Effectiveness of the use of developed teacher’s book in guiding the implementation of physics teaching that provides science literacy and instill spiritual attitudes

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Abstract. Research and development to produce Physics teacher’s book products to guide the planning and implementation of Physics teaching that can provide scientific literacy and instill students' spiritual attitudes has been carried out. Usage test of the developed teacher’s books have been carried out in one of the high schools in West Java. Subject in this study is one of physics teacher and 40 students. The focus of the research is to get an overview of the effectiveness of the use of the developed physics teacher’s books in guiding teachers to carry out physics learning that can improve the science literacy and spiritual attitudes of students. The instrument used in this study are the science literacy test and the spiritual attitude scale respectively. The effectiveness of the teacher's book in guiding the teacher to carry out physics teaching is determined based on the number of students who achieve a high increase in science literacy and spiritual attitudes. The results of the study show that the use of the developed teacher’s books has high effectiveness in guiding teachers to carry out physics learning that can improve science literacy and moderate effectiveness in instill a spiritual attitude.

1. Introduction
The 2013 curriculum has assigned three domains of learning outcomes as competencies that must be achieved by students, namely the domain of knowledge, domain of skills and attitudes. For physics subjects, the complete domain of learning outcomes is included in scientific literacy. According to the OECD there are three aspects of scientific literacy that must be provided through science learning, namely aspects of competence, aspects of knowledge and aspects of attitudes [1]. One of the attitudes that must be invested in physics learning is a spiritual attitude.

For its implementation, the 2013 curriculum is equipped with various supporting curriculum tools. Supporting tools that are operationally closely related to the implementation of physics learning in the classroom are teacher’s books and students’ books. The teacher’s book is a book that is compiled as a source of guidance for teachers to plan and carry out learning in accordance with what has been established in the 2013 curriculum. While the student book is a student handbook arranged as a learning resource for students.

Since the 2013 curriculum was assigned, there are teacher books written by several authors. The results of the class XI physics teacher's book analysis showed that there were various shortcomings of the physics teacher's book contents if used as a guide for planning and implementing physics teaching.
Some crucial deficiencies include: 1) there are no operational guidelines for the implementation of scientific methods in physics learning, there are still theoretical levels, 2) there are no operational guidelines for the implementation of physics learning that trains 21st century skills, there are also still at the conceptual level, and 3) there is no operational guide to inculcate a spiritual attitude through physical content and learning activities.

In order to the physics teacher's book to truly guide physics teachers in carrying out learning processes and orientations in accordance with the 2013 curriculum, a physics teacher's book is needed in accordance with the 2013 curriculum. To fulfill these needs, through research and development activities, a physics teacher's book oriented to provides science literacy, 21st century skills and instill spiritual attitudes has been developed.

The development of physics teacher’s books was carried out using the 4D model of research and development (R & D) developed by Borg & Gall which included stages: 1) needs assessment of physics teacher books, 2) development of physics teacher book products (design, production and validation), 3) usage test of the resulting teacher book products, and 4) revision of the physics teacher product as shown in Figure 1 [2].

![Figure 1](image)

**Figure 1.** The stage of developing physics teacher books

The developed physics teacher book products have specific features in which there are operational guidelines for teaching by using levels of inquiry model of instruction, guidance on problem solving oriented learning activities, and guidance on instilling spiritual attitudes through the presentation of chain dialogical questions that lead to the nature of God.

In the R and D stage, there is a usage test stage for the development of book products. This study was conducted in order to usage test of the development of the teacher's book product to get an overview of the effectiveness of its use in providing guidance to teachers to carry out physics teaching in accordance with the 2013 curriculum. This paper describes the process and results of the study.

2. **Methods**

This study focused on usage test of the developed physics teacher book products. The method used in this study is a pre-experiment with one group pretest-posttest design. In this design, at the time before and after treatment of the research subjects were given pretest and posttest. The form of given treatment is the physics teaching followed the guidelines of the physics teacher book developed. The research design used in this study is shown in Table 1.
Table 1. The research design used in this study

| Group    | Pretest | Treatment | Posttest |
|----------|---------|-----------|----------|
| Experiment | $O_1$   | $X$       | $O_1, O_2$ |

here $O_1$ is a scientific literacy test related to the content of the kinetic theory of gas, $O_2$ is a spiritual attitude scale and $X$ is a treatment in the form of physics teaching following the developed teacher's guide book. This usage test was conducted in one of the high schools at one district in West Java. The number of usage test subjects was one a physics teacher and 40 high school students. Research subjects were selected randomly. The instrument used for collecting scientific literacy data is a scientific literacy test in a multiple-choice form covering two aspects of scientific literacy, that is the competency aspect consisting of three indicators, that is: (1) explaining scientific phenomena (K1), (2) evaluating and designing scientific research (K2), and (3) interpret scientific data and evidence (K3) and knowledge aspects consisting of three indicators, that is: (1) content knowledge (P1), (2) procedural knowledge (P2), and (3) epistemic knowledge (P3) [1]. Whereas to collect data on students' spiritual attitudes used spiritual attitude scale which includes: (1) belief in the existence of God, (2) God is a creator, (3) God is all-set, (4) God is all-nurturing, and (5) God is all-powerful. literacy and spiritual attitudes were analyzed by using the concept of normalized gain ($g$) based on pretest and posttest scores. Normalized gain is the difference between the posttest and pretest scores that have been normalized. Normalized gain illustrates the increase in competency in learning outcomes between before and after learning. The calculation of the normalized gain average ($<g>$) is done using equation (1) [3].

$$<g> = \frac{<S_{post}> - <S_{pre}>}{Smidt - <S_{pre}>}$$

(1)

here $<g>$ is the average normalized gain, $<S_{pre}>$ is the average pretest score, $<S_{post}>$ is the average posttest score and Smidt is the ideal maximum score. To describe the average normalized gain value ($<g>$) which depict the increase category, a guide is used as shown in Table 2 [3].

Table 2. Category of $<g>$

| The average Normalized gain | Enhancement category |
|-----------------------------|----------------------|
| $<g>$ > 0,70                | High                 |
| 0,30 $<g>$ $\leq$ 0,70     | Moderate             |
| $<g>$ $\leq$ 0,30           | Low                  |

The effectiveness of the use of developed teacher books in guiding teachers to carry out physics teaching that can improve scientific literacy and spiritual attitudes of students is determined by calculating the number of students who reach the category of high improvement in increasing scientific literacy and changing their spiritual attitudes. Table 3 shows the classification of the effectiveness of the use of developed teacher books in improving scientific literacy and improving the spiritual attitudes of high school students [4].

Table 3. Classification of the effectiveness of the use of developed teacher books in improving scientific literacy and spiritual attitudes of high school students

| Student quantity (N) that reaches high N-gain average ($<g>$) (%) | Classification of effectiveness |
|-----------------------|-----------------------------|
| 75 $< N \leq$ 100    | High                        |
| 50 $< N \leq$ 75     | Moderate                    |
| $N \leq$ 50          | Low                         |
3. Results and Discussion
Table 4 shows the data recapitulation of the improvement of science literacy in the aspect of competence related to the content of the kinetic theory of gas achieved by high school students who followed physics learning held by their teacher guided by developed physics teacher book.

**Table 4. Improvement competence aspects of science literacy achieved by high school students**

| Treatment                          | Competence Aspect of Science Literacy | Enhancement Category |
|------------------------------------|--------------------------------------|----------------------|
| Physics teaching guided by developed teacher’s book | 0.74                                 | High                 |

In Table 4, it appears that the implementation of physics teaching guided by the developed teacher book can improve competencies aspects of scientific literacy in the high improvement category. More specifically, the improvement in each indicator of competencies aspect of scientific literacy is shown in Table 5.

**Table 5. Improvement of every indicator of competencies aspect of scientific literacy**

| Indicator of Competence Aspects of Science Literacy | Competence Aspect of Scientific Literacy | Enhancement category |
|----------------------------------------------------|-----------------------------------------|----------------------|
| Explain the scientific phenomena (K1)              | 0.75                                    | High                 |
| Evaluate and design scientific research (K2)       | 0.70                                    | High                 |
| Interpret scientific data and evidence (K3)        | 0.78                                    | High                 |

If calculated the number of students in each enhancement category in competencies aspects of science literacy obtained data as in Table 6.

**Table 6. Number of students in each \(<g>\) category in competencies aspects of science literacy**

| Average N-gain category in competency aspects of science literacy | The number of students (%) |
|------------------------------------------------------------------|----------------------------|
| High                                                             | 77                         |
| Moderate                                                         | 17                         |
| Low                                                              | 6                          |

The data in Table 6 shows that the use of developed teacher’s books has a high effectiveness in guiding physics teachers to organize physics teaching that provides competencies aspects of scientific literacy.

Table 7 shows the data recapitulation of the improvement of knowledge aspects of scientific literacy related to the content of the kinetic theory of gas achieved by high school students after attending physics teaching held by the teacher guided by the developed physics teacher’s books.
Table 7. Improvement knowledge aspects of scientific literacy achieved by high school students

| Treatment                                      | Knowledge Aspect of Science Literacy | Enhancement Category |
|------------------------------------------------|-------------------------------------|----------------------|
| Physics teaching guided by developed teacher’s book | 0.78 | High      |

In Table 7, it appears that the implementation of physics teaching guided by the developed teacher’s book can improve knowledge aspects of scientific literacy in the high improvement category. In the developed physics teacher’s book there are parts designed to provide guidance to teachers to carry out teaching using the scientific method, namely a guide to the use of one of the teaching models using an inquiry approach, precisely the level of inquiry model of instruction and a guide to using problem-solving-oriented instruction models. So that when the teacher carries out the teaching according to the guidelines in the teacher's book, the learning provides scientific literacy in the aspect of competence and knowledge. This result is consistent with the results of Wenning’s research which shows that the use of levels of inquiry model of instruction in physics teaching can provide aspects of science literacy [5, 6].

More specifically, the improvement in each indicator of knowledge aspect of scientific literacy is shown in Table 8.

Table 8. Improvement of every indicator of knowledge aspect of scientific literacy

| Indicator of Knowledge Aspects of Science Literacy | Knowledge Aspect of Science Literacy | Enhancement Category |
|---------------------------------------------------|-------------------------------------|----------------------|
| Content Knowledge (P1)                            | 0.82                                | High                 |
| Procedural Knowledge (P2)                         | 0.78                                | High                 |
| Epistemic Knowledge (P3)                          | 0.73                                | High                 |

If calculated the number of students in each enhancement category in knowledge aspects of scientific literacy obtained data as in Table 9.

Table 9. Number of students in each <g> category in knowledge aspects of scientific literacy

| Average N-gain category in knowledge aspects of science literacy | The number of students (%) |
|-----------------------------------------------------------------|----------------------------|
| High                                                            | 81                         |
| Moderate                                                        | 15                         |
| Low                                                             | 4                          |

The data in Table 9 shows that the use of developed teacher’s books has a high effectiveness in guiding physics teachers to organize physics teaching that provides knowledge aspects of science literacy.

Table 10 shows the number of students who have increased confidence in the presence of God and the attributes possessed by God after following in physics teaching and learning which the teacher carries out guided by the developed physics teacher book.
Table 10. Quantity of students who have increased confidence in God after follow physics learning

| No | Spiritual Attitude                                           | The number of students (%) |
|----|-------------------------------------------------------------|----------------------------|
| 1  | Students who have increasing in faith of the presence of God | 75                         |
| 2  | Students who have increasing in faith that God is a creator  | 73                         |
| 3  | Students who have increasing in faith that God is all-set    | 75                         |
| 4  | Students who have increasing in faith that God is all-nurturing | 73                       |
| 5  | Students who have increasing in faith that God is all-powerful. | 75                     |
|    | Average                                                     | 74                         |

In Table 10, it appears that the average quantity of students who have increase in their spiritual attitudes after following physics teaching held by the teacher guided by the developed teacher's book is 74%, this shows that the use of developed teacher books has moderate effectiveness in improving spiritual attitudes high school student. In the teacher's book that was developed there was a section that contained guidelines for instilling spiritual attitudes through a series of dialogical questions which led to divinity. When the teacher in his teaching uses this guide, then he has instilled a spiritual attitude on his students. This result is in accordance with the research conducted by Johan which shows that the use of chain dialogical questions in science teaching can instill a spiritual attitude [7].

4. Conclusion
The grade XI physics teacher book products have been produced as a guide for physics teachers in carry out physics teaching and learning oriented debriefing scientific literacy, 21st century skills training and instilling students’ spiritual attitudes. The developed physics teacher’s book has a high effectiveness in providing aspects of competence and knowledge of scientific literacy and has moderate effectiveness in improving the spiritual attitudes of high school students. This teacher's book is suitable to be used as a guide for the implementation of physics teaching and learning at the high school level.

5. Reference
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