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DEVELOPMENT OF ANSARI LEARNING MODEL BASED ON A PROJECT TO HELP STUDENTS CARRY OUT TEACHING ASSISTANCE AT SCHOOLS

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ABSTRACT

Solving non-routine math word problems is important to do because it will train students' and teacher students' creative, critical, collaborative and communicative thinking. Aims of this study are (1) to conduct developmental research to produce a product, that is, an innovative project-based learning model abbreviated as ANSARI (Auditory, Negotiation, Strategies-somatic, Administer Information, Reflection, and Interaction-communication) which is valid, practical and effective, namely the ANSARI model as a learning medium, (2) to find out its effectiveness after being trained on teacher students, teachers and students in schools as a group in solving non-routine word problems. The samples were 145 students from five high schools with different levels in Sigli City, Aceh Province, Indonesia. Data were analyzed quantitatively with One-way Anova and qualitatively to determine students' perceptions. The findings revealed that the ANSARI model has an influence in increasing teacher students' and school students' HOTS in the pre-test and post-test as well as students' perceptions of the learning model.

Keywords: Ansari Model; PjBL; HOTS; Perception, Industrial Revolution 4.0.

INTRODUCTION

Teaching assistance is one of programs in the current Indonesian curriculum, i.e., Merdeka Belajar-Kampus Merdeka (MB-KM). This activity is performed by teacher students to gain experience studying off campus, especially at school, to apply theoretical knowledge they have learned at university before going into real teaching practice. In this activity, teacher students are assisted by teachers at the school. Its goal is to disseminate creative and innovative learning products to improve the quality of learning at schools (Menteri Pendidikan dan Kebudayaan, 2020). The activity has several stages namely planning, implementation, dissemination, and reporting. In the implementation stage, teacher students use the innovative learning products that have been produced with experts to help students solve math real-world problems. It is common that students complain when working on real-world problems because they get confused where and how to start (Cai, 2020). In addition to help students' difficulty solving math problems, this activity trains students to sharpen their logical thinking in welcoming the 21st century. Experts state that the challenge of education in this century is that every educational institution must be able to produce graduates with good 21st century skills, namely being able to work together (collaboration), think critically, think creatively, and have communication skills (communication and problem-solving) (Rojko, 2017).

Furthermore, Bacanlı et al. (2011) and Malawi et al. (2019) claim that the important skills include critical thinking and problem solving, creative, communicative, and cooperative (4Cs). Besides that, the fundamental skills students need to prepare are being able to communicate, be creative, innovative, critical, and analytical to solve real-world problems effectively in the era of global competence (Sang et al., 2018; Winarso & Haqq, 2020; Zhou, 2018). All these abilities are known as higher-order thinking skills (HOTS). Higher-order thinking skills occur when students connect new information with previous information stored in memory and develop this information to reach solutions to difficult situations (King et al., 1998). Indicators for measuring HOTS include analysis (C4), evaluation (C5) and creation (C6) (David, 2002; Saputra, 2016). Based on the background above, we raise a question of how to sharpen logical thinking of teacher students and students at school so that they are interested in and are able to solve math real-word problems?

To answer the question above, we propose a learning approach appropriate and effective to engage student participation, called as ANSARI, an acronym for Auditory, Negotiation, Strategies-somatic, Administer information, Reflection, and Interaction-communication. The stages of the ANSARI learning model is described in Table 1.

Table 1. Stages and Activities in the ANSARI Learning Model

NO	ANSARI Stages	Activities
1	Auditory	• Listen to the teacher's explanation, recognize, and understand problems
2	Negotiations	• Negotiate in teams, accept and share • information, make an illustration if needed, • and generate alternative solutions;

3	Strategies and Somatic	• Use the formula based on the illustration, • look for variables needed for solutions, discuss he team to get a solution;
4	Administer Information	• Write down any information from group discussion and teacher explanation to get best solutions;
5	Reflections	• Review the solutions obtained;
6	Interaction and Communication	• Each team presents solutions and communicates • verbally.

The ANSARI learning approach uses project-based learning. It means that after this approach is declared valid (first year), practical and effective (second year), it is trained to mathematics education students who are taking the research methods course. After that, they apply the approach for students at school to help them solve math real-world problems through project-based learning (PjBL). Therefore, the objectives of this research are (1) to produce innovative products, that is, project-based ANSARI learning model which is valid, practical and effective, including: (a) ANSARI model as learning media, (b) website-based ANSARI model, and (c) the application and android-based ANSARI learning model accessible in smartphones and laptop/pc for all levels of education, (2) to find out its effectiveness after being trained on teacher students, teachers, and students at school in solving non-routine word problems. Therefore, the research questions are formulated below:

1. How is the effect of the development of project-based ANSARI learning products on addressing student difficulties in solving non-routine math problems at school?
2. How efficient is the ANSARI approach to enhance students' interest in solving non-routine math problems at school?

Higher-Order Thinking (HOTS)

Conklin (2012) identifies two key characteristics of higher-order thinking skills: critical thinking and creative thinking. Critical thinking refers to the ability to analyze and evaluate information (Griffi et al., 2012). In essence, it involves the art of thinking critically about one's own thought processes to enhance their quality. Redhana (2019) explains, "Critical thinking is the art of thinking about thinking while thinking, in order to improve thinking." Thus, experts agree that critical thinking comprises two primary cognitive processes: analytical reasoning and decision-making.

Reasoning involves activities such as ensuring clarity, accuracy, validity, relevance, depth, and reliability of information, along with analyzing evidence to support arguments and derive conclusions (Yudha, 2004). Therefore, critical thinking is a process of reasoning that delves into the complex "why" and "how" of problem-solving, ultimately leading to informed decision-making.

Creative thinking, on the other hand, encompasses cognitive, affective, and metacognitive skills. Cognitive skills include (1) flexibility, (2) fluency, (3) originality, and (4) elaboration (Sukmadinata, 2005). Affective skills pertain to recognizing problems and opportunities, tolerating uncertainty, understanding the environment and others' creativity, openness to new ideas, taking risks, building self-confidence, exercising self-control, fostering curiosity, expressing and responding to emotions, and anticipating the unknown (Pucio & Murdock, 2001). Metacognitive skills involve designing strategies, setting goals and making decisions, predicting outcomes from incomplete data, understanding creativity beyond surface levels, diagnosing incomplete information, weighing multiple considerations, managing emotions, and advancing problem-solving elaboration and planning (Levy & Murnane, 2005).

To foster these higher-order thinking skills, higher education institutions must design and implement innovative learning processes that optimize students' outcomes across affective (character), cognitive (knowledge), and psychomotor (skills) domains. One effective method is Project-Based Learning (PjBL), which actively engages students in a collaborative, innovative environment.

Table 2. Stages of Project-Based Learning

No	Stage	Description
1	Project planning	a. Identify real problems and find the root of the problem, b. Finding alternative problem solving strategies, c. Doing planning.
2	Project implementation	a. Student guidance in completing assignments, b. Examination of task completion, c. Discussion between teams in groups
3	Project evaluation	a. Progress in solving the problem, b. Teamwork and individuals, c. Diary book, d. Performance evaluation and presentation, e. Project report in written form

PjBL is a student-centered learning model that emphasizes meaningful, time-focused projects rooted in problem-solving. It integrates concepts from various fields of knowledge and experiences, promoting collaborative learning within heterogeneous groups. Through this approach, students develop essential skills by actively engaging in the three phases of project-based learning, as illustrated in Table 2.

RESEARCH METHODOLOGY

Research Design and Research Subject

To achieve the research objectives, we implemented a participatory learning approach through research development and training. This study used the Research and Development (R&D) model while the training utilized the project-based learning (PjBL). The R&D model employed ADDIE (Branch, 2009), namely Analysis, Design, Development, Implementation, and Evaluation. This research will produce an innovative product, that is a valid, practical and effective project-based learning model, namely the ANSARI model as a learning medium.

The samples of this study were 25 mathematics education students who were taking the research methodology course in Semester 6 at Jabal Ghafur University. Meanwhile, the sub sample was 56 students from five high schools in Pidie Regency with various levels. The subjects used for trial in this research were tenth- and eleventh-grade students. The research subjects for the readability trial were 15 students randomly selected from school A. In the next trial, the researchers randomly selected 32 students from school B.

Research Procedure

There are four stages in teaching assistance using the PjBL method, namely: (1) planning, (2) implementation, (3) dissemination, and (4) reports, which will be described below.

In the planning stage, teacher students conducted observations at school for two weeks (need assessment). In this stage, students worked in a team, including: (a) preparing what students' needs in class based on a need assessment–they generally had not yet had innovative learning steps that help students solve non-routine word problems more easily, (b) discussing with lecturers and teachers at school to actualize their learning experience at school for 10 weeks. After that, in the dissemination stage, students practiced innovative learning steps at school, especially in solving real-word problems in groups (four weeks). The final stage of the PjBL method is that teacher students were required to report/present their work in front of lecturers and other college students (one week).

In the implementation stage (10 weeks), the researchers will produce an innovative product– that is, a valid ANSARI learning model (year 1) through a study of three early stages of ADDIE development model. Before visiting schools, teacher students were first trained by the research team on the ANSARI approach in solving non-routine word problems. The teacher students also learned to design lesson plans based on ANSARI learning model along with the learning assessments and consulted them with the school teacher where they carry out the project. The teacher students also observed the teacher's teaching practice in the classroom as a model for them. Finally, they administered pre-tests to students in their respective schools.

In the dissemination stage (four weeks), teacher students practiced the ANSARI learning steps completely on students at school. After that, the students took the HOT-based final test to measure creative, critical, collaborative thinking, problem solving, and communication skills. Finally, students were asked to fill out a questionnaire about their perceptions of the ANSARI approach.

Data Collection

Data collection and data analysis based on the ADDIE stage are presented below.

1. Analysis Stage (Initial stage)

At this stage, an analysis of the need for product/model development and the feasibility of the development requirements were carried out. This analysis is needed to gather supporting information for planning further activities and for consideration in developing a quality product. In this stage, descriptive data about the school curriculum, subject matter, learning resources, and an analysis of student characteristics are needed.

2. Design Stage (Initial stage)

The activities aim to obtain an overview of the product/model which will be designed based on the needs analysis carried out in the first stage. The design stage is a systematic process that begins with setting learning objectives, designing lesson plans, designing products, designing learning materials, and designing evaluations. At this stage, the activities include designing a concept map for the learning model. Instruments that will be compiled at this stage comprise model validation sheets and lesson plan validation, student response questionnaires, and observation log of learning implementation and evaluation tools.

3. Development Stage (Initial stage)

The development stage is the product realization stage. Activities at this stage involve writing and developing lesson plans and learning models based on the design framework that has been obtained at the design stage. The development process also needs to consider the terms and principles of preparing lesson plans and the model in order to obtain a good and quality model. The resulting model was then consulted with teachers to get suggestions and improvements. The model must be validated before being tested in the field. The validation process found for opinions and suggestions from two material expert lecturers, one media expert lecturer, and one teacher. Validation was carried out to determine the quality of the model developed using the lesson plan and model assessment sheet. The validation results will be used as a reference for revising and improving the learning model that has been developed. At this stage, data on product quality will be obtained based on aspects of validity.

4. Implementation Phase (Year 2)

The implementation phase was carried out by testing the product in the learning process in the classroom. The trials aim to test the quality of project-based ANSARI learning model that had been produced in the previous stage. At this stage, data on product quality was obtained based on practical aspects.

5. Product feasibility test Evaluation Stage (Year 2)

The evaluation stage aims to determine the effectiveness and practicality of the resulting learning model. In addition, at this stage, we improved products by conducting the second revisions based on input from teachers and students when the trials were conducted. Then, data was analyzed whether it meets the feasibility of the model in terms of the aspects of validity, practicality and effectiveness.

Research Instruments

The instruments used in this study consisted of ten types of analysis sheets following the ADDIE stages. There were six instruments involved in this initial stage study, namely: 1) curriculum analysis sheet, 2) learning resources and evaluation tools, 3) student needs and characteristics, 4) lesson plan validation sheets, 5) evaluation tools and guidelines for using the ANSARI method, 6) expert and teacher validation. Then there were four instrumen in second years namely learning implementation, observation of student activities, teacher response and student response questionnaires. Each of these instruments was developed simultaneously with the learning model. Expert validation aimed to examine one aspect of product development quality by expert lecturers, and teachers, feedbacks were then obtained from the validators. The validators recommendation was necessary to examine the feasibility of the product.

Data Analysis

The data obtained in field trials at the implementation and evaluation stages of the ADDIE model were analyzed to test the practicality and effectiveness of products developed based on the recommendation from Nieveen (1999) regarding the practicality of a product and the effectiveness of a product. The post-test in this study is presented below.

1. A mosque dome has a diameter 5 m. If the outer surface of the dome is to be painted at a cost of Rp. 27,000.00/m2, 2 m2 requires 1 kg of paint. How much cost and kg of paint are needed to paint the dome?

2. The increase in volume as the circular cone radius increased by 26 cm is equal to the increase in volume when the height of the cone increased by 26 cm. If the initial height is 4 cm, determine the initial radius. How do your predictions this answer? Please check!
3. Given that a cube of ABCD.EFGH, B1 is the sphere outside the cube, and B2 is the sphere inside the cube. Anne has calculated that the comparison of the B1 and B2 is 2 :1. What is your opinion, is it right? Please check!

HOTS Indicators

Table 3. HOTS Indicators

No	HOTS Aspect	Indicators
1	Creatively	Arranging all the strategy on the problem solving systematically.
		Creating patterns and ideas as well as linking and applying them to solve problems.
2	Critically	Understand the problem and conduct an assessment to select a solution to the problem.
		Implement decisions and there are conclusions.
3	Communication	Able to communicate effectively to the audience
		Proposing a strong supporting argument that can be accepted logically.
4	Collaborative	Able to work in teams.
		Be actively involved in group discussions

RESEARCH RESULTS

In this study, teacher students were given tests and applied the ANSARI model to solve non-routine problems before they taught students at schools. The test results showed that the use of the ANSARI model had a significant effect on improving HOTS. Meanwhile, questionnaire were conducted to investigate the students' satisfaction on using ANSARI learning model. Quantitative data analysis was a standard deviation, mean and percentage. Satisfaction data analysis was conducted in three categories, namely attractiveness, easiness and benefit. While students' perceptions were in the good category (scale 1-5). Students' activity during the implementation of ANSARI model is given below.

Figure 1. Classroom Situation during the Implementation of ANSARI Learning Model

Furthermore, the results on student abilities, including critical, creative, communication and collaboration in the analytic hot course, and their satisfaction is presented in Table 4.

Table 4. The Results of Test Scores and Students' Satisfaction with ANSARI Learning Model

No	Measured variables N (56)			
1	HOTS Outcome	Score	Satisfaction (Perception)	Score
2	Critical	68.4 (15.4)	Attractiveness	4.21
3	Creative	68.7 (16.6)	Easiness	4.23
4	Collaboration	85.6 (15.8)	Benefit	3.87
5	Communication	87.2 (16.2)	---	---
	Average	77.7 (16.7)	----	4.11

Table 5. Teacher students' and students' hots ability in pretest and posttest and students' perceptions of the ANSARI learning model

	Pretest	**Posttest**	**Perception**		
			2	**3**	**4**
Teachers N= 25	51.7 (13.5)	86.5 (15.7)	-		
Student N = 56	48.5 (13.3)	77.7 (15.2)	4.21	4.23	3.9

Based on Table 4 above, in general, teacher student scores on HOTS increased from the initial test to the final test. It serves as a provision for teaching assistance to high school students in an effort to overcome students' difficulty in solving non-routine questions. From the results of interviews with several teacher students, they collaborated to overcome students' difficulty at school so that students' abilities could increase from the initial test to the final test. However, there were eight teacher students who had less collaboration with their teams, resulting in unsuccessful performance in the classroom. That is, they were unable to answer questions from students at school, when they were in front of the class.

Therefore the development of thinking skills should start from communication and collaboration to improve HOTS. It is evident that HOTS can be achieved if communication and collaboration skills increase and as a basic skill to achieve critical and creative thinking skills. Communication skill is one of the abilities recommended by experts to be mastered by students in the era of globalization to face the challenges of the 21st century. Furthermore, the results of the questionnaire showed that students' perceptions of the ANSARI learning model are in the good category. Majority of students think this learning model made them easier to solve non-routine questions. Meanwhile, a few students considered this learning model less beneficial because it took a relatively long time.

CONCLUSION

The result of this study revealed that quantitatively, the ANSARI model can significantly improve teacher students' HOTS from the pre-test (51.7) and post-test (86.5) and students from the pre-test (48.5) and post-test (77.7). Qualitatively, students' perceptions differ between the attractive, ease and benefits of the ANSARI model in solving problems. They contended that this learning model helps them in solving non-routine problems (4.23) but takes a lot of time (3.87) with the scale from 1 to 5.

The implications of the findings above indicate that the ANSARI model, which is valid, practical, and effective, is capable of enhancing students' higher-order thinking skills. Therefore, the ANSARI model can be utilized as a problem-solving teaching method in schools. Based on these implications, it is recommended that teachers frequently adopt a Project-Based Learning approach in mathematics instruction and implement the ANSARI model in problem-solving activities.

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