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ANALYSIS OF LEARNING MODEL AND MATHEMATICAL MATERIAL TO BUILD STUDENTS' CHARACTER THROUGH MATHEMATICS LEARNING

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Abstract. The mathematics that has been taught from primary school to high school with a lot more time studying math in the classroom can be a passage to build students' character. Students' character building is not easy; therefore, it requires a planned, continuous, and systematic effort in learning mathematics. Lesson plans involving students' character building must be purposefully designed (by design). It cannot be accidentally happened (by chance). The use of innovative learning models in learning mathematics needs to be analyzed to be able to build students' character. This study aims to describe the relationship between learning models, mathematical material, and student character that is built through mathematics in junior high schools. This study employed a descriptive research method with a qualitative approach. Data were collected through documentation, interview, and observation techniques. Data analysis techniques followed three steps, namely data reduction, data presentation, and conclusion. The results of the analysis offered an overview of students' character that can be formed by applying innovative learning models in learning mathematics. Furthermore, the results of the analysis will be used in developing the steps (syntax) in learning mathematics.

Keywords**:** Innovative Learning Models; Characters; Mathematics

I. INTRODUCTION

It happens because of the phenomena that occur today and challenges in the future that will be faced by the students becomes more complex. The characters such as honesty, discipline, responsibility, hard work, politeness, and caring are increasingly lost. One of the proofs of the lack of awareness in performing honest behavior is the rising number of cheating and plagiarism in education. Other phenomena such as the culture of queuing, orderly traffic, smoking prohibition, or throwing garbage in its place are still a difficult thing to do consciously and responsibly by students. Discipline and responsibility sometimes only appear when they are supervised and threatened by punishment, so it is not attached as part of the character.

The Ministry of National Education has launched a nationwide character education in 2010 targeting all schools to successfully integrate character education in teaching and learning in 2014. Integrating the characters in the learning process is expected to build a positive student's character. Integrating character education in learning has been stated in the curriculum of 2013. One of the characteristics of the 2013 curriculum is to develop competencies presented in the form of Core Competencies (KI) and thoroughly described in the Basic Competency (KD) subjects. All basic competencies and learning processes are developed to achieve core competencies.

Core competencies are designed in four interrelated groups to consist of spiritual attitudes, social attitudes, knowledge, and skills. The four groups become the reference

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of basic competencies and must be integrated into every learning. The competence of spiritual attitudes and social attitudes is the focus on building students' character. Character education applied in schools is not taught in special subjects, but internalized in each subject learned at school in the form of core competencies relating to spiritual and social attitudes. Both of these competencies are not developed directly. They are developed when students learn about knowledge and skills.

To achieve the goal of building students' character along with students learning knowledge and skills, a character education design is needed that will facilitate the teacher in carrying out the learning. The teacher needs clear guidance on how to integrate the characters with the material they teach. But in reality, the teachers still cannot integrate character education in the subject matter. The results of the preliminary study conducted by the researchers showed that teachers complained that there were no clear guidelines for integrating character education in the lessons they taught.

The results of this preliminary study are in line with the results of research by Sardjijo and Ali (2017) who find that teachers can write what types of characters they develop in lesson plans, but in their implementation, most teachers do not understand how to emphasize the types of characters written in lesson plans to be applied in the learning process. Therefore, it is necessary to have a device that can be used easily by teachers in developing the character of students in the learning process that they do in class.

Some mathematicians reviewing to build student's character through mathematics learning (Bishop, 2012; Prabowo and Sidi, 2010; Seah and Wong, 2012). Therefore, this study attempted to develop models of character education-based learning which was begun with analyzing the relationship between learning models and mathematics material with characters that could be formed through the learning model. The results of the analysis provided an overview of students' characters that could be formed by applying innovative learning models in mathematics learning, which used in developing the steps (syntax) in mathematics learning. With the existence of clear learning steps, teachers are expected to be able to integrate the characters in the learning process that they do.

II. Methodology

This study employed a descriptive research method with a qualitative approach. The descriptive method was used because this study described the relationship between learning models, mathematics material, and student's character that was built through mathematics lessons in junior high school. The research data was collected by using documentation study techniques (syllabus, lesson plan, and mathematics textbook), interview, and observation. The aspects that were analyzed and observed included basic competencies, subject matter, competency achievement indicators, constructed characters, and learning models. This study analyzed the mathematics material of junior high school for grade VII, VIII, and IX.

The technique of data analysis followed three steps namely data reduction, data presentation, and conclusion. Researchers used the triangulation of data collecting techniques and triangulation of data sources to ensure the credibility of the conclusions of the research results.

III. Results and Discussion

As described in the introduction, the characters that will be developed in the mathematics course for junior high school students for grade VII, VIII, and IX relates to core competencies one and two, namely spiritual attitudes and social attitudes. Competence to be achieved regarding the spiritual attitude is appreciating and living life in the way that the religion wants. This character is more developed through the problem solving or problems given in the learning process. It is not developed in the use of learning models. In some meetings, this character can be generated through the application of a learning model. It is not specific to a particular model but corresponds to the mathematics material being studied.

Characters related to social attitudes consist of two types that are the character's value about himself/herself and the character's value about others. Character values about himself/herself are honesty, discipline, hard work, responsibility, logical, critical, and creative thinking, curiosity, and confidence. The value of the character about others is politeness, appreciation, and care. These characters are related to social values which will be developed following the special characteristics or characteristics contained in a learning model and the subject matter that has been taught.

Basically, a learning model can develop many characters. However, to make the teacher focuses on developing the character of students in learning, the analysis result of this study is concerned with the characters that will be developed following the learning model that has been used. Characters related to social values differ for each class level based on the core and basic competencies of mathematics lessons stated in the 2013 curriculum.

Several studies tried to build character through innovative learning models and successfully changed the student's character. (Darlina, Sabani, and Mihardi, 2015) used the general physics learning model which succeeded in improving the character of students in every meeting. Rohana et al. (2015) in their research concluded that there was a significant difference between improving the character of the prospective teacher by using reflective learning and conventional learning. Aisyah (2014) in her research concluded that the application of character education using the contextual learning model made students had a belief, attitude, behavior, motivation, and good skills according to the culture and character of the Indonesian nation.

The implementation of the learning model requires a long time to be able to build the students' character, therefore this study analyzed all the mathematics material taught in junior high school so that it can be applied for three years for junior high school students. This study is correspondent with Kusumah and Suherman's (1990) which stated that building

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an affective domain (character) as a result of learning mathematics occurred more slowly than the cognitive domain and psychomotor domain. Learning models that were used to build student's characters in this study were constructivist-based learning models, namely direct instruction models, problem-based learning models, guided discovery learning models, cooperative learning models, and open-ended approach.

The direct instruction model has some learning steps as follows: (1) orientation, (2) presentation, (3) guided exercise, (4) assessing student performance and providing feedback, and (5) self-exercise [9]. In carrying out direct instruction, the teacher needs to provide a clear description, demonstrate behavior correctly, and offer opportunities for students to practice. The students must master the trained skill. Assessment of student learning outcomes is emphasized in the practice of developing and applying appropriate basic knowledge. Teachers must carefully measure the simple and complex skills of their students, and provide feedback to students.

If the assessment is done by the teacher, the teachers will certainly find it difficult to ensure that all of their students have mastered the skills or competencies. By using the technique of exchanging jobs through teacher guidance, students can correct each other's work. The teacher emphasizes that students' honesty in correcting their friends' work. Through this activity, the honest character can be formed by the teacher.

Guided exercise and self-exercise steps indirect instruction requires the hard work of the students to complete their work. Through this activity, the teacher can motivate students to work hard and take responsibility for their work. Through activities' indirect learning model, the students are expected to form an honest character, hard work, and responsibility.

A problem-based learning model has a characteristic that is a problem as a means to facilitate the learning process. The steps in problem-based learning are as follow (1) student orientation to the problem, (2) organizing the students, (3) guiding individual and group investigations, (4) developing and presenting the work, and (5) analyzing and evaluating the problem-solving process (Arends, 2015). In the second and third steps, the teacher asks the students in groups to solve the problem. In this step, the teacher can motivate the students to work hard in solving the problem and responsible for the results of their work.

The guided discovery learning model is a learning model that focuses on student activities in learning. Students are involved in experience and experimentation where they gain their knowledge and concepts (Cruickshank, Jenkins, and Metcal, 2012). In the learning process with this model, the teacher acts as a facilitator who directs students to find concepts, propositions, procedures, algorithms, and so forth. In the process of finding, the teacher motivates students to have curiosity, so students are excited about finding something. The process of finding can also build the character of logical, critical, and creative thinking.

The guided discovery learning model has the following learning steps: (1) orientation, (2) the stage of problem formulation, (3) data collection, (4) communicating or presenting the work to classmates, and (5) conclude the discussion. In the fourth step, students are asked to present the results of his work. In this activity the teacher reminds students to be confident in presenting their work, submitting or refuting in class discussions with polite language, and appreciating differences of opinion with their friends. Through these activities in this guided discovery learning model, the math teacher can build the character of curiosity, confidence, politeness, appreciation, logical, critical, and creative thinking.

An open-ended approach is a learning approach that starts from introducing or exposing students to open problems. The lesson proceeds by using many correct answers to the problems given to offer students experience in finding something new in the learning process (Shimada, 1997). Through this activity, the students are also expected to be able to answer problems in many ways which stimulate the intellectual potential and experience of students in the process of finding something new. This activity can certainly build the students' character of logical, critical, and creative thinking.

The open-ended approach has learning steps (1) giving problems, (2) exploring problems, (3) recording student responses, and (4) discussion of student responses in class discussions. In step three, the teacher asks several students as the representative of several groups to present the results of their discussion. Students are expected to respond to problems in various ways or solutions. During the discussion, the teacher should record the conversation. This is advantageous to build confidence for every student in displaying the results of their work. In the class discussion process or the fourth step, the teacher encourages students to be able to provide answers and conclusions about the concepts being taught. In this step, the teacher reminds the students to speak politely and appreciate his friend's opinion. Various activities conducted in the open-approach are expected to form the character of logical, critical, and creative thinking, curiosity, appreciation, and confidence in students.

Cooperative learning models have the following learning steps: (1) communicate goals and motivate students, (2) present information or subject matter, (3) organize students in study groups, (4) guide learning groups, (5) evaluate the work of students, and (6) give reward to each group.

In the first step, besides communicating the goals and motivating students, the teacher also informs the steps of the activities that students will take. Students are required to follow each stage of learning according to the time given by the teacher. This activity is aimed to build the character of discipline. In the third step, students are asked to work in groups. The group leader must ensure that all group members understand what they are doing in the task because at the evaluation stage they will be given a quiz where individual quiz scores will affect the group's assessment. This will build a caring character because students will work

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together to make all the members in a group understand the material. In the evaluation step, the teacher provides a quiz that must be filled individually. In this phase, the teacher builds honest character in students. Through these activities in this cooperative learning model, mathematics teachers build caring, honest, and discipline characters.

The results of the overall analysis of junior high school mathematics material relating to the character to be formed and the learning model used are presented in Table I.

TABLE I
LINKAGE ANALYSIS OF CHARACTER AND LEARNING MODEL FOR JUNIOR HIGH SCHOOL STUDENTS

Learning Model	Developed Character
Direct instruction	honesty, responsibility, and hard work
Problem-based learning	responsibility and hard work
Guided discovery learning	politeness, confidence, appreciative, curiosity, and logical, critical, and creative thinking.
Open-ended approach	logical, critical, and creative thinking., politeness, appreciative, and confidence
Cooperative learning	Care, honesty, and discipline

Table II presents the relevance of the mathematics material of class VII about numbers towards learning models that can be used. Then, it refers to Table I to determine the characters needed to be developed.

TABLE II
LINKAGE ANALYSIS OF MATHEMATICS MATERIAL (NUMBERS) AND LEARNING MODEL FOR GRADE VII STUDENTS

Subject Matter	Learning Model
Comparing integer	Direct instruction
Addition and subtraction operation of integer	Guided discovery learning
Multiplication operation of integer	Guided discovery learning
Division operation of integer	Problem-based learning
Least common multiple and Greatest common divisor	Direct instruction
Fractions and symbols	Direct instruction
Comparing fractions	Open-ended approach
Addition and subtraction of fractions	Problem-based learning
Multiplication and division of fractions	Cooperative learning
Powers of Numbers	Open-ended approach

The results of the analysis of mathematics material (number) relating to the character to be formed and the learning model used are presented in Fig. 1.

The result of linkage analysis between mathematics material, learning model, and character that will be built becomes the basis for preparing learning steps and student worksheets. The example below is an example of learning steps to teach the material of addition and subtraction operations of integers. This material will be taught using a guided discovery learning model, as displayed in Table II. Based on Table I, the guided discovery learning model is targeted to build the characteristic of politeness, care, confidence, appreciation, curiosity, discipline, logical, critical, and creative thinking.

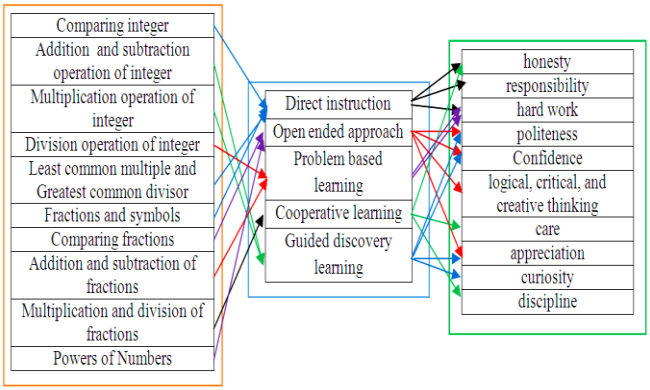

Fig. 1 Linkage analysis of mathematics material (numbers), character, and learning model

Example: (1) Orientation stage: at this stage the teacher opens the lesson by greeting and praying, discussing or informing the material to be studied and learning objectives, reminding about the material about comparing integers, giving explanations or directions regarding activities to be carried out during learning, and explaining briefly about the addition operation and the subtraction of integers. (2) The problem formulation stage: the teacher gives problems related to the addition and subtraction of integers written in the student worksheet. (3) Data collection stage: at this stage the teacher asks students to solve the problems written in the student worksheet together with friends in the group by filling out the addition table so that students can find the properties besides integers. The teacher gives direction so that the students can work well together to find the properties besides of integers. This activity is directed to build curious characters. (4) Communicating or presenting stage: at this stage, the teacher appoints several groups to present the results of their work to classmates. It is useful to build self-confidence in students. The teacher asks other groups to respond to the results of the presenter's work. The teacher reminds students to speak politely and respect their friends' opinions.

The product of this research is an innovative learning model based on character education for mathematics teachers of junior high school in the form of a guidebook for mathematics teachers which contains a lesson plan and student worksheet. This guidebook is expected to assist teachers in integrating character education into their math learning process. Besides, the guidebook is expected to be used by Universities who have mathematics education courses to be able to prepare prospective teachers to successfully integrate character education in the learning process. It is following the research of Stallions and Yeatts (2003) stating that students in teaching faculty need to be prepared with theoretical and practical knowledge and skills to ensure the capability to apply character education in the learning process.

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IV. CONCLUSIONS

This study had resulted in an innovative learning model based on the character of education for mathematics teachers of junior high school which was begun with analyzing the relationship between learning models and mathematics material with characters that could be formed through the learning model. The results of the analysis provided an overview of students' characters that could be formed by applying innovative learning models in mathematics learning, which used in developing the steps (syntax) in mathematics learning. With the existence of clear learning steps, teachers are expected to be able to integrate the characters in the learning process that they do.

This innovative learning model based on character education manuals still requires a series of trials using models to test the effectiveness of this model in building student character. Therefore, this study still requires further research so that the books produced can be used on a wide scale and are useful for teachers and society in general.

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