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Design of Teman Ritma's Application to Increase Student's Problem-Solving Ability

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ABSTRACT
Problem solving ability is kind of ability to collect information, analyze situations and identify problems to produce alternatives in decision-making. Learning media that have not yet integrated problem-solving ability need to be developed. Hence, the purpose of this study is to develop android-based learning media to increase student's problem-solving ability. The data sources in this research are students of seventh grade of SMPN 5 Yogyakarta (public junior high school), learning material validators, and learning media validators. The instruments used in this study are interview guidelines, observations, questionnaires, problem-solving based test, learning material expert questionnaires, and learning media expert questionnaires. Data analysis techniques contain stages of data reduction, displaying data, and conclusions. The results showed that (1) student's problem-solving ability are relatively low, so an android-based learning media called "Teman Ritma" was developed; (2) creating of application is assisted by Microsoft Office PowerPoint integrated with ISpring suite, and a converter HTML-to-App software called "Website 2 APK Builder"; (3) Teman Ritma's learning media application contains kind of features as follow: title screen, main menu screen, student's competencies to be achieved, learning material menu, learning materials that presented using combination of text and video, mini games, exercises task with explanations, and quizzes; (4) validation results of learning materials experts and learning media experts showed that the Teman Ritma's marked as "excellent criteria" for learning materials aspect, and "good criteria" for learning media aspect. Teman Ritma's declare valid and eligible to use. This research will continue to implementation and evaluation phase.

***Keywords**: Problem solving ability; Teman Ritma's learning media application*

INTRODUCTION
Education is an important sector that affects the improvement of quality of life among people and nations. According to Law Number (No.) 22 of 2003 on National Education System, mathematics is used as compulsory subject to be taught and studied at all education's levels from primary education to higher education. In education sector, mathematics is kind of essential subject (Rusadi, 2017; Sholohah & Mahmudi, 2015; Roffi et al., 2018). The reason is because mathematics has many uses such as science (for scientists), aids, and as an attitude and mindset guide (Ramadhan et al., 2019). One of the important roles of studying mathematics is learning how to solve the problems (Permatasari & Margana, 2014).

Problem-solving ability is related to the ability to collect information, analyze situations, and identify problems in order to produce alternatives in decision-making (Soimin, 2014). Hence, when studying mathematics, students are expected to have the ability to solve mathematics problems critically, creatively, logically, and precisely (Widjajanti, 2009). Branca explain that mathematics curriculum contains core processes that include methods, procedures, and strategies, and stated that every single student must have problem-solving ability because the goal of studying mathematics is to have problem-solving ability because problem-solving ability is one of the basic competencies (Sumartini, 2016). The National Council of Teacher of Mathematics (NCTM) stated, problem-solving ability cannot be separated because problem-solving is an integral part of mathematics learning (Marhaeni, 2020).

But in reality, student's problem-solving abilities are relatively low (Amam, 2017). According to the report entitled "Education in Indonesia: Learns from 2018 PISA Results" that published by Ministry of Education and Cultures Republic of Indonesia, Indonesia scored 379 on PISA test results in mathematics subjects, far below the average PISA score of countries assessed is 489. Based on the results, many Indonesian students still need problem-solving ability when faced with mathematics problem. According to Nursyaidah, one of the efforts that teachers can use to improve student's problem-solving abilities in mathematics learning is to use learning media (Hodiyanto et all., 2020). Learning media is a tool to deliver the learning materials (Rusadi et all., 2017). Hence, this research focuses to design android-based learning media applications.

METHOD

This kind of research is known as research and development (R&D) using ADDIE model. The ADDIE model contains 5 phases of development as follows: analysis, design, development, implementation, and evaluation (Astuti, 2017). The product that developed is an android-based learning media application namely "Teman Ritma" to increase student's problem-solving ability. Data collection instruments used are interviews with teacher and students, observations, questionnaires, problem-solving based test, learning materials questionnaires to materials experts, and learning media expert questionnaires to media experts. The data sources in this research are students of seventh grade of SMPN 5 Yogyakarta (public junior high school), learning material validators, and learning media validators. Observation is used to knowing current situation of teacher and students in classroom. Researchers use interview technique to gather additional information such as teaching materials that teacher use, student's characteristics, and thought about learning media. Questionnaires are used to collect information about student's responses of teaching materials that used by teachers, the use of technological devices, and student interest on using mathematics learning media application. To knowing student's competencies about problem-solving ability, researchers use problem-based test. Learning materials and learning media questionnaires are used to knowing product eligibility. Data analysis techniques use interactive analysis by Miles & Huberman that contain 3 stages as follows: data reduction, displaying data, and conclusion (Latifah, 2021). In this research, the research phase is carried out until the development phase, where the product is declared valid if the product marked as "good-averaged criteria". Hence, this research will continue to implementation and evaluation phase.

RESULT AND DISCUSSION

Result

Analysis Phase

The first phase of development of learning media application is analysis. The analysis phase has been conducted and shows that: (1) the student's problem-solving abilities are relatively low; (2) teaching materials that teacher use have not been able to stimulate students to improve their problem-solving ability; (3) students use android smartphone more than 3 hours a day, and (4) the content that students access when using android smartphone is dominated by learning content. Based on the analysis, researchers then developed an android-based learning media application called "Teman Ritma". The title of Teman Ritma is an acronym of "Aplikasi Matematika Bertemakan Aritmetika Sosial" when the contents of this application contain social arithmetic chapter. According on Indonesian Curriculum 2013 (locally say as "K-13"), social arithmetic contains basic competencies as shown as Table 1 below:

Table 1. Basic Competencies

No	Basic Competence
3.9	To knowing and analyze various situation that related with social arithmetic (sell, buy, discount, loss and profit, loss and profit percentage, simple interest, gross, net, and tare)
4.9	To solve the problems that related with social arithmetic (sell, buy, discount, loss and profit, loss and profit percentage, simple interest, gross, net, and tare)

Design Phase

After the first phase of development has been done, the next phase is design. The product in this research is android-base learning media applications called "Teman Ritma" to increase student's problem-solving ability. The application was designed using Microsoft Office PowerPoint integrated with ISpring suite that provide quiz function feature, and a converter HTML-to-App software called "Website 2 Apk Builder". Teman Ritma's learning media applications contain several features as follows: title screen, main menu, student's competencies to be achieved, materials menu, learning materials that presented using combination of text and video, mini games, exercises task with explanations, and quizzes. Exercises task and explanations was designed based on aspects of Polya's Problem-solving ability aspect such as collecting and understanding problems, devise a plan, carry out the plan, and look back or check and interpret (Yuwono, et all., 2018).

The title screen contains the main title of the application called "Teman Ritma". There's a subtitle namely "Aplikasi Matematika Bertemakan Aritmetika Sosial" and a single button called "Play" that direct user to the main menu. The title screen and main menu display are shown as Figure 1 below:

Figure 1. Title Screen (Left) and Main Menu (Right) Display

The main menu consists of 3 buttons called "KI/KD" to display basic competencies of social arithmetic that must be achieved, "Materi" to bring up the menus of social arithmetic materials, and "Kuis" to access multiple-choice quizzes. Display of competencies to be achieved, social arithmetic materials menus, and quizzes are shown as Figure 2 below:

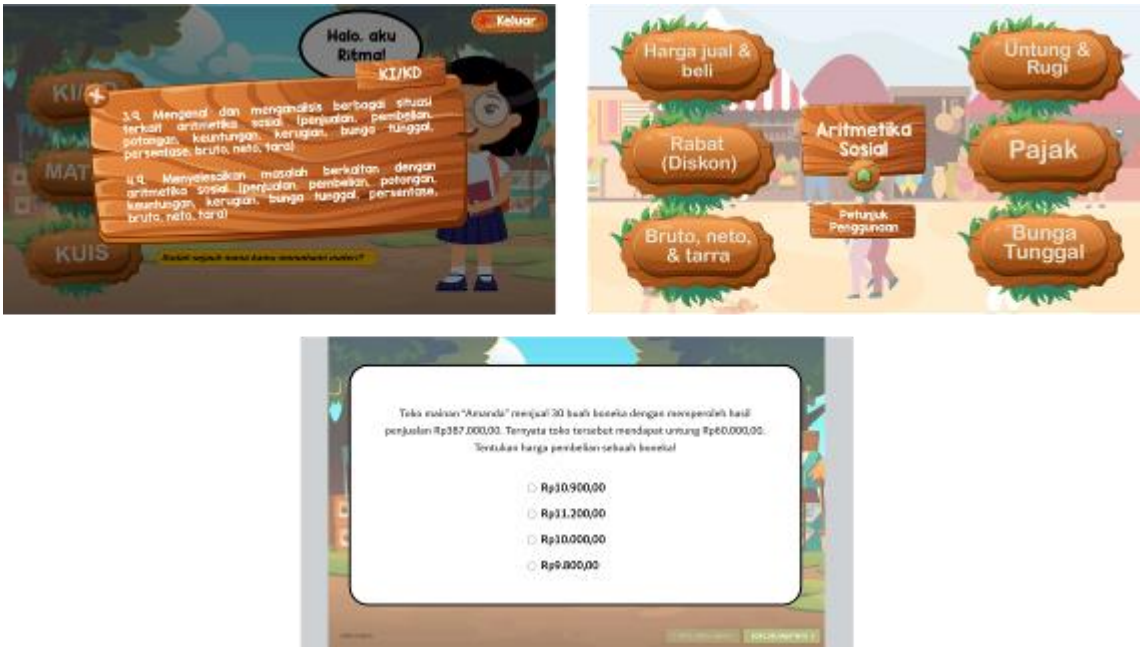

Figure 2. Basic Competencies (Left), Materials Menu (Right), and Quizzes (Lower middle) Display

Social arithmetic materials contain the selling and buying, profit and loss, discount, tax, simple interest, gross, net, and tare (Dila & Zanthy, 2020). The materials are presented using combination of text and videos that shown as figure 3 below:

Figure 3. One of Materials Presented Display

Teman Ritma's application also contain task exercise with explanation and mini game which can be accessed in the discount section. The display of task exercise and mini game are shown as figure 4 below:

Figure 4. Mini Game (Left) and Task Excercise (Right) Display

Development Phase

The design that has been developed then need to be validated by learning material experts and learning media experts. The instruments used has also been validated by the instrument validator. In this research, the number of learning material experts and learning media experts was two experts each. The validation instruments for learning material experts were developed by modifying the instruments of Romi Satria Wahono (2006) with 11 number of statements, while validation instruments for learning material experts was developed by modifying and combining the instruments of Romi Satria Wahono (2006), Surono (2011), and Wulandari (2018) with 18 number of statements. Total scores from learning materials and media validators then interpreted with the classification of criteria according to Widoyoko (2012) as shown as table 2 below:

Table 2. Score and Criteria of Materials and Media Quality

No	Score	Criteria
1	$\bar{x} > \bar{x_i} + 1.8sb_i$	Excellent
2	$\bar{x_i} + 0.6sb_i < \bar{x} \leq \bar{x_i} + 1.8sb_i$	Good
3	$\bar{x_i} - 0.6sb_i < \bar{x} \leq \bar{x_i} + 0.6sb_i$	Fair
4	$\bar{x_i} - 1.8sb_i < \bar{x} \leq \bar{x_i} - 0.6sb_i$	Poor
5	$\bar{x} \leq \bar{x_i} - 1.8sb_i$	Very Poor

Based on table 2, the interpretation of materials criteria is shown in table 3, while media criteria are shown in table 4.

Table 3. Calculation Result of Material Quality Criteria

No	Score	Criteria
1	$\bar{x} > 46.2$	Excellent
2	$37.4 < \bar{x} \leq 46.2$	Good
3	$28.6 < \bar{x} \leq 37.4$	Fair
4	$19.8 < \bar{x} \leq 28.6$	Poor
5	$\bar{x} \leq 28.6$	Very Poor

Table 4. Calculation Result of Media Quality Criteria

No	Score	Criteria
1	$\bar{x} > 75.6$	Excellent
2	$61.2 < \bar{x} \leq 75.6$	Good
3	$46.8 < \bar{x} \leq 61.2$	Fair
4	$32.4 < \bar{x} \leq 46.8$	Poor
5	$\bar{x} \leq 32.4$	Very Poor

Based table 3 and table 4, the design of Teman Ritma's learning media application is said to be valid if the scores marked as "Good" criteria. Hence, if Teman Ritma's learning media declare valid, then the media could be used for learning by students to increase problem-solving ability. The results of assessments from material experts and media experts are shown as table 5 and table 6 below:

Table 5. Material Expert Result and Criteria

Expert	Total Score	Criteria
Ageng Triyono, S.Pd., M.Pd	53	Excellent
Adhitya Prasetyaningtyas, S.Pd., M.Pd	52	Excellent
Total score of experts 1 and 2	105	
Average	52.5	
Criteria	Excellent	

Table 6. Media Expert Result and Criteria

Expert	Total Score	Criteria
Bayu Sudarmaji, S.Pd	62	Good
Dr. Suharno., S.Pd.,S.Pd.T.,M.Pd	82	Excellent
Total score of experts 1 and 2	144	
Average	72	
Criteria	Good	

From table 5 the scores from material experts are 52.5 and Teman Ritma's materials has an excellent criterion. Meanwhile, from table 6 the scores from media experts are 72 and Teman Ritma's learning media application has a good criterion. Hence, Teman Ritma's learning media applications declare valid and eligible for used by students to increase problem-solving ability.

Discussion

The purpose of this research is to develop Teman Ritma's learning media application which was declared valid and eligible by material experts and media experts. At design phase, researchers consider suggestions and opinions from students about media attractiveness that will increase student's problem-solving ability. The student's suggestions and opinions make Teman Ritma's learning media application has materials, quizzes, mini game, that related with daily activities. At development phase, Teman Ritma's learning media applications declare valid with some revisions over quality of materials and media. Revisions can be seen in table 7 below:

Table 7. Revision list based on Expert

Materials	A number to be written to each question to make it easier to navigate between questions
	A minor error of text typography, but the text can be read enough
	There's a single question with incomplete information
	If tax chapter in materials including general explanation (tax itself), it would be good
Media	Lack of back sound
	Suggestion to improve quality of video materials
	Unique features such mini-game and exercise need to be highlighted in the main menu
	In-app hint can be placed upper screen instead of lower screen

There're many things to consider in the designing of Teman Ritma's learning media application to increase student's problem-solving ability. One of many things was similar study, entitled "Development of Android-based Mathematics Learning Media Assisted by Smart Apps Creator in order to Improve student's problem-solving ability" by Mahuda, et all (2021). Their research shows that the validity of material quality criteria is excellent with a score 81% from learning materials expert and media quality reach a score 94.16% from media experts, so the media quality criteria is same as material quality. For the practical aspect, the average score is 88,08%, which means that their product affects the improvement of student's problem-solved ability. It also conducted that the product in their study could be used to improve student's problem-solving ability.

CONCLUSION

The results of this research showed that (1) student's problem-solving ability are relatively low, so an android-based learning media called "Teman Ritma" was developed; (2) creating of application is assisted by Microsoft Office PowerPoint integrated with ISpring suite, and a converter HTML-to-App software called "Website 2 APK Builder"; (3) Teman Ritma's learning media application contains kind of features as follow: title screen, main menu screen, student's competencies to be achieved, learning material menu, learning materials that presented using combination of text and video, mini games, exercises task with explanations, and quizzes; (4) validation results of learning materials experts and learning media experts showed that the Teman Ritma's learning media application marked as "excellent criteria" with average score is 52.5 for learning materials aspect, and "good criteria" with average score is 72 for media aspect. Teman Ritma's learning media application declare valid and eligible to use. This research will continue to implementation and evaluation phase.

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