

Development of Natural Science Books Inquiry Based Learning Model with Character Contents

Harry Satria¹, Yulkifli¹, and Ramli¹

¹*Department of Physics, Universitas Negeri Padang, Indonesia*
Corresponding Author: Harry Satria

Abstract: *The textbook used in junior high school science learning must contain a learning model. The steps of the Inquiry Based Learning Model are applied to the science textbook to strengthen the scientific approach in learning. There is a character content in the textbook to produce graduates with character. The purpose of this study was to develop an integrated science textbook Inquiry Based Learning Model with characters on the theme of science objects and their observations. The procedure for developing this textbook used a model of Plomp development which consists of 3 stages: preliminary research, prototyping phase, and assessment phase. The instruments of this study were validation questionnaires, practicality questionnaire sheets and learning outcomes assessment sheets. The results of of this study is the integrated science textbook Inquiry Based Learning model contains characters on the theme of the science object and his observations is proved to be valid, practical and effective.*

Keywords: *Development, Textbooks, Inquiry Based Learning, Character Contents*

Date of Submission: 08-05-2019

Date of acceptance: 23-05-2019

I. Introduction

Learning in 2013 curriculum is carried out using a scientific approach. Students are encouraged to find themselves and transform complex information, check new information with what is already in their memories, and develop then into information or abilities that are appropriate to the environment, place, and time. According to Permendikbud No. 22 of 2016, to strengthen the scientific approach, integrated theme for the whole subjects and specific subject are necessary in inquiry-based learning.

Inquiry based learning is a model that requires students to conduct a series of scientific processes [1] in an effort to build new knowledge and meaning [2] with stages of the orientation, conceptualization, investigation, conclusion and discussion phase [3] The higher the involvement of students in experimental activities, the higher the achievement of students' understanding and science process skills [4]. This Inquiry Based Learning model can also provide good reasoning for students [5].

Learning activities do not only involve educators and students but also learning resources in the form of textbooks. Textbooks are mandatory reference books to be used in schools which contain learning material in order to increase faith, character, and personality, mastery of science and technology, sensitivity and aesthetic abilities, physical potential and health arranged based on the National Education Standards (SNP)[6]. Furthermore, the Directorate of Secondary Education states that textbooks are a set of writings which systematically made up of certain subject matter, prepared by the author using applicable curriculum references.

Textbooks are one of the supporting materials for teachers so that they can be used to convert an interesting curriculum and must be mastered by students. Therefore, the substance in the textbook must be derived from the competencies that must be mastered by students. Arranging a textbook must meet standards compiled by the experts in the field of instructional purposes and objectives, which appropriate teaching tools and are easily understood the student so that it can help them in teaching learning process.

Textbook is an instructional media which has the main role in the classroom and crucial part in education system. Therefore it is an important tool for delivering the material in curriculum. The need for textbook raises the most important priority scale. On this basis, textbook is used for certain subjects, and should be based on the learning objectives referred to the curriculum.

Permendikbud No. 8 of 2016, the criteria for Textbooks and Non-Text Books which are suitable for Education must fulfill the following elements: (a) Cover (front and back page); (b) Initial part (title, publishing, introduction, table of contents, image list, table of content, and page numbering); (c) content (fulfilling material, linguistic, material presentation, and graphic aspects); (d) Final part (fulfilling information about author, glossaries, bibliography, indexes, and attachments)

Students' books generally contain the following things namely: Chapter title, concept map, introduction, part of student activities both experiment and non-experiment or discussion, exercise, summaries,

evaluations, and assignments for students[7]. The use of textbook is suggested to begin by reading and reviewing the introductory part of the chapter, conducting the activities, discussing and verifying the results with information concepts in the book. Other material descriptions are part of deeply understanding concepts and ending with questions to test the individual understanding.

One of the fundamental changes in 2013 curriculum is textbooks. The Ministry of Education and Culture explained the general concept of the 2013 curriculum book are: (a) Referring to core competencies; (b) Explaining input in producing skills and attitude; (c) Using a scientific approach; (d) Emphasize data in analyzing and evaluating; (e) Inviting students to find concepts deduction; (f) Contains a gradual assessment of learning outcomes; (g) beginning with the formulation the problem, finding ways and solutions; (h) Emphasizing the importance of the process through the formulation of procedures in problem solving; (i) Emphasize to use clear, logical, and systematic language; (j) Skills in abstract, concrete works in real life; (k) Emphasize high order thinking[8].

In addition, students' books set by the government have several aspects: (a) As a guide as well as activities book which makes students active in learning; (b) Have detailed explanation of the content and use; (c) Learning activities are examples that can be chosen by the teacher in implementing the material/lesson; (d) Activity-based so students and teachers are able to complete material from various sources; (e) Teachers and students can adjust the learning; (f) Activities in books are possible to maximize the potential of all learning resources; (g) Provided space for students to write reports, conclusions, problem solving, and other assignments.

The ideal textbook must meet the established criteria. The criteria that must be fulfilled by a science text book include several aspects: (a) Content; (b) Organization; (c) Readability; (d) concepts and principles understanding; (e) Instructional approach; (f) illustration approach; (g) Support learning approach; (h) Trial instructions; (i) Teacher assistance; (j) Indexes and glossaries; (k) Physical appearance.

From the various references that have been stated above, it can be concluded that the ideal structure of student books includes: (1) The initial part (Title, Preface, Table of contents, List of images, List of tables; (2) Contents (Concept map, Introduction, Activities (experiments / non-experiments / discussions), Exercises / questions, Summary / evaluation, Tasks); (3) Final part (Glossary, Bibliography, Index, Appendix).

The quality of student books as a result of development can be determined based on the criteria of validity, practicality and effectiveness.

Validity is a product evaluation in terms of material and appearance. Validity is a concept related to the extent to which the test has measured what should be measured. The validity that is measured construct validity. Validity testing will show the strengths and weaknesses of the products. Validity testing is carried out by the experts. Product validity can be done by several experienced experts to assess the weaknesses and strengths of the products[9]. The experts are the people who are considered to understand the content and substance of the book or it could be someone who is professional in its field such as a lecturer.

The validity tested in this book are content validity and construct validity. Content validity relates to the content and format of the student book developed. In addition, language validity is also conducted to assess the use of the language used in the textbook. These components include the components of eligibility the content, language, presentation, and graphics. Eligibility content includes the suitability of the material with the curriculum. Language components include readability, information clarity, conformity with Indonesian grammar, and language effectiveness. The presentation component includes the clarity of the objectives, the order of the presentation, the interaction, and the completeness of the information. Furthermore, the graphic component includes the use of fonts, layouts, illustrations, images, photographs and display designs.

Practicality is related to the ease of using books by teachers and students. The level of practicality is seen from whether the teacher (and other experts) consider that the material is easy and can be used by teachers and students. Practical testing is done by assessing the practicality of a product. Practical testing is assessed from practicality questionnaires through teacher and student responses after the book was used. Several things stated the practicality of the book are the costs used are not too high, easy to administer, cast, and interpret, and the time used is not too long [10]

Effectiveness is the level of influence caused by the product produced on the learning outcomes. Effectiveness is the level of success of an action or effort towards value: price / things / characteristics which are important for humanity. Effectiveness is measured by the level of student achievement. It can be concluded that a student book can be said to be effective if the student book used can improve learning outcomes. The effectiveness of student books can be measured from the learning outcomes achieved by the students [11]. The effectiveness of a product is reviewed by using four indicators: the learning quality, learning suitability, incentives and time[12].

Effectiveness criteria of this study refers to : (1) learning mastery, learning can be said to be effective if at least 85% of the number of students have obtained the minimal value in improving learning outcomes[13]; (2) The learning model is said to be effective in improving student learning outcomes if statistically the learning outcomes of students show a significant difference between initial understanding and understanding after

learning; (3) The learning model is said to be effective if the student show a better interest and motivation and learn in pleasant conditions.

II. Method

This type of research is research and development. This study aims to produce integrated science textbooks based on Inquiry Based Learning models with characters on the theme of science and observations.

The procedure of developing this textbook uses the Plomp development model. it consists of three phases: preliminary research, prototyping, and assessment phase[14]. Preliminary Research (initial investigation phase) is needed to obtain information about problems in the education sector. The objectives of this phase are:

- a. To obtain information about existing problems and the possibility of needing improvement and innovation.
- b. To get the temporary characteristics of the product developed.

Important activities that will be carried out at this stage include needs analysis, context analysis, and literature review. The method used at this stage are interviews and classroom observations. The next step is to conduct a relevant literature review and content validation.

In the Development or Prototyping Phase, it began after the preliminary research phase was completed. During this phase, prototypes are developed, evaluated, and revised repeatedly (cycles). This phase has a microcycles that helps in developing and repairing products to produce a valid and practical end result. This phase uses formative evaluation. it is an evaluation aimed at improvement, found in all phases and cycles that are repeated in design research. Formative evaluation presents several functions aimed at differences in quality criteria in various development cycles.

Some formative evaluation methods can be chosen such as self evaluation / one-one evaluation, expert review, small group evaluation, and practicality and effectiveness in large tryout group.

- a. Self evaluation uses a checklist of important characteristics or design specifications.
- b. Expert review, group of experts (subject matter or learning design experts) provide assessments and suggestions for the developed product.
- c. One-to-one evaluation with representative users.
- d. Small group or micro evaluation, small groups of users use products in normal situations.
- e. Field or tryout tests, target groups that use products.

Calculation of final value data from the validation results was analyzed using the Aiken's-V formula with criteria if the value obtained is ≥ 0.6 , it is valid, if <0.6 then it is invalid.

III. Results And Discussion

This study includes three phases of the Plomp development model, preliminary research, prototyping, and assessment phase. Problems in learning activities occur because the needs of students have not been fulfilled and the incompatibility of expected learning outcomes with the facts that occur in the field. Needs analysis is a step to determine the abilities or competencies that students need to learn in improving performance or learning achievement.

Determination of the need for textbooks to overcome the learning outcomes is carried out through the preliminary, students, and material analysis. The preliminary analysis consists of performance analysis of graduate competency standards, character analysis, and analysis of learning difficulties. The results of the performance analysis are in the good category. The teacher has planned and prepared learning tools, mastery of the material, and the selection of learning strategies has been done well. The teacher has well also implement student centered learning but its implementation is still constrained.

The results of the performance analysis also shows that the facilities and infrastructure are good. class rooms, libraries, laboratories and their contents are well available and support the learning process. School policy also supports the implementation of good learning. School policies that facilitate teachers in learning activities both in the academic and non-academic fields, are a manifestation of mutual support of stakeholder and a good social psychological climate. Good social relationship are external forces for students in achieving competences. The results of the performance analysis found that learning in SMP Negeri 1 Danau Kembar has supported the implementation of the 2013 curriculum well.

The results of the analysis of graduate competency standards is to see the final needs of students consisting of an analysis of spiritual and social attitudes, knowledge and skills. Indicators of spiritual attitudes are in the good category. Students have understood the diversity of religions, nations, tribes and races in the school environment. Indicators of social attitudes of students are also in the good category. However, some students have not been able to communicate well and politely so they need to be directed and trained in every learning process. Students' interest in labor activity can be directed to train ways of communication both oral and written

The analysis of students' learning difficulties in a motivation indicator are in the good category. Students like to read science books and have good motivation in learning. The indicator method is in the good category. Systematic learning methods are very important to facilitate understanding of the science concept in

students. The learning source indicators are in a fairly good category. Students used less various learning resources. Material indicators are in a fairly good category. It is seen that the ability of students to relate facts in science materials is still low. Therefore, the learning process in elementary school education units, especially for the early classes, should be focus on students' characteristic who will get experience of learning as a whole. Learning packaging must be designed appropriately because it will affect the meaningfulness of students' learning experience. Learning experiences that show the connection of conceptual elements both within and multi subjects will provide opportunities for more effective and meaningful learning.

Several students' analysis is an analysis that is then carried out. Analysis of students is seen from aspects: attitudes, knowledge and skills indicators. Attitude analysis consists of spiritual attitudes and social attitudes. Indicators of spiritual attitudes and social attitudes are in the good category. Analysis of spiritual attitudes and social attitudes reinforces that the need for character values should be included in the textbook.

Knowledge analysis consists of factual, conceptual, principal and procedural indicators. The results of the knowledge analysis found that the factual indicator is in good category while the conceptual and principal indicator are in the sufficient category. Students do not like conceptual learning and disagree that conceptual learning will make learning simpler. Procedural indicators of students still do not understand learning systematically. One initiative to deal with this problem the students who do not enjoy learning connect learning with activity their real life, it makes them easier to understand learning material. it can be done by using Inquiry Based Learning Model that instills ideas to the students. Themes are used to make it easier in connecting Biology and Physics to Integrated Science. The theme used is close to their daily lives, one of which is the Science Object and Observation.

Analysis of skill aspect is in the good category. The results got from the skill indicator are not maximal yet. it can be seen from the low value of the trying, processing, presenting and reasoning. Indicator the scientific skills approach is one of the alternative to improve students' competency skills.

At the material analysis phase, an assessment and adjustment is made between the material and the curriculum demands. In learning process students are required to be able to find their own concepts and principles of several phenomena which are observed and investigated according to the model used, the Inquiry Based Learning Model. Based on the material analysis, result the learning and material to be taught which supports the students' competency achievement in accordance with the character of the students are well prepared. Specifically learning that is designed to support the learning process as a whole, such as practical activities, discussions, acquisition of information that is more related to the subject and stimulate students to build their character. In preliminary resarch phase, it is found that it is needed to develop of integrated science textbooks, inquiry based learning models with characters on the themes of science objects and observations.

The prototyping phase began after the preliminary research phase is completed. During this stage, prototypes are developed, evaluated, and revised repeatedly (cycles). This phase has a microcycles which is healful in developing and repairing products to produce a valid and practical end result.

At this phase the textbook is designed refers to the structure of the textbook and the principle of developing a textbook. This textbook is created using Microsoft Word 2010 and is assisted with the Coreldraw X7 application. In the design of this textbook, the character content is introduced at the beginning of learning first, then followed by the phases of Inquiry Based Learning Model.



Figure 1. Character Contents in a Textbook

Lesson 1 PENYELIDIKAN IPA

Let's pray before we start our lesson
 رَبِّ زِنِّي عِلْمًا، وَاِرْزُقْنِي فِيهَا وَاجْعَلْنِي مِنَ الصَّالِحِينَ
 "Ya Allah, tambahkanlah aku ilmu, dan berilah aku karunia untuk dapat memahaminya, dan jadikanlah aku termasuk golongan orang-orang yang saleh".

Orientation Phase

Kalian telah mempelajari lingkungan sekitar ketika dibangku SD/MI. Perlu kalian ketahui bahwa lingkungan sekitar kita merupakan bagian dari sains atau ilmu pengetahuan alam (IPA). Di bangku SMP/MTs ini, kalian juga akan mempelajari bagian dari lingkungan tempat tinggal kalian, misalnya benda-benda yang ada di alam. Dengan mempelajari benda-benda di alam ini, berarti kalian telah mempelajari ilmu pengetahuan alam. Ilmu Pengetahuan Alam adalah ilmu yang mempelajari tentang segala sesuatu yang ada disekitar kita secara sistematis.

(a)

Conceptualization Phase

Langkah awal dalam melakukan satu proses dari penyelidikan IPA yakni mengamati. Cobalah kamu amati sebatang tanaman yang ada disekitar mu!

Proses #1. Mengamati



Menggunakan pancaindra, termasuk melakukan pengukuran dengan alat ukur yang sesuai. Pengamatan dilakukan untuk mengumpulkan data dan informasi.

Sumber: www.google.com/imag

Gambar 1.1.2 Seorang anak mengamati bunga

Nah, setelah kamu mengamati tanaman tersebut, apa yang kamu lakukan dengan hasil pengamatanmu?

Proses #2.



Sumber: www.google.com/imag

Gambar 1.1.3 Proses menjelaskan pengamatan

(b)

Investigation Phase

Tujuan : Melakukan pengamatan terhadap benda-benda disekitar.

Langkah kegiatan:

1. Amatilah benda yang ada disekitarmu!
2. Datalah benda yang kamu amati kedalam tabel!

No.	Benda	Termasuk	
		Logam	Nonlogam

3. Kamu tuliskan ciri-ciri logam dan nonlogam yang kamu amati!

Ciri-ciri Logam	Ciri-ciri Nonlogam

(c)

Figure 2. Inquiry Based Learning phases at the beginning of learning (a) Orientation Phase, (b) Conceptualization phase, and (c) Investigation Phase.

In the phases of inquiry based learning model, there are columns that can be used by students as learning activities. After the results of this design is completed then formative evaluation is carried out and revise repeatedly to obtain a valid textbook. This phase has a microcycle which is helpful in developing and improving textbooks so it produces valid and practical final results. Overall, the textbook validation is valid with the value of each indicator validation ≥ 0.6 .

Table 1. Results of Science Textbook Validation

Validation aspects	Expert review	
	Score	Criteria
Content	0,727	Valid
Advisability	0,746	Valid
Construct	0,770	Valid
Language	0,759	Valid
Mean	0,751	Valid

Textbook is stated to be valid because the components of the textbook are accordance with literature review, Integrated learning Inquiry Based Learning model, the demands of the core competencies, the basic competencies and indicators of competency achievement and textbooks competency indicator, and fill in with character building. Textbook is declared to be valid in language because the language used is in accordance with Indonesian grammar rules. The textbook is valid in the presentation of material because the illustrations of textbook is interesting according to reader age level, able to clarify the material politely, and not contain deviations. The textbook is graphically valid because it is suitable for reader in terms of age and material. The components of the book is in accordance with the indicators that have been set in the textbook validity questionnaire. In addition, this book is developed by measuring validity (content, construct, and linguistic validity).

One-on-one evaluation is carried out on students by asking students to read the textbooks of the lesson without being taught first by the teacher. Researcher gives questions to students after reading the book. The question given are of understanding of activity sheet, material, and of character values content. Students argue that the activity sheet with the Inquiry Based Learning Model stage makes them easier to understand the learning. It is because student activity sheet is directed in solving the problems. The material of this book is clear and readable because it is related to everyday life. The color composition aspects of the book make students interested in since the colors are contrast and bright.

Evaluations in small groups are carried out to see the practicality of textbooks in the learning process. The evaluation was carried out seven students. The student were asked to do the steps of the learning model in the textbook gradually. Then students are asked to answer several questions at the end of the textbook. At the end of learning the students fill in the practice sheet to see the level of transparency of this book. The results of the small group evaluation state that this book is practical to be used in the learning process.

Large group evaluations or field tests are conducted in class VII of SMP 1 Danau Kembar consisting of 28 students. This evaluation was conducted in four meetings. At each meeting the data are obtained from teachers and students. Practicality tests are carried out using textbooks in the learning process. Practical results are obtained through questionnaires filled out by teachers and students. This practicality is seen in four meetings.

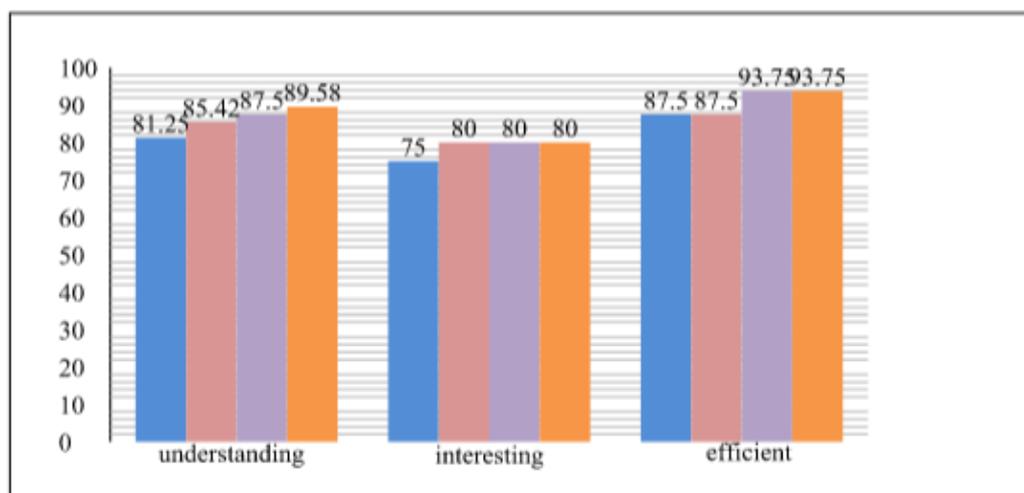


Figure 3. The results of the practicality of teacher's response questionnaire

The results shows that student and teachers' aspects are very practical. It aims to see how far (teacher / student) and other experts consider the intervention whether a product is attractive and can be used under normal conditions. However, there are few obstacles in the small group test, that the time used by students is not efficient and requires more time in understanding the book description. Therefore, the researcher revised it to minimize these obstacles by adding more intervention to the textbook so that it become more efficient.

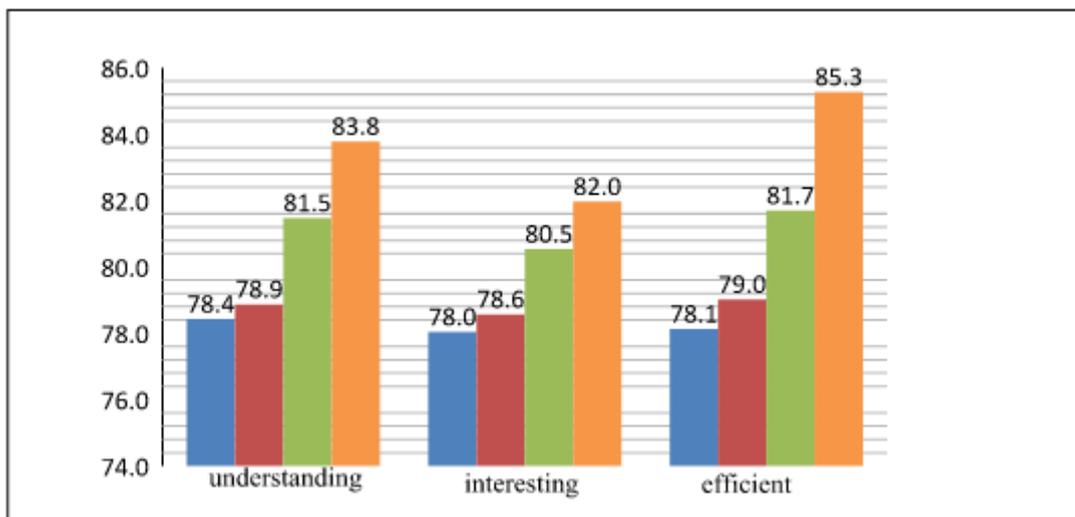


Figure 4. Learners' Practicality

Assessment phase is done to determine the effectiveness of the use of science learning textbooks in the learning process and the potential impact of the product being developed. Based on the effectiveness test, textbook helps students in carrying out learning and gives an influence on improving student learning outcomes. The assessment phase is done by looking at the learning outcomes of students taken during the learning process. Assessment is seen from the competencies of knowledge, attitudes and skills that have been developed. The three competencies are assessed at each meeting and try out is conducted in four meetings. Based on try out that have been conducted, it is found that the Integrated Science textbook Inquiry Based Learning Model was effective in improving the competency of students' attitudes.

The attitude competencies observed are curiosity, honesty, cooperation, responsibility, and self-confidence. These competencies are increas in each meeting. Competency attitude is measure because the students are guided by activity sheets in textbooks containing Inquiry Based Learning Model. The Activity Sheet in learning with Inquiry Based Learning Model is based on the principle that the real life topic is a starting point for gaining new knowledge that triggers the curiosity of students.

The effectiveness of students' competency knowledge is seen from the test results on each meeting. Based on the try out result, it is found that the Integrated Science textbook Inquiry Based Learning Model is effective on improving students' knowledge competencies. The result of students' knowledge assessment are different, it is because the ability of each student to understand material is also different. So, the different of students adability causes the results showed by each student is also different.

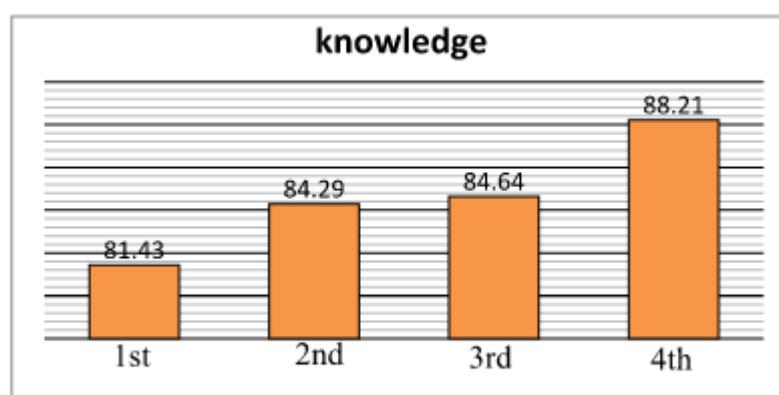


Figure 5. Average value of knowledge competence

Competency skills observed are observing, asking questions, conducting experiments and looking for relevant sources, discussing and concluding. These aspects have increased at each meeting. Based on this result, it can be concluded that the integrated science lesson text Inquiry Based Learning Model contains characters in the Science Objects theme and its Observation is effective in improving students' competency skills. This book can improve competency attitudes, knowledge and skills due to revisions made at the formative evaluation phase, thereby it increases students' understanding of the material.

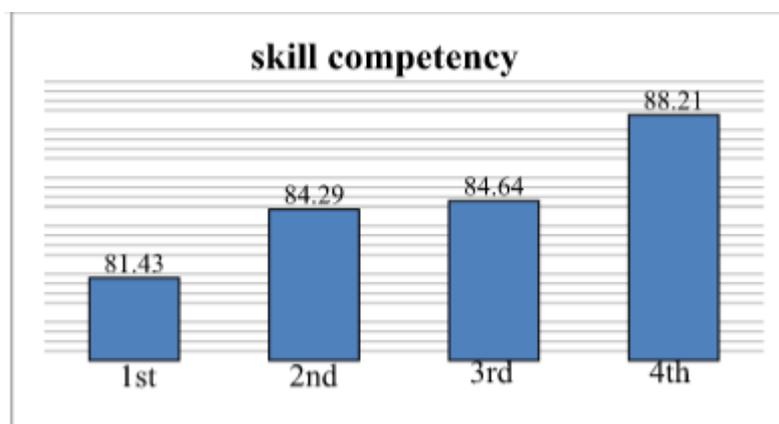


Figure 6. The Average score of skill competency

The increasing of assessment value of attitudes, knowledge and skills in textbook trials shows that the book is in the effective category. It can improve the competence of attitudes, knowledge and skills due to the revisions made at each meeting. Thus, it increases the convenience of students in understanding the lesson.

IV. Conclusion

Based on the results of the needs and context analysis, the design stage, formative development and evaluation, as well as the assessment phase it can be concluded as follows:

1. The results of the needs analysis: it is necessary to develop an integrated science textbook with the Inquiry Based Learning model with characters on the theme of the science object and its observations.
2. Results of the design phase: The design of the book is valid and practical through the formative evaluation.
3. Results of effectiveness phase: The textbook used in the learning process is effective in improving student's learning outcomes which include knowledge, attitudes, and skills aspects.

Reference

- [1]. Abidin, Yunus, *Desain Sistem Pembelajaran dalam Konteks Kurikulum 2013* (Bandung: Refika Aditama.2014)
- [2]. Sani, Ridwan Abdullah, *Pembelajaran Sainifik untuk Implementasi Kurikulum 2013* (Jakarta : Bumi Aksara. 2014)
- [3]. Pedaste, dkk, *Phase Of Inquiry-Based Learning: Defenitions And The Inquiry Cycle*. Educational Research Review: Elsevier.2015
- [4]. Widayanto, *Pengembangan Keterampilan Proses Sains dan Pemahaman Siswa Kelas X Melalui Kit Optik*. Jurnal Pendidikan Indonesia. 2009;5
- [5]. Damawati, N.A.C. *Pengaruh Inquiry Based Learning Terhadap Kemampuan Penalaran Siswa Kelas VII Pada Materi Kalor*. Jurnal Pendidikan Fisika.2016; 12(1): 19-25
- [6]. Prastowo, Andi, *Pengembangan Bahan Ajar Tematik*. (Jakarta: Kencana.2014)
- [7]. Anggela, Mila. *Pengembangan Buku Ajar Bermuatan Nilai-Nilai Karakter Pada Materi Usaha Dan Momentum Untuk Pembelajaran Fisika Siswa Kelas XI SMA*. Pillar Of Physics Education.2013: 1
- [8]. Kemendikbud. (2015). *Materi Pelatihan Guru Implementasi Kurikulum 2013 Tahun 2015 SMP/MTs Mata Pelajaran IPA*. Jakarta : Badan Pengembangan Sumber Daya Manusia Pendidikan dan Kebudayaan dan Penjaminan Mutu Pendidikan Kementerian Pendidikan dan Kebudayaan.
- [9]. Sugiyono, *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R & D* (Bandung : Alfabeta.2011)
- [10]. Yusuf, A. Muri, *Dasar-Dasar dan Teknik Evaluasi Pendidikan*. (Padang:UNP.2005)
- [11]. Wena, Made, *Strategi Pembelajaran Inovatif Kontemporer Suatu Tinjauan Konseptual Operasional*. (Jakarta : Bumi Aksara. 2012)
- [12]. Slavin. R. E., *Educational Psychology Theory And Practice*. Tenth Edition Pearson Education. Inc. New Jersey. USA. 2012
- [13]. Trianto, *Model Pembelajaran Terpadu: Konsep Strategi, dan Implementasinya dalam Kurikulum Tingkat Satuan Pendidikan (KTSP)*. (Jakarta: Bumi Aksara.2010)
- [14]. Plomp, T, *Educational Design Research : An Introduction*. Netherlands: Enschede.2013