The Development of Teaching Materials Base on Inquiry Oriented Discovery

W Mataheru, N C Huwaa, and C Matitaputty
Mathematics Education Study Program, Pattimura University
E-mail: chmatitaputty@gmail.com

Abstract. Textbooks are guidelines for training and improving students' skills in understanding material and solving problems. Inquiry-oriented discovery refers to academic situations, namely small groups of students trying to find answers to the topics of inquiry. In these situations, students can find concepts or detailed information. This study aims to produce textbooks. Type of research, namely development research through define, design, and develop stages. The results of the study showed that after the textbooks were validated, they were read and met the criteria for good (valid).

1. Introduction
One of the students' miss understanding of School Mathematics Study 2 courses is that they don’t have a textbook, even though the lecturer has explained the material. Having textbooks can help students to repeat the material taught by their lecturers. This is possible, because not all students have the ability to remember.

Textbooks are important components that must be prepared by the lecturer before carrying out learning activities. Completeness of textbooks will assist lecturers and students in learning activities. More than that, textbooks are a crucial component for achieving learning goals.

[1] Teachers as implementers of education are required to be able to produce quality textbooks. Quality textbooks intended are textbooks that can answer problems and meet students' needs to achieve their learning goals. Therefore, textbooks should be able to provide knowledge, skills and attitudes that students must learn to achieve predetermined competency standards.

There are several formulations about the meaning of textbooks or referred to as learning materials, [2] learning material, is a summary of material given and taught to students in the form of printed material or in other forms stored in electronic files, both verbal and written. In order to strive for students to have an initial understanding of the learning material to be discussed, it is recommended that this learning material be delivered or shared first to students before the learning and learning process is carried out. This is good to do, because by learning it first, students are expected to be able to actively participate during the learning and learning process.

Lecturers as implementers of education are required to be able to make quality textbooks. Quality textbooks intended are textbooks that can answer problems and meet the needs of students to achieve their learning goals. Therefore, textbooks should be able to provide knowledge, skills, and values and attitudes that students must learn to achieve predetermined competency standards. According to [3] the inquiry method of teaching is a valid and compelling alternative to the more traditional educational methods utilized in the past. In addition, discovery learning is a of the learning model on learning mathematics that can improve student's mathematics learning achievement higher [4]
In this study, Inquiry oriented discovery textbook will be developed. Inquiry oriented discovery refers to academic situations, where small groups of students try to find answers to the topics of inquiry. In these situations, students can find concepts or detailed information.

Inquiry is another greeting for the inquiry method. Inquiry requires more than simply answering questions or getting a right answer. It espouses investigation, exploration, search, quest, research, pursuit, and study. It is enhanced by involvement with a community of learners, each learning from the other in social interaction [5]. The Inquiry method can be carried out to all classes as part of inquiry activities, called social inquiry. Even though the inquiry method has the most support and is used by educators, it does not mean that other methods are ignored or not used to achieve the objectives of inquiry [6]. Inquiry is a form of student-oriented approach. That said, because in this approach, students hold a very dominant role in the learning process [7]. Based on the above opinion, inquiry is defined as a method that gives students flexibility to learn actively, analytically, and creatively in solving mathematical problems.

Inquiry oriented discovery refers to academic situations where small groups of students (typically 4 to 5 members) try to find answers to the topics of inquiry. In these situations, students can find concepts or detailed information. This model can be implemented to all classes as part of inquiry activities. The assumptions underlying inquiry are as follows: (1) Critical thinking skills and deductive thinking are used relating to data collection related to the hypothesis group; (2) Benefits for students from group experiences where they communicate, share responsibilities, and jointly seek knowledge; and (3) Learning activities are presented with the spirit of various inquiries and discovers that increase motivation and expose participation [6].

Instructional strategies can succeed if the teacher give more attention to the following criteria: (1) Clearly defines the topic of inquiry that is considered useful for students; (2) Form groups by paying attention to the balance of academic aspects and social aspects; (3) explain the task and provide feedback to the group in a responsive and timely manner; (4) Interventions to ensure the interaction between individuals in a healthy manner and in the progress of the implementation of tasks; and (5) Evaluate in various ways to assess group progress and results achieved.

The implementation of group inquiry in a class is carried out by small groups, where each group member performs a particular role as follows [6]. (1) The group leader is responsible for starting the discussion, preparing groups to do assignments and completing tasks, meeting with the teacher to discuss the progress and needs of the group, describing information from the teacher to the group, and conveying information to the class or to other groups; (2) recorders; create and maintain notes, written works, and group writing material, both those made when discussing and sharing them with group members, as well as making a check list and attendance list for group members; (3) discussion monitoring (discussion monitor); seeks to ensure that the discussion takes place smoothly and all opinions are submitted and discussed in the discussion. Monitoring is needed so that discussions take place openly and get support; (4) prompter; maintain mental discussion of members with techniques using a checklist of participation for all group members. Encourage each member to contribute and try to describe a more detailed explanation from group members; (5) Summary maker (summarizer); during the discussion and when drawing conclusions at each inquiry meeting, the summaries summarize the main points that emerge and summarize specific tasks both complete and incomplete, inviting questions from the group to clarify the position of progress and group goals; and (6) Advocates: tasked with carrying out and giving comparative opinions to the arguments presented in the discussion against those submitted by other groups.

In this study, there are activities that must be carried out by group members based on the following instructions. (1) Each group consists of 4 - 5 people; (2) Discuss the activities that have been prepared; (3) If among group members, there are those who do not understand, may be asked by friends or lecturer; (4) A member is tasked with recording the results of the discussion and its conclusions; (5) A member is tasked with recording the activity of his group members; (6) A member is assigned to present the results of the discussion in front of the class.
The formulations of the problem in this study are how the development and results of the development of a disk-oriented inquiry-oriented textbook on lectures in School Mathematics Study 2 Subject in Mathematics Education Study Program FKIP Unpatti? Whereas the purpose of this study is to produce a valid disk-oriented inquiry-based textbook on the study of School Mathematics 2 Subject in the Mathematics Education Study Program FKIP Unpatti.

To avoid misinterpretation in this study, it is necessary to explain the following terms. (1) Textbooks are a systematic arrangement of various learning materials, which are used as guidelines by lecturers and students in learning; (2) Development of textbooks is a process to get good learning material, in accordance with the steps in the development model of textbooks used; (3) Textbooks are said to be valid if the validator team (experts and practitioners) declare textbooks that are developed valid (based on strong theoretical rationales and there is consistency among the components of textbooks internally), and in the implementation of trials, textbooks fulfill certain conditions; and (4) Inquiry oriented discovery is an academic situation, where small groups of students (generally between 4 to 5 people) attempt to find answers to the topics of inquiry.

2. Methods
This research was a research and development or R&D method. R&D is a research method used to produce certain products, and test the effectiveness of these products [9]. The product that will be developed in this study is a lecture aid in the form of an Inquiry oriented discovery textbook.

This study uses a development research design with a 4-D development model designed by Thiagarajan, Semmel, and Semmel [9], which includes: define, design, develop and disseminate stages. Given the limitations of time, this research is only carried out until the development stage. The procedures performed for the three stages are as follows. (1) Define phase. At this stage the activities carried out are: Analyzing the Syllabi or Semester Program Plan and Analyzing the Lesson Plan or SAP; (2) Design phase. At this stage the activities carried out are designing the textbook format. Each topic consists of: learning achievement, subject matter, sample questions, activities (practice questions) to be done in groups during lectures, summaries, practice questions to be done individually at home, and key answers; and (3) Development stage. This stage aims to produce a final draft of a good or valid learning material. Activities at this stage are as follows. (a) Expert Validation / Assessment. The development phase begins with validation by experts. Validation is carried out on learning materials Syllabi, Textbook and Student Worksheet which are developed at the design stage. This activity was carried out to obtain input and suggestions from several validators in the field of mathematics. Validators amounted to five peoples, consisting of two lecturers of Mathematics Education and three mathematics teachers from Senior High School. Based on the assessment, correction, and suggestions from the validator, a revision of the learning materials is carried out; (b) readability test of Learning materials. The purpose of the test is the readability of the learning materials, which is to obtain input whether the learning materials can be read clearly and understandably. Subjects in the readability test of learning materials, namely five validators as mentioned above and two students. The readability test for learning materials was held on Saturday, September 9, 2017; and (e) filed test learning materials. The purpose of the learning materials is to obtain input from validators, students, and observers on the learning tools that have been prepared. Subjects in the field test are twenty five students. The learning materials test was conducted on September 11 until November 1, 2017.

The instruments used in this study are as follows. (1) Validation sheet for learning materials, used to obtain data on the quality of learning materials consisting of: validation sheets of Syllabi, Textbook and student activity (2) readability test sheet for learning materials for students and validators, used to collect data about suggestions and difficulties contained in the learning materials; (3) Observation sheet for lecturer activities, used to determine the feasibility of learning materials in the classroom; (4) Lecturer and student questionnaires, are used to obtain information about their response to the Inquiry oriented discovery method; and (5) Student activity, used to find out students' mastery of the material.
Data collection techniques in this study were carried out as follows. (1) The validation data of learning materials (lesson plan, textbook, and worksheet) are obtained based on the validator's assessment. The validator provides an assessment before the implementation of the learning materials; Readability test data is obtained based on input in the form of comments and suggestions from validators and students. These comments and suggestions are given prior to the implementation of the learning materials test; (3) Observation data of lecturer activities in learning, collected through observation. Observations are carried out during learning. Observations were carried out by a peer lecturer, (4) lecturer and student response data on the disk-oriented inquiry method was collected through a questionnaire. Questionnaires are given to peer lecturers and students after learning ends; and (5) worksheet data is collected at the end of learning.

Data analysis techniques in this study were carried out on several data as follows.

- The general evaluation of the validator on learning materials in the form of Syllabi, textbook and students worksheet was analyzed based on the mean score formula below:

  \[ \bar{x} = \frac{\text{Number of assessments of all validators}}{\text{number of validators}} \]

- Furthermore, the mean score was classified according to the following references.

  1.00 \leq \bar{x} < 1.50: bad
  1.50 \leq \bar{x} < 2.50: enough
  2.50 \leq \bar{x} < 3.50: good
  3.50 \leq \bar{x} < 4.00: very good

  The learning materials is said to be valid, if the learning materials is in the "good" category. The results of the analysis are used as guidelines for revision (legibility test). Readability test results for validators and students were analyzed for input in the form of suggestions and corrections from the validator and the student.

- Data from observations of lecturer activities were analysed using the formula:

  \[ y = \frac{\text{the number of observation items carried out by lecturers}}{\text{the total number of observation items}} \times 100 \%
  80\% \leq y <100\% = \text{Very High}
  70\% \leq y <80\% = \text{High}
  60\% \leq y <70\% = \text{Medium}
  50\% \leq y <60\% = \text{Low}
  40\% \leq y <50\% = \text{Very Low}

  Information:
  y: Lecturer activity
  Executed aspects are assessed 1.
  Aspects not implemented are rated 0.

  Lecturer activity in learning is said to be carried out, if the percentage of lecturer activity is more than or equal to 70% (y \geq 70%). Furthermore, if less than 70% (y <70%) will be considered for revision.

- While data from observations of student activities were analysed using the formula:

  \[ z = \frac{\text{the number of observation items of student activity carried out}}{\text{the total number of observation items}} \times 100 \%
  80 \% \leq z < 100 \%= \text{Very High}
  70 \% \leq z < 80 \% = \text{Height}
  60 \% \leq z < 70 \% = \text{Medium}
  50 \% \leq z < 60 \% = \text{Low}
  40 \% \leq z < 50 \% = \text{Very Low}
Information:

z: Student activity

Executed aspects are assessed 1.
Aspects not implemented are rated 0.

Student activity in learning is said to be effective, if the percentage of student activity is more than or equal to 70% (z ≥ 70%). Furthermore, if it is less than 70% (z < 70%), it will be considered for revision.

- Partner Lecturer Response Data Analysis using the formula:

\[ R_g = \frac{\text{(number of questions that were responded to)}}{\text{(total number of questions)}} \times 100 \%
\]

Information:
Rg: The lecturer’s response to the learning materials.

The lecturer response is said to be positive, if the average percentage obtained more than 70% is in the category of Strongly Agree (SS) and Agree (S).

- Student Response Data Analysis using the formula:

\[ R_s = \frac{\text{(number of students responding)}}{\text{(total number of students)}} \times 100 \%
\]

Information:
Rs: Student responses to learning materials

The criteria used, namely the student response is said to be positive, if the average percentage obtained more than 70% is in the category of Strongly Agree (SS) and Agree (S).

Based on the data analysis techniques above, it can be said that a disk-oriented inquiry-oriented textbook on the School Mathematics Study 2 course in the Mathematics Education Study produced is good (valid), if it meets the following criteria. (1) Validators provide a minimum rating of good; (2) Lecturer activity in learning is said to be carried out; (3) Positive lecturer response; and (4) positive student responses.

3. Result and discussion

In accordance with the purpose of this research, which is to produce a valid inquiry oriented discovery textbook on the School Mathematics Study 2 course in Mathematics Education Study, the results of the research will be described at define, design, and develop phases as follows.

In the define phase has conducted the following activities: (1) Analyze the Semester Program Plan (SPP). SPP contains: (a) Learning Outcome, that is, students are able to master two-dimensional, three-dimensional and trigonometry materials and can teach them, (b) Learning Outcomes of Course, (c) indicators, (d) study materials, (e) learning models/methods, (f) student learning experience, (g) time allocation, (h) assessment, (i) score, and (j) references. (2) Analyzing the Lesson Plan load indicator for the topic two-dimensional, three-dimensional and trigonometry.

At the design phase, have been activities of design textbook formats, while at develop phase, the validator give a general assessment of learning materials, the five validators gave an average rating of 3.07. This means that the assessment is in good category. In addition the validator said that the learning materials can be used with a little revision. Thus the revision is carried out in accordance with the validator's suggestions and comments.

The results of validation and revision of the Lecture Program Unit, the five validators gave an average rating of 3.2. This means that the assessment is in good category. In addition, the validator said that the Lesson Plan can be used with a little revision. Thus the revision is carried out in accordance with the validator's suggestions and comments.
The results of validation and revision of textbook, the five validators gave an average rating of 3.1. This means that the assessment is in good category. In addition, the validator said that this textbook can be used with a little revision.

Readability test was carried out for a day, on September 9, 2017. The readability test subjects were students of the Mathematics Education Study Program FKIP Unpatti. From the readability test result obtained the following data. Students said they could understand the sentences contained in textbook and student activity sheet, but in Chapter I and Chapter II there were pictures that were not given names. Based on the readability test results, the researcher decided to revise the learning materials (textbook and student worksheet). From the results of the revisions, the learning materials can be used in trials.

The trial activity was carried out for four days, on September 10, 2017 until October 15, 2017. The subjects of the learning materials trial were 25 students of Mathematics Education Study Program FKIP Unpatti. The 25 students have diverse academic abilities, which is high, medium and low ability. The trial was conducted in ten meetings. In this activity, the one who teaches is a lecturer (Research Team). In the learning process, students are grouped into 5 groups. Four groups included 4 members (Lavender group, Bangkai Flower group, Edelweys group and Cambodian group) and one other group (Mawar group) with 5 members. Student grouping is regulated by the lecturer, because she is more aware of the ability of his students every day in class.

Data obtained from the trial are data analysis to revise the learning materials draft final, based on the results of: (a) observation of lecturer activities, (b) validator response to the Lecture Program Unit, textbook, and student activity sheet, and (c) student response to textbook, and student activity sheet as follows. Observations by a colleague lecturer (Research Team) about the activities of lecturer in the learning process showed that the results of observation of the lecturer when using textbook in the ten meetings, namely at the first meeting 72.7%, the second meeting 81.8%, and the third meeting 90.9%, and fourth to tenth are 100% respectively. Thus it can be concluded that the lecturer can carry out learning in accordance with the inquiry oriented discovery method.

The response given by lecturers to lecture program unit, textbook, dan student activity sheet was based on a questionnaire, indicating that the response of lecturers in the category of strongly agree was 38.5% and agree was 61.5%. While the response with the doubt, disagree, and strongly disagree categories was 0%. Thus the teacher gave a positive response of 100%, which was obtained from the sum of strongly agree and agree categories.

The responses given by students to textbook and student activity sheet based on questionnaire, showed that the average student responded with a strongly agree category of 35.4%; agree 63.8%; doubt 0.8%; and disagree and strongly disagree 0%. Thus it can be said that students give a positive response of 99.2%, which is obtained from the sum of the categories strongly agree and agree. Based on the results of the research using a inquiry oriented discovery method, can be used as an alternative in learning in the material in the course "School Mathematics Study 2" which departs from the 4D model with the stages of defining, designing, and developing the discussion of research results are described as follows.

At this define stage an analysis of the Semester Program Plan and the Lecture Program Unit is carried out. Based on the results of the analysis, geometry and trigonometry material is one of the material that is considered difficult for most students who offer School Mathematics Study 2 courses. This is indicated by the low final grades obtained by students who offer the course. One of the low quality of learning is the use of learning methods used in the learning process. One of the causes of the low quality of learning is the learning process that is still carried out conventionally and is too abstract. This is clearly contrary to the cognitive development of students. As a result, many students have difficulty learning mathematics. Inquiry oriented discovery methods require students to find problem solving independently or with the guidance of lecturers. This is done to make it easier to identify student skills.

Activities at the design stage, namely designing the format of textbook covering: Learning Outcomes: students are able to master two-dimensional, three-dimensional and trigonometry materials
and can teach them; Lecture Learning Outcome, namely students are able to use the properties and rules about two-dimensional in problem solving; students are able to use geometric rules, abstractions and images in solving problems in three dimensional; and students are able to use trigonometric rules in problem solving; subject matter, examples, student activities, summaries, and practice questions to be done individually at home, accompanied by an answer

Textbook are designed in three chapters, according to the scope of the material as follows. Chapter I Two-Dimensional, Chapter II Three-Dimensional, and Chapter III Trigonometry. Textbook are designed for 16 meetings. At the VIII meeting, the Middle Semester Examination is held and the XVI meeting is held for the Final Semester Examination. In this study, only 10 meetings were observed. This is due to limited research time.

At the development stage, the learning tools that have been made, then carried out by the validators. Based on the results of the general assessment of the five validators, they gave an average rating of 3.07. This assessment is in good category. This shows that the first criteria has been met, but there are still some things that need to be revised. Thus, the researcher revised based on the validator's suggestions and comments.

Based on the validator's suggestions and comments on learning materials (learning program unit, textbook, and student activity sheet), then the readability was tested by 2 students and 5 validators. Students said they could understand the sentences contained in textbook and student activity sheet, but there were revisions that needed to be corrected. The same thing is said by the validator. They said they could understand the meaning of the sentences contained in learning program unit, textbook, and student activity sheet, but it was necessary to revise the learning materials. Thus learning program unit, textbook, and student activity sheet are revised.

After learning program unit, textbook, and student activity sheet was revised so the next activity, the learning materials was tested on 25 students of Mathematics Education Study Program FKIP Unpatti who offered School Mathematics Study 2 courses. Before start the learning process, students were divided into study groups with 4 to 5 students in each groups. Student placement in each heterogeneous group, namely high, medium, and low ability. The placement of students in this group is intended so that they can share their knowledge and experience. This is in accordance with [10], that the inquiry method is a method that is able to lead students to realize what has been gained during learning. Inquiry places students as active learning subjects. Although this method is centered on the activities of students, teachers still play an important role in designing learning experiences. The teacher is obliged to lead students in carrying out activities. Sometimes teachers need to provide explanations, ask questions, provide comments and through the creation of a conducive climate, using various media facilities and learning materials.

At the first meeting, the lecturers have not implemented the learning steps thoroughly. For example, the lecturer did not conclude the results of the discussion, did not repeat the concept that was just taught, and the use of time was not as expected. This is indicated by observations of lecturer activities in learning by 77.1%. In addition, it also appears that in each study group, there are several students who have not been actively discussing. This can happen, because this inquiry discovery-oriented method requires students to find themselves independently or with the help of lecturers. End of learning, lecturers who teach with observers (peer lecturers) discuss several things that are considered to be deficiencies at this first meeting, so that it is expected to be applied at the second meeting.

At the second meeting, it appeared that the lecturer carried out the learning in accordance with the planned learning steps. Also the students in the study group asked their friends and the lecturers about things that were not yet understood. This is consistent with the opinion [7], in the learning process; the teacher does not only act as a model or role model for students, but also the manager of learning. Thus the effectiveness of the learning process lies on the shoulders of the lecturer, and the successful implementation of a learning method will depend on the lecturer in using the learning method. This is indicated by observations on the activities of lecturers in learning increase, by 83.3%.
At the third and fourth meetings, it appears that the learning process is maximized when compared to the learning process in the first meeting and the second meeting. For example, every step of learning can be passed; the use of time is right, and student’s active in groups. If there is a group of friends who do not understand the material, they are invited to discuss. This is indicated by observations of lecturer's activities in learning by 100%.

To find out the response of lecturers and students on learning materials (learning program unit, textbook, and student activity sheet) that have been used, lecturers and students are asked to fill out a questionnaire. From the results of the questionnaire, it was found that the lecturer gave a positive response, namely in the category of strongly agree 42.2% and agree 57.8%. Also with the response of students, they responded positively to the learning materials, namely in the category of strongly agree 35.4%; agree 63.8%. Based on the response of lecturers and students, it can be said that the response criteria have been met, so that the learning materials does not need to be revised.

4. Conclusion
In Conclusion, it is known that all the criteria for learning materials are said to be valid. This means that the Inquiry oriented discovery method for lecturing in School Mathematics Study 2, which was developed by the researcher is valid. However, there are weaknesses in this research, namely that no observations were made of student activities in the group. This certainly affects to the results of the analysis of student activities on the implementation of learning materials trial.

5. Acknowledgment
The authors that to Faculty of Teacher Training and Education, Pattimura University that was funded this project.

References
[1] Mataheru W, Huwaa N C, and Matitaputty C, 2017 Writing Material Using Inquiry Oriented Discovery Method on Learning Mathematics Proc. Of The 2nd Int. Seminar on Education (Ambon) (Maluku: Universitas Pattimura)
[2] Gintings A 2008 Essensi Praktik Belajar dan Pembelajaran (Bandung: Humaniora)
[3] Ismail N and Abu R 2007 Implementing Inquiry-Based Learning an Innovative Method for Proactive Students (Universiti Brunei Darussalam)
[4] Taofik A, Ismail N, Gerhana Y A, Komarujaman K, & Ramdhani M A, 2018 Design of Smart System to Detect Ripeness of Tomato and Chili with New Approach in Data Acquisition In IOP Conference Series: Materials Science and Engineering 288
[5] Kuklthau C C, Maniotes L K, and Caspari A K, 2007 Guided inquiry: Learning in the 21st century (Westport, CT & London: Libraries Unlimited)
[6] Hamalik O, 2016 Proses Belajar Mengajar (Jakarta: Bumi Aksara)
[7] Sanjaya W, 2009 Strategi Pembelajaran Berorientasi Standar Proses Pendidikan (Jakarta: Kencana Prenada Media Group)
[8] Sugiyono, 2008 Metode Penelitian Pendidikan (Bandung: Alfabeta)
[9] Trianto, 2009 Mendesain Model Pembelajaran Inovatif-Progresif: Konsep, Landasan, dan Implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP) (Jakarta: Kencana)
[10] Hamzah A H M, and Muhlisrarini 2014 Perencanaan dan Strategi Pembelajaran Matematika (Jakarta: Rajawali Pers)