2012), hlm. 80.
14 Ibid., hlm. 81.
15 Erman Suherman, *Strategi* …, hlm. 123-142.
16 Ariyadi Wijaya, *Pendidikan* …, hlm. 61-62.

4. Provide a discovery activities (discovery), and receive recognition from other friends related to relevant solutions acquired.

Realistic approach

Realistic Mathematics Education (RME) which has been developed in the Netherlands since the 1970s, is based on the concept of Freudenthal, an expert Dutch mathematician. According to Freudenthal, mathematics is a human activity, so students must actively construct their own knowledge with the help of an adult/teacher[17].

PMRI (Realistic Mathematics Education of Indonesia) is an RME applied in Indonesia. In PMRI, there is no specific steps that must be passed. Although PMRI is derived from RME, but in its development it is adapted to the social conditions and culture of Indonesia. PMRI learning characteristics are[18]:

1. Pupils andteachers active, both physically and mentally/thinking.
2. Learning begins by presenting contextual/realistic issues.
3. Provide opportunities for students to resolve problems in their own way.
4. Teacher encourages interaction and negotiation.
5. Teacher acts as facilitator (*Tut wuri handayani*).

If students make a mistake instead of being scolded they are aided by asking leading questions.

The Error in Answering Mathematics Question

In mathematics learning, the error in learning an earlier concept will affect the understanding of the next concept because mathematics is a structured subject. There are several causes of students error in answering mathematical questions, they are: the error in understanding the question, the error in using the formula, the error in arithmetic operations, or the error in concluding.

Lerner argues in Mulyono[19]that some common mistakes made by children in mathematical tasks are the lack of knowledge about the symbols, the lack of understanding of place value, use the wrong process, calculation errors, and writing that can not be read so that students make mistakes because they do not unable to read their own writing.

According to Arti Sriati[20], students errors in answering mathematics questions are:

1. Error in mathematicsmodeling.
2. Misconception, i.e. the error in understanding mathematical concepts.
3. Error strategy, that is an error that occurs because students do not choose the right way of answering.
4. Systematic error, the error which relates to the wrong choice of extrapolation techniques.
5. Sign errors, i.e. errors in giving or writing marks or mathematical notation.
6. Count errors, i.e. errors in performing mathematical operations.

In answering geometry questions, Junia Mulyani in his research finds that the errors committed by students are[21]:

17 Koeno Gravemeijer, *Developing Realistic Mathematics Education*, (Utrecht: Freudental Institute, 1994), p. 12-13.
18 Y. Marpaung, Pendidikan Matematika Realistik Indonesia (PMRI), *Makalah*, disampaikan pada pelatihan guru-guru SD/MI kelas I-III pada 2 Oktober 2009.
19 Mulyono Abdurrahman, *Pendidikan Bagi Anak Berkesulitan Belajar*, (Jakarta: PT Rineka Cipta, 1999), hlm. 262.
20 Arti Sriati. 1994, Kesulitan Belajar Matematika pada Siswa SMA (Pengkajian Diagnosa), *Jurnal Kependidikan*, Yogyakarta, 1994, hlm. 4.
21 Yunia Mulyani Azia, *Upaya Mengatasi Kesulitan Siswa Belajar Geometridengan Pengajaran Remidial Kelompok*

1. Misconceptions.
2. Error count.
3. Error information, which often occurs in question using story form.

Based on various opinions above, basically the main errors in answering mathematics question are:

1. Error concept, that is the mistakes made at the time the students answer mathematics question which is caused by the students do not yet understand mathematical concepts required.
2. Calculation error, the error caused by the incorrect counting done by students, while the mathematical concepts used by them are correct.
3. Errors in understanding the question.
4. Errors in writing mathematical notation. In this case, the solution obtained by the students is correct, but the notations written are incorrect.
5. Errors in the use of unit.
6. Less skilled in performing numbers operation or arithmetic capabilities. Included in this case is the errors of writing operations that do not need, or do a number of inefficient operations.

In this research, the errors classified in number 4, 5 and 6, are not considered as errors in answering mathematics question, but it is something that needs to be fixed/better trained, so that students do not have difficulty in answering mathematics questions.

In this research, the mistakes made by students in answering mathematics questions are divided into three, they are;

1. Error concept, this case includes errors in understanding the question.
2. Calculation error.
3. Procedure error, this case includes the errors classifedas number 4, 5 and 6 above.

Research Methodology

This research is a field research which using qualitative descriptive method. The research was conducted by collecting data, and the data obtained is in form of descriptive data.

In broadly speaking, the steps of the research are:

1. Preparation, include: examine the curriculum in effect, create questions test, validate test questions, contact some schools/madrasah and ask for permission to conduct research.
2. Discuss with the class teacher/mathematic teacher about the procedures and test execution.
3. Retrieve the data, conducting tests in the class which becomes the object of research. At this phase, at the same time researcher conducts observations and interviews to some students.
4. The data analysis phase.
5. Making the reports.

The Result of Research in General

Data collection was carried out on 6-8 November 2013. The research subjects taken are 43 fifth grade students from four elementary schools in the city of Yogyakarta with various categories, they are: State MI, Private MI, SDIT, State SD (Elementary School).

The test questions which become instrument of research consist of 12 questions. Descriptively, the results of student answers can be described as follows:

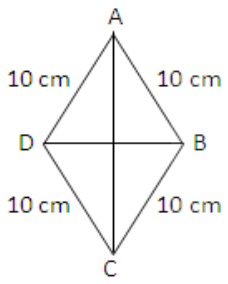
dan Remedial Bersama diSekolah Lanjutan Tingkat Pertama. Diakses dari http://digilib.upi.edu/pasca/available/etd-1011106-131035/padatanggal 13 November 2013.

From 12 questions, the student can answer 6.12 questions correctly on the average, and the average value was 50.97 with a standard deviation is 25.24. Most errors happens in question number 6, only 14% of students can answer it correctly. The fewest errors happens in question number 12, there are 83.7% of students answered it correctly.

Analysis of Error Types done by Students

1. Type 1 error: concept error.
2. Type 2 error: calculation error
3. Type 3 error: procedure error. Students who make the mistake of type 3 are not included in the group of students who make wrong answer.

Question number 1 and 2



The picture beside is an ABCD rhombud, the length of the diagonal BD = 12 cm, and the length of the diagonal AC = 16 cm. so:

Area = …..

Circumference = …

The correct answer is:

1. $Area = \frac{diagonal\ 1 \times diagonal\ 2}{2} = \frac{12\ cm \times 16\ cm}{2} = 96\ cm^2.$
2. $Circumference = 10\ cm + 10\ cm + 10\ cm + 10\ cm = 40\ cm.$

For question number 1, 27 students answer it correctly and 16 students answer it incorrectly. Based on three types of error occurred, from 27 student answer correctly, 18 of them make the type 3 error, that is: (1) do not use the unit area, and (2) using the wrong unit area.

From 16 students who answer it incorrectly, 2 students make a miscalculation and the rest make a misconception. There are various misconception of the student. Some of the wrong answers are as follows:

(a) $Area = \frac{10 \times 10}{2} \times t = \frac{10 \times 10}{2} \times 10 = 500\ cm$

(b) $Area = \frac{10 \times 4}{2} = \frac{40}{2} = 20$

(c) $BD = \frac{12}{2} = 6\ ;\ AC = \frac{16}{2} = 8$
$Area = 6 \times 8 = 48\ cm$

(d) $The\ area\ of\ A\ and\ B = 10$
$The\ area\ of\ B\ and\ C = 10$
$The\ area\ of\ C\ and\ D = 10$
$The\ area\ of\ D\ and\ A = 10$

Based on these answers, it can be said that the students make type 1 error, that is wrong in understanding the diagonal concept of rombus, do not understand yet how to calculate the area of a rhombus, and do nt understand yet the area concept/de f nition. The students also make type 3 error, that is do not use the correct unit.

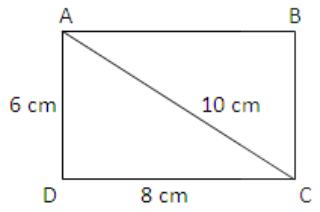
For question number 2, 29 students answer it correctly and 14 students answer it incorrectly. From 29 students who answer it correctly, 18 students make type 3 error, they are: (1) using the wrong unit, (2) do not use the unit, and (3) mathematic writing/notation error.

There are three kinds of wrong answers of the students because of concept error, they are:

(a) $Circumference = 10 \times 10 \times 10 \times 10 = 10.000\ cm^2$
(b) $Circumference = 10 \times 10 \times 10 \times 10 = 11.000\ cm$
(c) $Circumference = 12 + 16 = 28\ cm$

The answers show that the students do not understand yet the concept/definition of rhombus circumference. The students still confuse between the formula for the rhombus area and the formula for the rhombus circumference.

Question Number 3 and 4



Calculate the area and circumference of ABC triangle

Area = …

Circumference = …

The correct answer are:

3. $Area = \frac{6\ cm \times 8\ cm}{2} = 24\ cm^2$
4. $Circumference = 6\ cm + 8\ cm + 10\ cm = 24\ cm$

For question number 3, 16 students answer it correctly and 27 students answer it incorrectly. There are 3 types of error occurred. From 16 students who answer correctly, 8 students make type 3 error, that is do not use area unit or use the wrong unit area.

From 27 students who answer it incorrectly, 3 students make a miscalculation, and the other make a misconception. There are carious misconceptions made by students, they are:

(a) $Area = \frac{1}{2} \times (base \times height)$=…

(b) $Area = \frac{8 \times 10}{2} = 40 \times 6 = 240$

$Area\ I = \frac{8 \times 10}{2} = 40\ ;\ Area\ II = \frac{8 \times 10}{2} = 40$

(c) $Area = 40 + 40 = 80$

(d) $Area = 6 + 8 \times 10 = 140\ cm$

The students just write down the formula and they do not continue to work. The students do not know which one is *the base* and *the height* of the triangle. The students do not understand yet the area concept/definition, and they just memorize the formula of the triangle area. The students also make a type 3 error, that is the wrong use of area unit.

For question number 40, 20 students answer it correctly and 23 students answer it incorrectly.

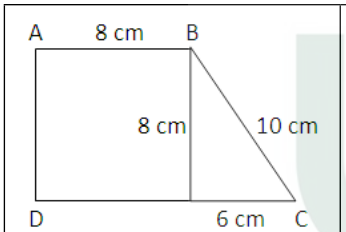
From 20 students who answer it correctly, 12 students make the type 3 error, they are: (1) do not use circumference unit, (2) use wrong circumference unit, and (3) do not write the answer in correct mathematic notation.

From 23 students who answer it incorrectly, all of them made the type 1 error, that is concept error. There are various concept error made by the students. The error is cause by the fact that the students do not understand yet the concept/definition of Planes circumference, especially triangle circumference. The students still confuse to differ between the circumference and the area concept. The students also do not use yet the formula of triangle are correctly. Some of wrong answer made by students are:

(a) $Circumference = 6 \times 8 \times 10 = 480$
(b) $Circumference = \frac{1}{2} \times 8 \times 6 = 24 \times 10 = 240$
(c) $Circumference = 10 \times 3 \times 5 = 150$
(d) $Circumference = 6 + 8 = 14 + 6 = 20 + 8 = 28$
(e) $6 \times 2 = 12$, $8 \times 2 = 16$, $10 \times 2 = 20$
$Circumference = 12 + 16 + 20 = 48$

The students make a concept error. The students do not understand yet the concept/definition of circumference. The students do not able yet to discern how to calculate the area and the circumference of a triangle.

Question Number 5 and 6



Calculate the area and circumference of the ABCD planes in the picture beside.

Area = …

Circumference = …

The correct answers are:

5. $The\ area = \frac{(8\ cm + 14\ cm) \times 8}{2} = 88\ cm^2$
6. $The\ circumference = 8\ cm + 10\ cm + 14cm\ + 8\ cm = 40\ cm$

For question number 5,16 students answer it correctly and 27 students answer it incorrectly. From16 students who answer it correctly, 8 students make the type 3 error, they are: (1) using the wrong unit,(2) do not use the unit, and (3) writing the wrong mathematics notation.

From 27 students who answer it incorrectly, 2 students make arithmetic error (type 2 error), and the rest make the concept error. Some of the wrong answers of the students are:

(a) $Area = \frac{8+10+6+8}{2} = \frac{32}{2} = 16$
(b) $Area = \frac{(8+6) \times 8}{2} = 51$
(c) $8 \times 8 = 64$, $\frac{6 \times 10}{2} = 30$
$Area = 64 + 30 = 94$
(d) $Area = \frac{base \times height}{2} = \frac{10 \times 8}{2} = 40\ cm$
(e) $\frac{6 \times 10}{2} = 30 \times 8 = 240,\ 8 + 8 + 8 + 8 = 32$

The students understand that the planes is a trapezoid, but the students do not understand yet what is meant by "the number of parallel side". Some students divide the planes into two parts of a square and a triangle, but the students do not understand yet how to calculate the area of a triangle. The students do not understand yet the area concept and they do not understand yet the formula for calculating the area of a trapezoid.

For question number 6, the students who answer it correctly just 6 students, and the rest 37 students answer it incorrectly. From 6 students who answer it correctly, 4 students make the type 3 error, they are: (1) using the wrong unit, and (2) do not use the unit.

From 37 students who answer it incorrectly, all of the students make concept error. Some students, in addition to make concept error also make arithmetic error (type 2 error 2) and writing notation error (type 3 error). The concept error made by the students can be grouped into two maor groups, they are:

(a) Dividing the planes into 2 parts, a square and a triangle. The students calculate the circumference of each sides and then add them together.

(b) The students add or multiplicate all of the sides of the known length.

Some eamples of the error made by students are::

(a) $Circumference = 8 + 10 + 6 + 8 = 32$

(b) I $= 8 + 6 + 10 \quad = 24$

II = $\underline{8 + 8 + 8 + 8 = 32}$ +

$56\ cm^2$

In the frst work, the students add all of the sides. In the second work, the students calculate the circumference of the square and the triangle, and then add them together.

Question Number 7

402-37+68=....

The correct answer : 402-37+68=365+68=433

For question number 7, 24 students answer it correctlt and 19 students answer it incorrectly. From 19 students who answer it correctlt, 11 students make calculation error (type 2 error), and the rest 8 students make concept error (type 1 error).

Question Number 8

6 + 12 : 3 =...

The correct answer: 6 + 12 : 3 = 6 + 4 = 10

For question number 8, 26 students answer it correctly and 17 students answer it incorrectly. From 17 students who answer it correctly, 11 students make calculation error (type 2 error), and 8 students make concept error (type 1 error). The most common concept error made by students is adding 6 and 12 and then divide by 3, so the reault of the calculation becomes:

The error like this one is done by 13 students. Another error is a concept error which is *coupled* by calculation error (type 2 error). There are students who calculate:.

Question Number 9

$$\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\cdots$$

The correct answer is:

$$\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{8}+\frac{1}{2}=\frac{1}{8}+\frac{4}{8}=\frac{5}{8}$$

For question number 9, 13 students answer it correctly and 30 students answer it incorrectly. From 13 students who answer correctly, 1 student make a type 3 error by performing the wrong steps of calculation. The student writes:

$$\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{4}\times\frac{1}{2}=\frac{1}{8}+\frac{1}{2}=\frac{2}{16}+\frac{8}{16}=\frac{10}{16}=\frac{5}{8}$$

From 30 students who answer incorrectly, all of the students make the concept error (type 1 error), and 8 students, in addition to make concept error also make type 3 error, they are:write wrong of mathematic notation, and perform the unnecessary steps of calculation. There are various concept error made by students, they are:

(a) $\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{8}+\frac{1}{2}=\frac{1}{10}$

(b) $\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{6}+\frac{1}{2}=\frac{1}{8}$

(c) $\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{4}\times\frac{2}{4}=\frac{2}{8}+\frac{1\times4}{2\times4}=\frac{8}{32}$

(d) $\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{8}+\frac{1}{2}=\frac{2}{1}+\frac{8}{1}=\frac{10}{1}=10$

(e) $\frac{1}{4}\times\frac{1}{2}+\frac{1}{2}=\frac{1}{4}\times\frac{2}{4}=\frac{2}{4}+\frac{1}{2}=\frac{2}{4}+\frac{2}{4}=\frac{4}{4}$

Question Number 10

-2 - 2 - (-2) + 2 =...

The correct answer is:

-2 - 2 - (-2) + 2 = -2 - 2 + 2 + 2 = 0

For question number 10, 16 students answer it correctly and 27 students answer it incorrectly. From 27 students who answer incorrectly, all of the students make a concept error (type 1 error). The concept error is occurred because students do not understand yet how to do the addition and substraction operations in positif and negative number. Some examples of wrong works of the students are as follow:

(a) -2-2-(-2)+2=-4-(-2)=2+2=4

(b) -2-2-(-2)+2=-4-(-2)=-2+2=-4
(c) -2-2-(-2)+2=-2+2+2+2=4

Question Number 11

The number of students in V class is: 13 female students and 14 male students. For the purpose of decorating the class, each female students carries 3 red balloons and male students carries 2 white balloons. How many balloons in the whole which is carried by all of V class students?

The correct answer is: 13×3+14×2=39+28=67

For question number 11, 34 students answer it correctly and 9 students answer it incorrectly. All of students who answer it correctly, answer the question by the way which more and less is same:

$$\begin{array}{l} 13 \times 3 = 39 \\ \underline{14 \times 2 = 28} + \\ \quad\quad 67 \end{array}$$

From 9 students who answer incorrectly, 1 student make type 2 error, that is calculation error, and the rest 8 students make type 1 error, that is concept error because of misunderstanding of the question. Some examples of the wrong work done by students are as follow:

(a) $\begin{array}{l} 13 \times 14 = 43 \\ \underline{\ 3 \times 2 \ = \ 6} + \\ \quad 49 \end{array}$

(b) $13 \times 14 = \frac{182}{2} = 91 \quad ; \quad \frac{182}{3} = 62$

(c) $3 + 2 = 5\ balloons$

(d) Seeking FPB for 13 and 14, and finally can not continue to answer.

Question Number 12

Mrs Heni allots colored paper to her students for making the kite. The number of students in the class is 30 students. If each student receives 3 sheets of paper, how many papers are allotted by Mrs Heni?

The correct answer is:

30×3 sheets= 90 sheets

For question number 12, 36 students answer it correctly and 7 students answer it incorrectly. All of students who answer correctly, working in the question by the way which more and less is same, that is:

From 7students who answer incorrectly, all of them make type 1 error that is concept error. Some examples of the wrong works done by students are as follow:

(1) 30 : 3 = 10

(2) 30×1=30

(3) 30×3=93

(4) Calculating KPK, and writing:

The Efforts to Fix the Errors

Area and Circumference of Planes

To repair the students' understanding of the concept of area and circumference, it can be done by the following learning process. Before getting into the material of planes area, the teacher needs to repeat frst the defnition of area of a rectangle. Teacher gives rectangular piece of paper with patches of units as in fgure 1, and asks students to calculate the area and circumference of the rectangle.

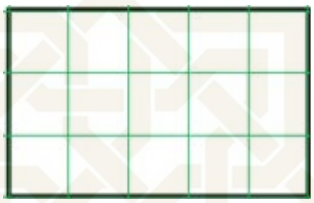


Figure 1. rectangle with unit patches

For reviewing the defnition of area and circumference, teaher gives the picture of non-geometrical form in tartan sheet as in fgure 2 and asks students to calculate the area and the circumference. Then the students are asked to create 3 different pictures of non-geomethrical form which have a certain area, and each of the pictures is calculated their circumference.

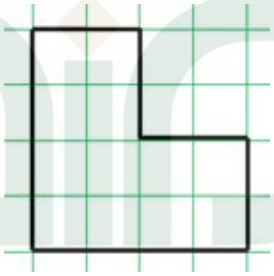


Figure 2. The Example of the picture of non-geomethrical form in a tartan sheet

Then the teacher gives pieces of parallelograms cardboard (with no certain size) as in Figure 3 and asks them to calculate its circumference. After that, the students are asked to calculate its area by cutting and reshapping it into a rectangular shape.

Figure 3. Parallelograms cardboard with no certain size

From this learning, it is hoped that the students will understand the concept of parallelograms area and determine the origin of the formula of its area. Then students are asked to draw some parallelograms with certain area and different size on tartan paper as in Figure 4.

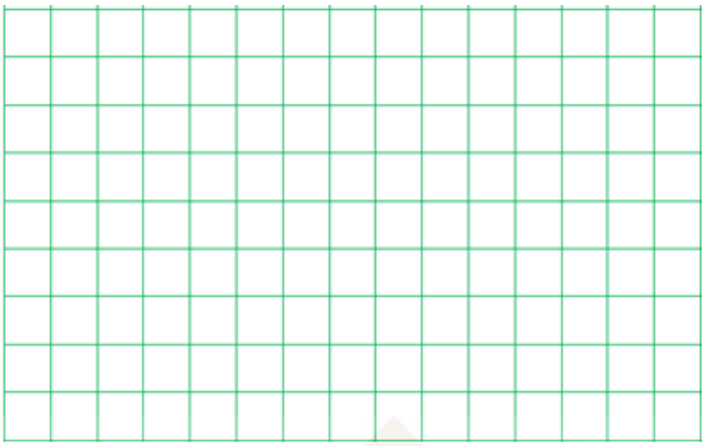


Figure 4. Tartan paper for drawing parallelograms

Similar activities can be done for another rectangular shape, rhombus, kite, and trapezoid.

The Mixed Operations of Integer

To practice and mastery of mixed operations of integer calculation, the following games can be used:

(1) **Four Number 4 Game**

Rules of the game:

Use 4 digits of number 4 for making the number 0 to 10, use any arithmetic operations. For example:

0 = 4 + 4 - 4 – 4

1 = (4 + 4) : (4 + 4)

(2) **Four Cards Game**

Prepare 10 cards (in the size of a playing card) and inscribed with the numbers 0-10. Shake the 10 cards, and take 4 cards at random. Then take another 1 card. With a variety of arithmetic operations, change the 4 digits of the card which is frst drawn into the numbers on the cardwhich is drawn last one. For example the drawn cards are the cards with the numbers 2, 5, 6, 7. One last card is the card with number 8, so it can be made 2+5+7-6=8.

The important point of these two games is that the students are asked to write down number operations performed. Students are trained to write correctly, using the correct brackets, and write the correct notation. By this game, in addition to material of integer operations that will be obtained by the students, the students are also trained to improve their creativity.

Addition and Subtraction of Positive and Negative Number

Negative number is an abstract concept. Teacher can use the visual aid pieces of positive/ negative to concretize the existence of positive and negative numbers. The visual aid is made of cardboard with a semi-circular shape with a diameter of approximately 3 cm, and it is made in 2 colors. White pieces to represent positive numbers, the black pieces to represent negative numbers.

See figure 5.

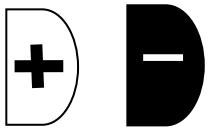


Figure 5. Positif and Negative pieces

Addition operation uses the unification concept of the member of the set. Subtraction operation uses the reduction principle of the member of the set. The basic principle of the unification of the pieces is: if one piece is negative, it will be a zero/neutral. See figure 6.

Figure 6. Positive and Negative pieces is unified into zero/neutral

Example:

-5 + 3 = …

The desmonstration:

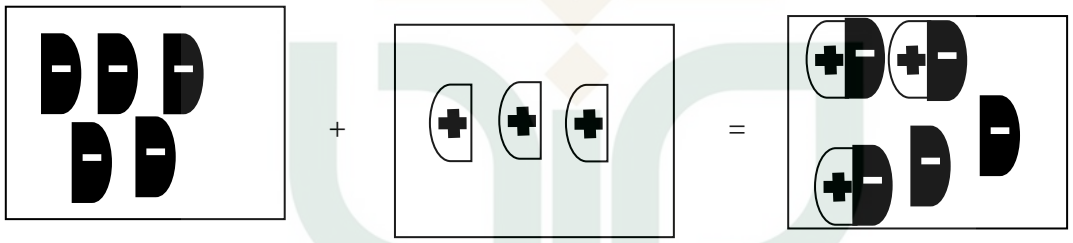


Figure 7. The demonstration of -5 + 3

Conclusion

1. The error made by students of the IV grade of SD/MI in answering mathematics questions can be classified into 3 types:

   Type-1: concept error, including errors in understanding the question.

   Type-2: arithmetic miscalculations.

   Type 3: procedure error, include: the use of unit, writing mathematical notation, the effectiveness of the arithmetic calculation.

2. In answering mathematics questions, the most frequent error is the error of type - 1, that is the concept error, both in the aspect geometry and the aspect of number. The error in the aspect of geometry is done more than in the aspect of number.

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