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Developing Student Worksheet In English Based On Constructivism Using Problem Solving Approach For Mathematics Learning On The Topic Of Social Arithmetics

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ABSTRACT

The purpose of this paper is to describe the development of student worksheet in English based on constructivism using problem solving approach for mathematics learning on the topics of social arithmetic, and its quality.

The development of the student worksheet follows ADDIE model, there are: analyze, design, development, implementation, and evaluation. The instruments of the research are validation questionnaire, student response questionnaire, learning observation sheet, teacher interview, and test.

The development process of student worksheet is: 1) analyze: need analyze, student analyze, and task analyze, 2) design: determining the component of the student worksheet based on analyze phase, 3) development: writing the student worksheet, doing expert validation, and revising student worksheet based on the validation, 4) implementation: implementing the learning process using student worksheet to examine its effectiveness and practicality, 5) evaluation: analyzing its effectiveness and practicality, and revising the student worksheet. The quality of student worksheet is: 1) the level of validity is 4,01, of 5 scales (valid), 2) the level of effectiveness is 80,56% (very effective based on student test), 3) the level of practicality are 81,6% (practice based on learning process observation), and 3,03 of 4 scales (practice based on student response).

Keywords: student worksheet, constructivism, problem solving, social arithmetic.

BACKGROUND

National education system in Indonesia has ruled in undang-undang no. 20 year 2003 pasal 50 ayat 3, said: ”Pemerintah dan/atau pemerintah daerah menyelenggarakan sekurang-kurangnya satu satuan pendidikan pada semua jenjang pendidikan untuk dikembangkan menjadi satuan pendidikan yang bertaraf internasional”. Based on government rule, many schools start became international school. Developing international school in Indonesia started by bilingual class/ class with two languages, foreign and Indonesian languages. Education makes human always increase their ability to faces every changing in the world. Therefore, education needs better attends to the problems related to input, process, and output.

Demand of globalization periods, request the students do not just receive and follow what teacher gave to them, but they must engage in learning process actively based on their ability. This way may lead students became confidence and creative. But, the fact (Asmin, 2003:2) that some mathematics teacher in Indonesia still use lecture

method in the class and monotone, so that students become passive. They receive mathematics concepts as finishing goods. This condition makes the students learn mathematics meaninglessly. Therefore, teacher should prepare students to face global competition in development of science and technologies. This is the role of educator to hold student center activities.

Trianto (2009:223) stated that student's knowledge and understanding powered by learning media in every experiment activities so that learning situation became more meaningful by the students. It needs the developing of learning media to facilitate students in international schools, one of solutions is student worksheet in English.

Using student worksheet in learning process help students to understand the material by themselves. Student worksheet also gives a large chance for the students to show up their ability and develop thinking process through looking for, guessing, and logically. The main of learning (Trianto, 2009: 9) is a changing behavior because an experience. Therefore, this student worksheet is to enrich student's experience.

Constructivism by Gita (2005: 18) emphasized that there are many ways to structure meaning and the meaning come from individual experience. Constructivism is the way to explained how human construct their knowledge. Therefore, students need to think divergently, such that: thinking creative, looks the problems from every side to find many possible solution based on the information. Therefore, in the effort of enrich students experience and construct their ability from the material that have been studied by the student with their ability, better use constructivism.

Problem solving approach (Majid, 2008: 142) is the way to give understanding with stimulates students to give attention, study, and think about the problem and then analyze the problem to solve it. Four phases of problem solving by Polya (1985: 5-6) are: 1) understanding the problem, 2) making a plan, 3) carrying out our plan, 4) looking back at the completed solution. whereas to increase problem solving ability, better use problem solving approach.

Mathematics is need to give to the students from elementary school to give logical thinking ability, analytics, systematic, critics, and creative, also problem solving ability (BSNP, 2006: 346). The quality of student worksheet also measured. According to Nieveen (1999: 127-128), product quality of design, development, and evaluation program have accomplished criteria of valid, practice, and effective. Based on three

aspects before, would knew the validity, practicality, and effectiveness of student worksheet in the learning process.

FORMULATION OF THE PROBLEMA

1. How does the development of *student worksheet* in english based on constructivism using problem solving approach for mathematics learning on the topic of social arithmetic?
2. How does the quality of students worksheet based on constructivism using problem solving approach according to quality of validity, practicality, and effectiveness in learning process?

GOAL OF THE RESEARCH

The purpose of this paper is describe the development of student worksheet in English based on constructivism using problem solving approach for mathematics learning on the topics of social arithmetic, and its quality.

RESEARCH METHOD

Method of this research follows ADDIE models, there are: 1) analyze: need analyze, student analyze, and task analyze, 2) design: determining the component of the student worksheet, 3) development: writing the student worksheet, doing expert validation, and revising student worksheet based on the validation, 4) implementation: implementing the learning process using student worksheet to examine its effectiveness and practicality, 5) evaluation: analyzing effectiveness and practicality of student worksheet, and revising it.

RESULT OF THE RESEARCH

The results of developing student worksheet according to ADDIE model are:

1. Analyze
   a. Need analyze: founding limited learning media that facilitate student to enrich their experience and construct their ability. This condition affects on learning process, especially mathematics. For better quality of mathematics learning process, teacher needs to give full chance to show up students ability. One of solution is student worksheet. Student worksheet can motivate students to study the material by themselves.
   b. Student analyze: students of junior high school have reached on formal operation, Fatimah (2006: 65) believed they can get scientific *problem solving*, and

possibility to test the hypothesis with certain variables. This various thinking related to abstract cases and indirect thinking process. It doesn't depend on place and time.

c. Task analyze:

1) Main structure analyze: developing material of social arithmetic based on standar isi 2006. Standard competency is using algebraic form, linear equality and inequality in one variable, and comparison to solve problems, and basic competency is using algebraic concept to solve simple social arithmetic problems.
2) Procedural analyze: following Polya's step in problem solving process, there are: explore, plan, solve, and examine.
3) Information process analyze: grouping student's task based on curriculum and timing. The results expressed in lesson plan.
4) Concept analyze: developing concept in student worksheet based on constructivism using problem solving approach, according to order of materials and relevant concepts.
5) Learning objectives analyze: the objectives are successful the standard competency and basic competency.

2. Design: arranging need map, determining title of student worksheet, writing student worksheet with determine basic competency, design of media, and material, also writing teacher book and lesson plan.
3. Development: developing student worksheet based on specified below: 1) visual media, 2) having component of title, material, guidance, standard competency and basic competency, indicators, illustrations, facts, prerequisites, activities based on constructivism and problem solving approach, vocabularies, exercises, using English, according to the layout in design, 3) bending on quality of validity aspect, there are: constructivism, problem solving approach, didactic, construction, technique, evaluation, and carrying out. After that, doing expert validation, the level of validity is 4,01 of 5 scales (very valid). The last, revising the student worksheet based on validation.
4. Implementation: implementing student worksheet in the class, and getting data of effectiveness and practicality.

5. Evaluation: analyzing data of effectiveness and practicality. The level of effectiveness is 80,56%, very effective based on student test. The level of practicality are 3,03 of 4 scales, practice based on student response questionnaire, and 81,6%, very practice based on learning observation sheet. The last, doing final revise based on implementation of student worksheet.

The quality of student worksheet is:

1. Very valid, based on validity questionnaire showed 4,01 of 5 scales.
2. Very Effective, based on student test reached 80,56% students can complete the test.
3. Practice and very practice, based on both student response questionnaire raised 3,03 of 4 scales and learning observation sheet raised 81,6%.

DISCUSSION

Based on description in the result of research using ADDIE model, through analyze, *design*, *development*, *implementation*, and *evaluation*.

Analyze phase used need analyze, student analyze, and task analyze. Need analyze expressed limiting learning media to enrich student experience, construct their concepts, concern on student center activities. Therefore, arranging student worksheet to help them find the concepts of materials, and using the concepts to solve their problems. The result of student analyze showed that junior high school student's reached formal operation, based on cognitive development by Piaget (Parkay & Stanford, 2008: 371), about 11-15 years age. Their cognitive ability reached the highest of their ability, they could made approximation, hypothesis, thinking process, also appreciate on language structure in communication.

Task analyze showed the main structure analyze is curriculum, procedure analyze to solve activities and exercise in the student worksheet based on problem solving step by Polya, there are: explore, plan, solve, and examine. Information process analyze done by arranged lesson plan. Concept analyze was need map that distribute the competency that must be reached on the student worksheet.

The last was learning objectives analyze based on standard and basic competency below: (1) determine selling price and buying price; (2) determine income and outcome; (3) determine profit and loss; (4) determine percent of a number; (5) determine the percent one number is of another; (6) determine a number when a percent of it has

known; (7) convert profit and loss into percent; (8) determine discount, gross, tare, and net; (9) differentiate gross, tare, and net; (10) determine simple interest and taxes; (11) determine simple taxes(income tax, selling tax, and value added tax); (12) solve social arithmetic problems used principal of buying price, selling price, profit, loss, gross, tare, net, discount, simple interest, and taxes.

Design phase was arranged student worksheet, teacher book and lesson plan. Arranging student worksheet done by arranged need map, title of student worksheet, and written student worksheet. Based on need map, we know the order and the number of student worksheet depend on prerequisite, there are: (1) student worksheet 1, selling price, buying price, profit, and loss, (2) student worksheet 2, converting profit and loss into percent, (3) student worksheet 3, discount, gross, tare, and net, (4) student worksheet 4, tax and simple interest. Determining the title of student worksheet based on indicator that must be reached by the student. It was social arithmetic for junior high school grade VII 1st semester constructivism based and problem solving approach mathematics student worksheet. Writing of student worksheet done by determining basic competency, design of media and material based on resources and modify it suitable with requirement used Coreldraw Graphics Suite X4, Adobe Photoshop CS3, Microsoft ® Paint, and Microsoft office word 2007, also writing teacher book and lesson plan.

Development phases done by developing student worksheet with specification below: title, material, guidance of study, standard competence and basic competences, indicator, supported information, activities, prerequisite, fact, check point & vocabulary, conclusion, and exercises. Activities is student activity based on constructivism using problem solving approach by Polya, there are: explore, plan, solve, and examine. Otherwise, it would held student center activities. Then, doing assessment with validation questionnaire by 5 validator, consist of 3 expert lecture and 2 mathematics teacher. This assessment was done to get suggestion and criticism from validators, after that doing revision. The result of this step is first product that ready to use in learning process.

Implementation phases done by tested student worksheet in the class, then students given test to measure their ability after used student worksheet. in this step, students filled students response questionnaire to know their response on mathematics learning

process using student worksheet. The form of test was essay because essay test could organized their idea with their handwriting (Supranata, 2005: 198). In other way, essay test have some special quality (Supranata, 2005: 232), there are: (1) students have privacy to write, organize, and express their idea, (2) it can measure ability/ competency that cannot done by objective test, (3) it can measure critical thinking ability/problem solving ability, (4) it doesn't need much time to make the test.

Evaluation phases done by evaluate learning process used student worksheet and analyze data of practicality and effectiveness.

Quality of student worksheet based on validity aspect shows average score from each validator is 3,98 for constructivism aspect, it means that student worksheet is valid and according to principals of constructivism. Problem solving aspect is 4,31, it means that problem solving approach on student worksheet is very valid. Didactic aspect is 3,8, it means valid and student worksheet follows principals of effective learning. Construction aspect is 3,98, it means valid and student worksheet bending on language structure, sentences, vocabulary, difficulty level, and clarity such that students can understand easily. Technical aspect is 4,2, it means valid and students worksheet has suitable technical and bend on arrange of written, figure, and display. Evaluation aspect is 4, it means valid and student worksheet help students to reach competency of study. Carrying on aspect is 4, it means valid and student worksheet could carried on in the class or at home. Final score in quality of validity is **4,01**, it means that very valid and student worksheet based on strong theoretical. Development of student worksheet with constructivism based and problem solving approach suitable with aspect of constructivism paradigm, problem solving approach, didactic, construction, technical, evaluation, and carrying on.

On the other hand, student response questionnaire showed average score in student self assessment on cognitive competency is 2,98, it means enough practice and they believed that their ability as the result of mathematics learning process. Students affective competency is 3,03, it means practice and students have attitude and interest on mathematics. Psychomotor competency is 3,01, it means practice and students had hold on skill in mathematics learning process. Confidence aspect was raised 3,04, it means practice and students have confidence. Introspection was raised 3,09, it means practice and students know their powerful and their weakness. Objectivity was raised

3,01, it means practice and students have objectivity in their assessment. Finally, practicality quality using student response questionnaire based on actual score is **3,03,** it means student worksheet is practice. Whereas, learning observation showed that learning consistence with the curriculum was raised 91,60%, it means very practice and learning process suitable with the purpose in the curriculum. Teacher carrying on was raised 83,33%, it means very practice and lesson plan could carried on excellently. Students carrying on was raised 36,67%, it means less practice and students have done the activity less suitable with lesson plan. Students motivation was raised 100%, it means very practice and students was showed high motivation in the learning process with student worksheet. students activity was raised 80%, it means practice and students was active in following learning process. Interaction between students and teacher was raised 96,67%, it means practice and there was a communicative relation between them. Teacher skill was raised 77,50%, it means practice and teacher was skilled applying their ability in the learning process. Finally practicality quality used observation sheet based on observation of learning process with student worksheet is **81,6%**, it means student worksheet very practice. From description above, knowing that student worksheet could used in the class, useful, and the level of carrying on student worksheet in the learning process is high.

Effectiveness quality from the test was raised **80,56%** of completeness percentage, it means very effective and the level of goal achievement suitable with the plan and learning process with student worksheet going on effectively.

Based on teacher interview, learning process with student worksheet more efficient with the time, decrease teacher dominate to give information. Student worksheet would helped the students if there was a cleared guidance. Student worksheet could held students center activity, helped students to construct their knowledge, and increasing problem solving ability.

The conclusion was social arithmetic for junior high school grade VII 1st semester constructivism based and problem solving approach Mathematics student worksheet have quality of very valid, practice, very practice, and very effective. It was showed that constructivism based in the student worksheet made students to construct their knowledge and their understand through experience in the activities and reflecting their experience to form new structure of knowledge in the conclusion. Student worksheet

with constructivism based also encouraged student to solve problem with their way. On the other hand, problem solving approach in the student worksheet used as forced to solve problem or question with activities, stimulate students to listen, beat out, think about problem and then analyze to solve the problem. Student worksheet with problem solving approach concern on how students can solve the problems, starting with understand the problem, make a plan, find the answer, and check the final result. It was got positive response from students, and teachers, it means student worksheet increase problem solving ability of the students.

CONCLUSION AND SUGGESTION

CONCLUSION

1. Development of student worksheet with constructivism based and problem solving approach for mathematics learning on the topics of social arithmetic through five phase, there are:
   a. Analyze. This phase have done by doing need analyze, student analyze, and task analyze.
   b. Design. This phase have done by doing arrange of student worksheet, teacher book, and lesson plan.
   c. Development. This phase have done by doing arrange and development of student worksheet with certain specify, there are: (1) visual media; (2) having component of title, material, study guidance, standard competency and basic competency, indicator, supporting information, activities based on constructivism and problem solving approach, prerequisite, fact, check point and vocabulary, conclusion, also exercise; (3) using english; (4) having layout; (5) bending on quality requirement. After that doing expert validation, then revision to get first product.
   d. Implementation. This phase done by doing test of student worksheet in the class. After that, we get data of students and teacher activities in learning observation, students response of learning processed by student worksheet, and data of students test.
   e. Evaluation. This phase have done by doing analyze data of practicality and effectiveness, then last revision to get final student worksheet.

2. Quality of student worksheet based on aspect of validity, practicality, and effectiveness, below:
   a. Very valid, based on validity questionnaire showed 4,01 of 5 scales. It means student worksheet based on strong theoretical.
   b. Very Effective, based on student test reached 80,56% students can complete the test. It means the level of goal achievement suitable with the plan and learning process with student worksheet going on effectively.
   c. Practice and very practice, based on both student response questionnaire raised 3,03 of 4 scales and learning observation sheet raised 81,6%. it means student worksheet could used in the class, useful, and the level of carrying on student worksheet in the learning process is high.

SUGGESTION

1. Social arithmetic for junior high school grade VII 1st semester constructivism based and problem solving approach Mathematics student worksheet should used in mathematics learning process on social arithmetic topics to enrich student's experience, construct mathematical concept, and increase problem solving ability.
2. Guiding use of student worksheet must give clearly.
3. Should held follow up from another researcher to develop student worksheet with constructivism based and problem solving approach in other material.
4. Experiment should done in some school to get medley of data and using full colour of student worksheet according to student worksheet that have been developed.

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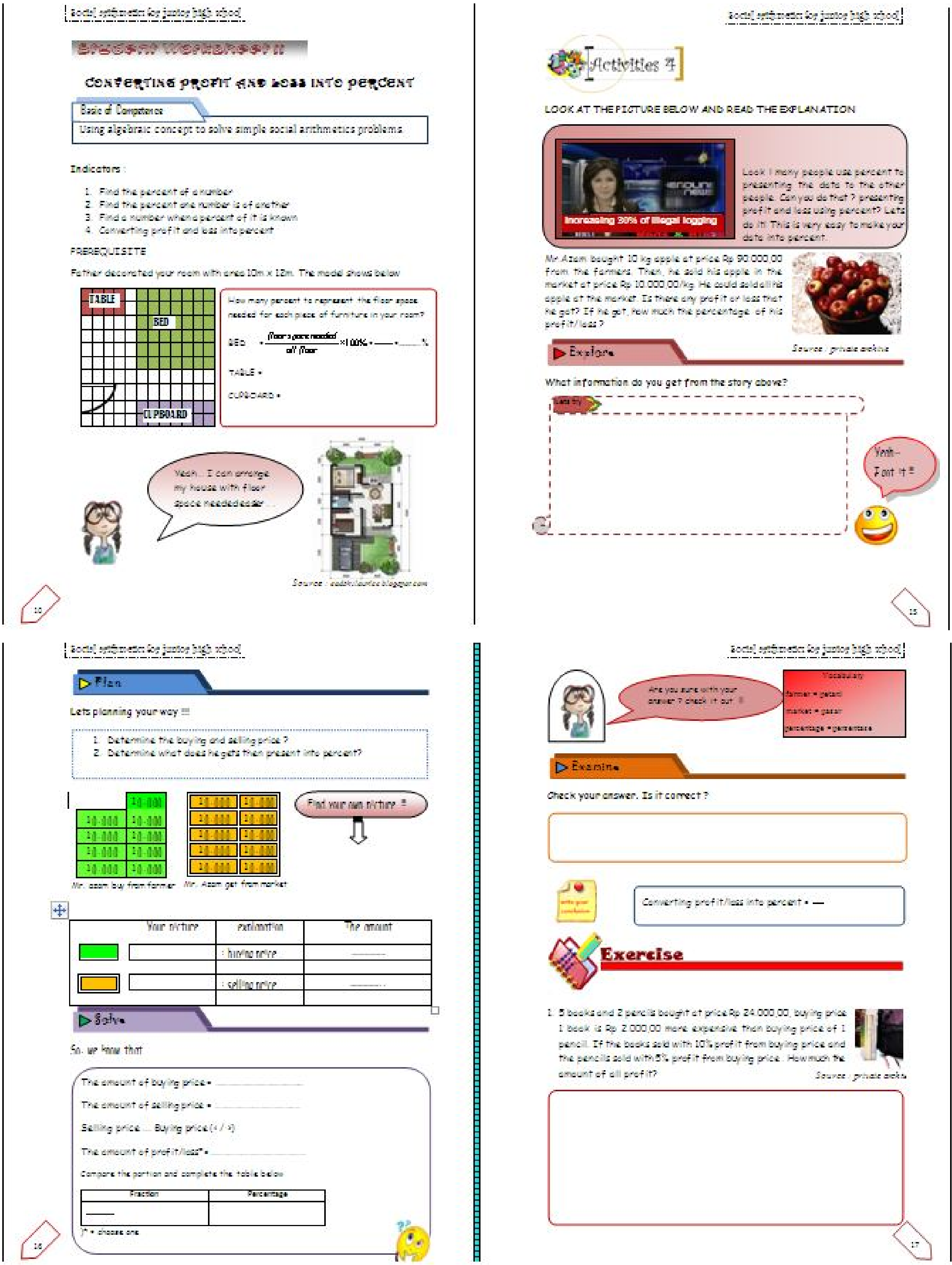
EXAMPLE OF STUDENT WORKSHEET



Social arithmetics for junior high school

STUDENT WORKSHEET II

CONVERTING PROFIT AND LOSS INTO PERCENT

Basic of Competence

Using algebraic concept to solve simple social arithmetics problems

Indicators :

1. Find the percent of a number
2. Find the percent one number is of another
3. Find a number when a percent of it is known
4. Converting profit and loss into percent

PREREQUISITE

Father decorated your room with area 10m x 12m. The model shows below

How many percent to represent the floor space needed for each piece of furniture in your room?

BED = $\frac{\text{floor space needed}}{\text{all floor}} \times 100\%$ = —— = ... %

TABLE =

CUPBOARD =

Source : sadahilaurice.blogspot.com

Social arithmetics for junior high school

Activities 4

LOOK AT THE PICTURE BELOW AND READ THE EXPLANATION

Look ! many people use percent to presenting the data to the other people. Can you do that ? presenting profit and loss using percent? Lets do it! This is very easy to make your data into percent.

Mr Azam bought 10 kg apple at price Rp 90.000,00 from the farmers. Then, he sold his apple in the market at price Rp 10.000,00/kg. He could sold all his apple at the market. Is there any profit or loss that he got? If he get, how much the percentage of his profit/loss ?

Source : private archive

Explore

What information do you get from the story above?

Social arithmetics for junior high school

Plan

Lets planning your way !!!

1. Determine the buying and selling price ?
2. Determine what does he gets then present into percent?

	Your picture	explanation	The amount
(green)		: buying price	....
(orange)		: selling price	....

Solve

So, we know that

The amount of buying price = ...

The amount of selling price = ...

Selling price ... Buying price (< / >)

The amount of profit/loss* = ...

Compare the portion and complete the table below

Fraction	Percentage
——	

)* = choose one

Social arithmetics for junior high school

Vocabulary

farmer = petani

market = pasar

percentage = persentase

Examine

Check your answer. Is it correct ?

Converting profit/loss into percent = —

Exercise

1. 5 books and 2 pencils bought at price Rp 24.000,00, buying price 1 book is Rp 2.000,00 more expensive than buying price of 1 pencil. If the books sold with 10% profit from buying price and the pencils sold with 5% profit from buying price . How much the amount of all profit?

Source : private archive

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