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Developing worksheet on mathematical modeling for financial literacy using social arithmetics

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Abstract. This study aims to: (1) Produce Student Worksheets on Financial Literacy based on valid and practical Mathematical Modeling subject of Social Arithmetic, and (2) Find out the potential effects on learning outcomes from the development of Student Worksheets Financial Literacy based on Mathematical Modeling the subject of Social Arithmetic. This type of research used is the Design Research Development Study type. The subjects of this study were eighth grade students of SMA Negeri 2 Tungkallilir. Data collection techniques are by walk through, documents, tests, questionnaires, and interviews. The results of this study are: (1) This research has produced a Student Literature Worksheet based on Mathematical Modeling based on valid and practical Social Arithmetic subjects. (2) Student Worksheets Mathematical Modeling-based Financial Literacy developed has a potential effect on learning outcomes.

1. Introduction

Demands on the ability of students in mathematics do not just have the ability to count alone, but the ability to reason logically and critically in problem solving. Solving this problem is not solely a problem in the form of routine problems but rather the problems faced daily. Such mathematical abilities are known as mathematical literacy abilities [1].

The mathematical abilities needed are in mathematical literacy, namely mathematical thinking and reasoning, mathematical argumentation, mathematical communication, modeling, presentation and problem solving, representations, symbols and mathematical tools [2]. The ability of mathematical literacy is the ability of individuals to formulate, use and interpret mathematics in various contexts [3].

Mathematics in 2012 on the topic of PISA was supplemented by financial literacy. Financial literacy is a knowledge and understanding of financial concepts and risks, skills, motivation and confidence to apply knowledge and understanding in making effective decisions in various financial contexts, as well as in improving the financial well-being of individuals and society, and to enable participation in life. Financial literacy has four contents namely, money and transaction (money and transaction), loss and profit (risk and reward), financial planning and management (planning and managing financial), and investment (financial landscape) [4].

Financial literacy is closely related to financial knowledge and skills of each individual in managing personal finances. A high level of financial literacy is a basic requirement for every individual to avoid financial difficulties. Financial difficulties are not caused by income alone (low income), financial difficulties can arise if there are mistakes in managing financial resources such as no financial planning and no savings [5].

Financial literacy consists of some knowledge and abilities related to finance owned by individuals to be able to manage or use a certain amount of money to improve their standard of living [6]. The



current era of global consumerism makes more and more student behavior consumptive and often makes purchases not as needed but only as desired. Consumptive behavior is a phenomenon that often occurs among students. Many students are willing to spend money to spend all needs without thinking about the benefits of purchasing the goods [7].

Financial literacy is the ability for a person to read, analyze, manage and communicate financial conditions that affect his welfare. An understanding of basic financial concepts is good, so when making decisions about finance do not experience problems in the future so as to be able to show healthy financial behavior to determine priority needs rather than just desires. The role of schools as forming the financial literacy of students is very important. This can be done in the form of learning related to economic issues which in the end can be used as provisions for students to make financial decisions, both when they are still students and when entering the workforce. [8]

In Mathematics learning, financial literacy is taught on Social Arithmetic material. Financial literacy has similarities with Social Arithmetic which is equally discussing about money, how the money is obtained and how to use it in everyday life [9]

In implementing the 2013 curriculum in mathematics learning teaching materials are needed and pay attention to appropriate learning approaches so that learning objectives are achieved One effort that can be made by educators to improve students' mathematical literacy skills is to innovate mathematics learning [10]. One innovation in learning mathematics is using modeling in solving real problems. [11]

According to Ang (2001), states that mathematical modeling is a process of solving real problems using mathematical concepts and rules by changing real world problems into mathematical problems. The process of mathematical modeling using mathematical concepts is contained in the curriculum as an approach in learning mathematics. The following is a chart of steps in solving real problems through mathematical modeling.

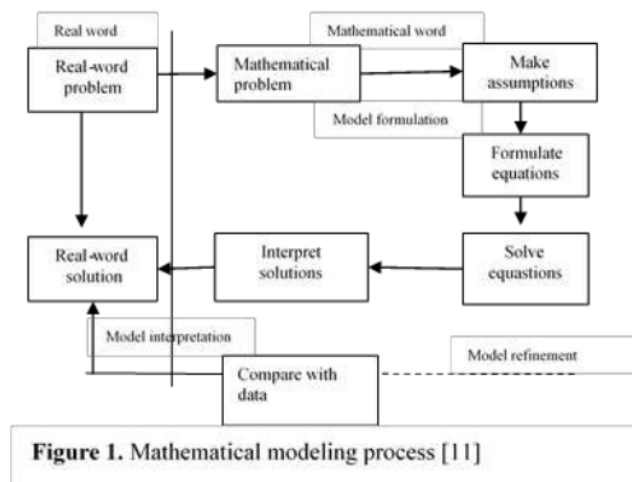


Figure 1. Mathematical modeling process [11]

From the chart, it is clear that some processes must be carried out in mathematical modeling, namely: identifying variables, forming models of variables, operating using models, interpreting results, validating mathematical models, reporting conclusions [12].

One of the teaching materials that can teach students to use mathematical modeling is through student worksheets. Student worksheets are one of the tools that in the learning process can help and facilitate learning activities so that the learning that occurs is able to lead students to find concepts that can be used in systematic problem solving [13].

Based on the description above the formulation of the problem in this study are: (1) How to develop financial literacy student worksheets based on mathematical modeling subject matter valid and practical social arithmetic? (2) What is the potential effect of the financial literacy worksheet on mathematical modeling based on social arithmetic? Then, the purpose of this study is to produce teaching materials

that are valid, practical, and have potential effects. In addition, this study is useful for: (1) students in completing modeling-based financial literacy learners; (2) as teaching materials that can be used by teachers in the learning process; (3) make a positive contribution in learning in schools; and (4) can be used as a reference for other researchers.

2. Method

The subjects of this study were VII graders of SMP Negeri 2 Tungkal Ilir which were held in the even semester of the 2018/2019 school year. In this study, the method used is the development or development research type development study. This development research consists of three stages, namely analysis, design, and evaluation [14]. At the evaluation stage, the Formative Evaluation stages are used as shown in Figure 2.

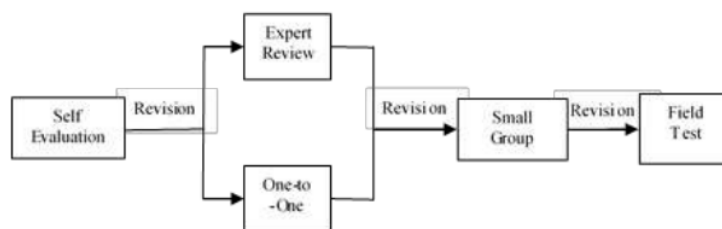


Figure 2. Formative evaluation stages [14]

This study develops Student Worksheets based on modeling on the subject of social arithmetic sub-subjects profit and loss material that meets valid, practical, and potential effects. For this purpose, the instruments used in the study are validation materials for teaching materials, Learning Implementation Plans, student worksheets as well as possible student answers, test grids, tests and test marking rubrics, questionnaires for student attitudes toward student worksheets, and interview guidelines. Data needed in the development of teaching materials are data about validity obtained from the results of expert validation and student comments as well as difficulties encountered by students in completing student worksheets in the one to one stage, data on the practicality of student worksheets obtained during the test try small groups, and data about the potential effects of teaching materials that have been developed that are obtained from student test results during the field test.

Data collection techniques include instrument validation (walk through), documents, tests, questionnaires and interviews. Then after all the data were obtained, a descriptive analysis was conducted covering validation data (walk through), document analysis, test data analysis, questionnaire data analysis, and interview data analysis.

3. Result and Discussion

This research was conducted in five stages, namely analysis, design, development, implementation, and evaluation. In the analysis phase, the researchers analyzed the characteristics of seventh grade junior high school students, it is known that seventh grade students still have difficulties in making mathematical modeling on social arithmetic story questions related to financial literacy. Then the researcher designs a container in the form of student worksheets so that students can make mathematical modeling to solve story problems related to social arithmetic, the researcher designs contextual problems that can be solved by social arithmetic that is suitable for grade VII students, and designs workmanship steps which is suitable with mathematical modeling. Furthermore, researchers develop problems that have been designed that are tailored to the characteristics of mathematical modeling. The researcher also develops the steps that will be used from the student worksheets, namely (1) understanding the problem, (2) making guesses, (3) making equations, (4) solving equations, (5) interpreting answers, (5) checking return the answer.

The next step, the researcher implements the questions and steps that the researcher has developed into the student worksheet format. At this stage the researcher had obtained 2 worksheets of financially dicycliterated participants based on mathematical modeling. The next stage is the evaluation stage, the student worksheets that researchers have developed pass the evaluation stage, the evaluation used by researchers is formative evaluation which consists of four stages, namely expert review, one-to-one, small groups, and field tests. The revision process is carried out at each stage in order to obtain a worksheet for financial literacy learners based on valid and practical mathematical modeling that has potential effects. At the expert review stage, the student worksheets that researchers have developed are given to 2 experts and one teacher. Comments and revisions of the expert review can be seen in Table 1.

Table 1. Comments on the expert review stage.

Expert	Comments / suggestions	Revision decision
Dr. Hartatiana, M.Pd	The story in the question is still confusing	The story in the problem was corrected according to the validator's suggestion
Dr. Yuli Fitriyanti, M.Pd	Fix the sentence in the description on the assumptions in the problem	Information on the assumptions in the matter was replaced
Zul yanti, S.Pd	The student answer column is enlarged	The student answer column is enlarged

After conducting the expert stage, the review is continued with one-to-one by giving students worksheets to five students. After one-to-one is done, there are 2 work sheets of students who are declared valid. Student worksheets that have been declared valid, followed by a small group stage in which researchers find students' worksheets that have been declared valid at the expert review and one-to-one stages to five students. After doing the small group stage, the results obtained from 2 worksheets of students based on mathematical modeling approaches are included in the valid and practical categories. Following is an example of one of the problems in a mathematical modeling based student worksheet that was developed by the researcher.

The next stage is the field test, at this stage the researchers tested three valid and practical worksheets for students in class VII of SMP Negeri 2 Tungkal Ilir to see the potential effects of the worksheets for students. When the field test students are seen actively discussing in finding variables and solving social arithmetic problems that researchers provide. The following is a documentation of students' activities in the discussion.

After conducting a field test the researcher conducted an interview to find out the potential effects of the students' worksheets on learning social arithmetic to several students. It was also known that students were interested in learning about social arithmetic stories by using financial literacy-based learners' worksheets because mathematical modeling sheets contained steps that help them in learning. In addition, researchers also gave questionnaires to students after learning, to determine the potential effects of students on student worksheets that have been developed. From the results of the questionnaire, it is known that students are interested in studying students' worksheets and also helps them in learning about social arithmetic stories related to financial literacy.

LEMBAR KERJA PESERTA DIDIK

Perhatikan gambar berikut ini!

Pak Andi baru saja mendapat ganti rugi karena olih perusahaan Batu Bara sebesar Rp 150.000.000,00. Pak Andi berencana untuk membeli sebuah mobil seperti pada gambar yang ganti rugi tersebut tidak terpakai, namun Pak Andi akan mencari nilai yang paling efisien supaya dia bisa membeli mobil tersebut!

Model	2017	2018	2019
1. Toyota Innova 1.800 cc	1.100	1.200	1.300
2. Toyota Innova 2.000 cc	1.200	1.300	1.400
3. Toyota Innova 2.500 cc	1.300	1.400	1.500
4. Toyota Innova 3.000 cc	1.400	1.500	1.600
5. Toyota Innova 3.500 cc	1.500	1.600	1.700

1. Identifikasi dan memahami masalah

a. Informasi apa saja yang didapat dari bacaan tersebut?

b. Informasi apa saja yang belum kamu ketahui agar kamu dapat menentukan cara pembelian sebuah mobil secara yang ada di bawah?

2. Membuat model

a. Ketika kamu ingin membeli sebuah mobil tersebut, informasi apa yang akan kamu lakukan?

3. Mengidentifikasi variabel

a. Ubah la informasi dari bacaan tersebut menjadi bentuk simbol matematika a, b, c, d, e, f !

4. Memformulasikan

a. Bagaimana cara menghitung konstanta?

b. Bagaimana cara menghitung hasil?

5. Mengartikan secara matematika (jaring matematika: English)

a. Dengan menggunakan simbol matematika yang telah kamu buat, identifikasi hubungan antara besaran dengan jumlah sehingga Pak Andi. Buatlah perkiraan yang dapat menjawab pertanyaan tersebut!

b. Dengan menggunakan simbol matematika yang telah kamu buat, identifikasi hubungan antar besaran yang akan dilakukan oleh Pak Andi. Buatlah perkiraan yang dapat menjawab pertanyaan tersebut!

6. Memeriksa hasil (hasil in context - integer)

Buatlah hasil interpretasi dari permasalahan diatas!

0-00

Penilaian

skor total = $\frac{\text{skor yang diperoleh}}{\text{skor maksimal}} \times 100$

Figure 3. Modeling based student worksheets.

In terms of construct, the worksheets of the students developed are well organized in accordance with modeling theory, where based on the theory of modeling the questions used have used context and in accordance with the steps in mathematical modeling, namely understanding the problem, making guesses, making equations, solving equation, interpret solutions, and check answers. From the constructs of the modeling-based worksheets that the researchers developed, it is known to have a characteristic (1). The modeling-based student worksheet that the researcher developed starts from asking students to understand the problem, at this stage students analyze what is known and asked questions, so students become focused in answering questions. (2) The second step of this student worksheet helps students to obtain variables and equations to answer the problem, besides that in the second step the worksheet of students is divided into a number of guesses so that the worksheet of these students can guide students to find similarities through each conjectures are divided into several conjectures to lead students to find mathematical models through each conjecture. In terms of language, the students' worksheets that have been developed have used good and correct language where students have no misunderstanding of the information or questions in the problem.

The practicality of students' worksheets is known based on the small group stage that the students' worksheets that have been developed also meet practical criteria. 2 student-based modeling worksheets, each of which consists of 1 question that has been seen in practicality at the small group stage. The results of the small group stage of two questions are included in the practical category. From the observations it can also be seen that students can use the worksheets of the students even though there are still students who feel confused and often ask questions because they are not accustomed to using the worksheets based on modeling of some sections in student worksheets, because the questions given have also never been studied by students before. However, there are no significant obstacles in the use of modeling-based student worksheets on social arithmetic material. Student worksheets based on valid and practical modeling modeling are then tested on students of class VII of SMP Negeri 2 Tungkal Ilir in learning. From the results of observations during the field test, it is known that learning with a worksheet based on modeling has a potential effect on student interest. Almost all aspects of attitudes in the 2013 curriculum appear, students are active and able to interact with group members and discuss

before determining the answers to each assumption, students are serious about working on problems on the student worksheets, students' collaboration in working on the worksheets of students is also evident during the field test stage. The results of this observation are in accordance with the advantages of learning mathematics modeling, namely students become more interested in mathematical modeling activities through learning using the context of financial literacy.

From interviews with several students it was also found that the worksheets of these students made students interested in learning, helped students to understand the variables in story problems, and helped students make mathematical models of everyday problems. The following are excerpts from the results of researchers' interviews with students.

- Researcher* : What do you think of the modeling-based financial literacy learners?
Student 1 : When first seen it looks difficult but after following the steps the completion can be though rather long.
Student 2 : In my opinion, the worksheets of these students can make me understand how to determine the variables and how to formulate a solution and make a decision which one is profitable which losses.
Researcher : Are you interested in using this modeling-based financial literacy learners worksheets?
Student 1 : Yes, because the steps to solve the problem are easy to follow even though they need more explanation.
Student 2 : He, because the problem being solved lets me know how to use money well, it could be a business opportunity to get money.

From the interview results it was found that the VII grade students of SMP Negeri 2 Tungkal Ilir liked learning mathematics by using modeling-based student worksheets. In addition, the students' worksheets that are presented are interesting as well as the problems contained in the worksheets of students using everyday problems so that students more easily understand the material being studied. Then based on interviews it was found that the modeling-based student worksheets were easy to understand and understand. However, there are some questions that are difficult in understanding the material and have difficulty in answering questions that provide responses and conclusions.

From the results of the questionnaire that researchers gave to students who had been analyzed using a Likert scale, it is known that the worksheets of students provided made students interested in learning to use worksheets of students, making students more active, more able to understand problem problems with stories, students became trained in determining variables, students become trained in making mathematical models in the problems of everyday life, and students are interested in learning mathematics by using student worksheets based on modeling on social arithmetic material. From the results of this questionnaire it is known that students are interested in learning social arithmetic by using modeling-based financial literacy learners.

2. Membuat asumsi

a. Ketika kamu ingin membeli sebuah mobil tersebut, informasi apa yang akan kamu lakukan?

- Nilai Hafiasi = $\frac{3,35 + 3,02 + 3,61 + 3,31 + 3,49}{5} = 3,32\% \checkmark$
- Nilai bunga mayemut = $\frac{1.593 + 5.297 + 6.359 + 6.191 + 6.061}{5} = 5.708 = 5,7\%$
- Angsuran Kredit per bulan tetap
- Jangta waktu Kredit sama dengan investasi

Figure 4. Student's answers.

From the mathematical modeling steps in the student worksheet, mistakes and confusion of students most often occur in the second step, which is to make guesses or a foundation of thinking, so that researchers provide much assistance to students to understand this second step. The results of this study have several shortcomings. Lack of research on students' working time is quite long. From this it can be seen that in learning mathematics modeling, researchers should pay attention to the selection of questions in accordance with the ability of students so that students feel excited in the process.

4. Conclusion

Based on the research that has been done, the conclusions can be drawn, namely: 1) Worksheet modeling based financial literacy learners are included in the valid and practical categories. The validity of students' worksheets is based on content, construction and language. In terms of content, the modeling-based student worksheets that researchers have developed are in accordance with IC and BC in the 2013 curriculum. While in terms of language, the worksheets of students who developed have used good and right language where students have no misunderstanding of the information or questions in the questions and information on the worksheet of students. Practically illustrated from the results of small group trials where almost all students are able to work on the student worksheets. 2) The characteristics of the student worksheets that the researcher developed are (1). Worksheets for students based on mathematical modeling that researchers develop help students in understanding mathematical variables and models of everyday problems of social arithmetic material. (2) Student worksheets that researchers develop help students in working on social arithmetic stories systematically. 3) Modeling-based worksheets are proven to have good potential effects, based on the results of observations, interviews and questionnaires given, namely students become more active and confident in learning mathematics and are interested in learning modeling-based worksheets.

As for some suggestions from researchers from the results of this study, namely: 1) For teachers it is advisable to use financial literacy-based modeling worksheets on social arithmetic materials that have been made by researchers as learning resources. 2) For students, it is recommended to use financial literacy-based modeling worksheets on social arithmetic materials so that students' abilities in determining variables and mathematical models become better and students become better trained in utilizing money in everyday life. 3) For further researchers, it is recommended to be able to develop student worksheets based on modeling on other material by considering time efficiency, choice of context of questions, and the level of difficulty of the questions used in learning so that students do not feel bored when working on the worksheets of these students.

5. References

- [1] Sari R H N 2015 *Literasi matematika: Apa, Mengapa, dan Bagaimana, Seminar Nasional Matematika dan Pendidikan Matematika* (Yogyakarta: Universitas Negeri Yogyakarta)
- [2] Lange J d 2006 *Journal of Educational Study in Mathematics* **25** 13
- [3] OECD 2013a PISA 2012 Assessment and Analytical Framework Mathematics, Reading, Science, Problem Solving and Financial Literacy (Paris: PISA OECD Publishing)
- [4] OECD 2014 PISA 2012 *Results: Students and Money, Financial Literacy Skills for the 21st CENTURY (Volume VI)* (Paris: PISA OECD Publishing)
- [5] Akmal H and Saputra Y E 2016 *Jurnal Ekonomi dan Bisnis Islam* **1** 235
- [6] Lusardi A and Mitchell O 2014 *JEL* **33** 1
- [7] Shalahuddinta A and Susanti 2014 *JPAK* **2** 1
- [8] Lusardi A 2009 U.S. Household Savings Behavior: The Role of Financial Literacy, Information and Financial Education Programs In: Foote C, Goette L and Meier S (eds) *Policymaking Insights from Behavioral Economics* (Boston: Federal Reserve Bank of Boston) pp 109-149
- [9] Wardono A W K 2015 *Jurnal Matematika Kreatif-Inovatif, Kreano* **6** 93
- [10] Blum W, Galbraith P L, Henn H W and Niss M 2007 *Modelling and applications in mathematics education: The 14th ICMI study* (New York: Springer)
- [11] Ang K C 2001 *The mathematics educator* **6** 63
- [12] Lowe J 2018 *Mathematical Modelling in the Junior Secondary Years An approach incorporating mathematical technology* (Australia: Queensland University)

- [13] Abrams J P 2001 Teaching Mathematical Modeling and the skills of representation In: Cuoco A and Curcio F (Eds.) *The Roles of representation in School Mathematics* (Reston VA: NCTM) p 269-282
- [14] Akker J V D 1999 *Design approaches and Tools in Education and Training* (London: Kluwer Academic Publishers)

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