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Identifying Conceptual Mistakes on SMA Teaching Books in Materials of Imune System for Eleventh Graders

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Abstract

Textbooks as compulsory reference books containing misconceptions may prevent students from learning. This study aims to determine the mistakes of the concepts contained in biology textbooks especially immune system material and to determine the percentage of mistake concept. This research belongs to the type of evaluation research and data collection techniques used is documentary study. The object of research in this study is immune system material in a textbook published by Erlangga, Yudhistira, and Grasindo. In order to facilitate this research, the books are each given a symbol A, B and C. Identification mistake concept in this study used the standard criteria of mistake according to the concept Dikmenli (2009) and Hersey (2004) which include: Oversimplifications, Overgeneralizations, Undergeneralizations, Obsolete Concept and Terms, and Misidentifications. Immune system materials in textbooks that are used as objects in this study are identified to contain mistakes of the concept categories namely Oversimplifications, Overgeneralizations, Undergeneralizations, and Misidentifications. The percentage of each category for book A is 23.5%; 5.9%; 5.9% and 5.9%; that of book B is 41.2%; 17.6%; 0% and 11.8%; while that of book C is 58,8%; 0%; 11.8% and 11.8% respectively. The results of this study indicate that the mistake of the concept on the books is very fatal. Therefore, the preparation of textbooks must meet the criteria of instructional materials according to BSNP covering four aspects, namely content, language, graphics and serving content (techniques, materials, and learning).

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INTRODUCTION

Advancement of Science and Technology (Science and Technology) increasingly supports the development of the era. This has brought many positive impacts, especially in education. Educators are increasingly facilitated by creating sophisticated tools to support the learning process. In line with this, they also can access any information anytime and anywhere easily. However, this does not necessarily mean that the National Education Minister's Decree No. 11 year 2005 Article 1 concerning the textbooks of the text explains that: textbooks are the compulsory reference books for use in schools containing learning materials in the context of improving faith and piety, character and personality, ability of mastery of science and technology, sensitivity and aesthetic ability, physical and health potential compiled based on national standard of education.

As a compulsory textbook, reference books greatly affect educational success of learners. Therefore, the issuance of textbooks must meet eligibility requirements and through the assessment process by the Boards of National Education Standards. This is especially important because it is in accordance with Nusantari's opinion (2011: 72-73) which reveals that textbooks are usually composed by a team of teachers or lecturers using different source books, so the quality is also different. In addition, textbooks must also adjust to the latest developments in science and technology.

Although before being published, the textbook has been passed through the assessment process by the Board of National Education Standards and is deemed to have eligibility. This does not guarantee that the textbook does not have a misconception of the material. As for the initial identification with the criterion of standard mistake of concept which refers to Dikmenli (2009) and Hersey (2004) using reference book among others are Campbell (2004), Guyton (1990) and L. Carlos Junqueira (1997) on material content in high school textbooks, this misconception can be found in the most widely used biology textbooks in Yogyakarta, namely Erlangga, Yudhistira, and Grasindo textbooks, especially on immune system material and in terms of content, grammar, and also images that are lacking describing the authenticity of the object in the material. One example in Erlangga's biology textbook is that it does not present the concept of immunization; in Yudhistira's book, the aspect of the definition of antibodies is too broad compared to that of the curriculum; while Grasindo's biology textbook defines immunity, not the immunity system, like the ability to survive and fight against all kinds of organisms and toxins that can damage cells, tissues, or organs of the body. In addition, according to Kholifah et al. (2015: 14) in his research, the findings revealed that the students have difficulty in understanding the concept, one of which is because the immune system material presented contains conceptual mistakes.

Biology textbooks especially on immune system materials that present the correct concept in the perspective of the experts explain the concept of the light and thoroughly support the understanding of student concepts. In contrast, biological textbooks on immune system material that contain conceptual mistakes will precisely bring different interpretations to students who are inconsistent with the scientific concepts conveyed by experts. This will have an impact on the emergence of misconceptions.

In the world of education today, misconceptions in the field of science have become the center of attention of educational experts because misconceptions have occurred in various countries and widened to various subjects (Novak, 1987) (Saraswati, 2014: 22). The misconception is a concept that is not by the concept recognized by experts or also called the concept of alternative (Suparno, 2005: 8) (Hafizah 2014: 100). According to Puspitasari (2009) and Mentari (2014: 77), misconceptions that occur in students will impact on students' understanding of the next material. A similar opinion is expressed by Setiawati (2014: 22) stating that if misconceptions occur in the student, they tend to be sedentary and difficult to change and will affect the next learning process.

METHODS

Type of research used in this research is evaluation research. Evaluation research is a design or procedure in collecting and analyzing data systematically to determine the benefits of the educational practice. Evaluative research is needed to design, refine, and test the implementation of practice (Sukmadinata, 2009: 121). In this study, the gap between the real conditions and the expectations conditions expressed in the criteria that are sought. Based on the gap, the findings revealed a picture whether the object under study is appropriate, less appropriate or not in accordance with the criteria. This evaluation research is done by identifying the mistake of immune system concept in high school biology textbook of class XI then presents its contents in the form of percentage diagram and describes it descriptively.

This research was conducted by classifying the material concepts of immune system in the textbooks of high school textbooks for class XI namely Erlangga, Yudhistira, and Grasindo using the fifth edition, the third volume by Campbell, et al (2004); Basic Histology of the 8th edition by Junqueira, et al (1997) and the book entitled Human Physiology and Treatment Mechanism of Guyton's III edition of Illusions (1997) and several journals commonly used as an international reference to the criterion of concept criteria according to Dikmenli (2009) and Hersey (2004) covering Oversimplivications (OS), Overgeneralizations (OG), Obsolete Concepts and Terms (OCT), Undergeneralizations (UG), and Misidentifications (MI); and spelling mistakes and feasibility of textbooks according to BSNP standard.

The data collection technique used is documentary study. Documentary study (documentary study) is a technique of collecting data by collecting and analyzing documents, both written documents and unwritten documents such as pictures and electronics (Sukmadinata, 2013: 221-222).

The steps in data collection are as follows:

1. Determining the Biology textbook for eleventh graders of senior high school which is mostly used in schools in Yogyakarta. Based on the results of the survey that refers to the journal and conducted interviews on students and senior high school teachers of class XI in Yogyakarta, it is known that the books used are from some publishers namely Erlangga (A), Yudhistira (B), and Grasindo (C).
2. Determining the standards used to analyze conceptual mistakes in textbooks. The standard used is a standard that refers to the standard of conceptual mistake criteria according to Dikmenli (2009) and Hersey (2004) and the feasibility of textbooks according to the standards of BSNP.
3. Determining the standards used to analyze conceptual mistakes in textbooks. The standards used are criteria of conceptual mistake according to Dikmenli (2009) and Hersey (2004) and the feasibility of textbooks according to the standards of BSNP.
4. Developing a research instrument containing the concept of the material in textbooks (in the form of text, pictures and tables), concepts according to reference books and journals (literature), the concept of mistake category which refers to the standard of concept mistake criteria according to Dikmenli (2009) and Hersey (2004).

Table 1. Design of Data Sheet of Conceptual Mistake Identification

No	Concept of the Teaching Book	Criteria for Conceptual Mistakes																Evidence of Conceptual Mistakes
		OS			OG			OCT			UG			MI				
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
1																		
2																		
3																		
Etc																		

Keterangan:

A : Buku ajar biologi SMA kelas XI terbitan Erlangga

B : Buku ajar biologi SMA kelas XI terbitan Yudhistira

C : Buku ajar biologi SMA kelas XI terbitan Grasindo

OS : *Oversimplifications*

OG : *Overgeneralizations*

OCT : *Obsolete Concepts and Terms*

UG : *Undergeneralizations*

MI : *Misidentifications*

Σ (%) : Jumlah total Kesalahan konsep dalam %

Information:

OS : *Oversimplifications* UG : *Undergeneralization*

OG : *Overgeneralizations* MI : *Misidentification*

OCT : *Obsolete Concepts and Terms*

5. Conducting instrument validity and content review with expert lecturers from education (for instruments) and scientific fields (for content) to obtain the accuracy of the instrument.
6. Performing document analysis (from the validated instrument) to obtain evidence of conceptual mistakes by using data sheet of misconception analysis.
7. Conducting validation of research results with expert lecturers in the field of science.
8. Perform tabulation of data by calculating the percentage in each category of misconception based on calculation (Utami, 2013: 6) in each textbook as follows:

$$K = \frac{Nks}{Nk} \times 100\%$$

Note:

K = Conceptual Mistakes

Nks = Number of Conceptual Mistakes

Nk = Number of All Mistakes

Data analysis technique used in this research is quantitative descriptive analysis. This analysis was conducted to illustrate or reveal biological misconceptions in immune system material contained in textbooks and the magnitude of misconceptions in the book by calculating the percentage of their misconceptions.

RESULT AND DISCUSSION

Based on the research that has been done, the results obtained tabulation data of identification of conceptual mistakes in biology textbook of senior high school for class XI about the immune system. The results are presented as follows:

Table 2. Tabulasi Kesalahan Konsep Buku Ajar Biologi SMA Kelas XI Materi Sistem Imun

Buku	Kategori Kesalahan Konsep					Jumlah Kesalahan Konsep (%)					Σ (%)
	OS	OG	OCT	UG	MI	OS	OG	OCT	UG	MI	
	4	1	-	1	1	23,5	5,9	0	5,9	5,9	41,2
	7	3	-	-	2	41,2	17,6	0	0	11,8	70,6
	10	-	-	2	2	58,8	0	0	11,8	11,8	82,4

Table 2. describes the results of the tabulation of conceptual mistakes data in biology textbook of senior high school for class XI about immune system especially on books published by Erlangga, Yudhistira, and Grasindo. Based on the table, it is known that the book C is identified as the book that contains the most mistakes of the concept of category Oversimplifications with ten aspects (58.8%). While book A and B were identified to contain the concept of this category mistake as many as four aspects (23,5%) and seven aspects (41,2%). Book B is the most widely identified as the book containing the overgeneralizations category concepts as many as three aspects (17.6%), book A contains one aspect (5.9%) with the conceptual mistake of this category, while book C does not contain mistakes of the concept of this category (0%).

The unidentified A, B and C books contain the conceptual mistakes of the Obsolete Concepts and Terms category (the percentage of each is 0%). Book C has been identified as the most misunderstood concept of Undergeneralizations category (2) (11.8%), book A has been identified to contain one concept aspect mistake (5.9%), while book B is not identified to contain the conceptual mistake of this category (0%). Books B and C are identified as the most misidentified concept of Misidentifications categories, i.e. 2 (11.8%), while book A is identified to contain conceptual mistakes for category Misidentification as many as one aspect (5,9%).

To more easily see the percentage of each category of conceptual mistakes in the book studied, then the percentage mistake concept is made in the form of graphs as follows:

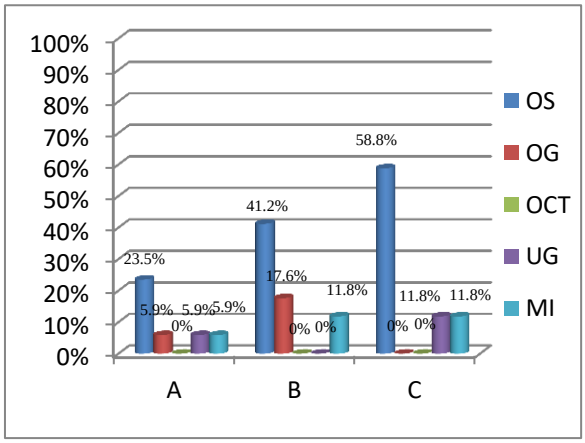

Figure 1. Graph of Percentage of Mistake Categories of Concepts in Textbooks

Notes :

A : Teaching Book for Erlangga OS : *Oversimplifications*

B : Teaching Book for Yudhistira OG : *Overgeneralizations*

C : Teaching Book for Grasindo OCT : *Obsolete Concepts and Terms*

UG : *Undergeneralizations*

MI : *Misidentifications*

From the total number of conceptual mistakes, book C is identified as the most common book containing the conceptual mistake as much as 82.4%, the second one is book B that is as much as 70.6%, while the last one is book A with the conceptual mistake as much as 41,2 %. To more easily see the percentage of total conceptual mistakes in the textbook, then the percentage is also made in graph form as follows:

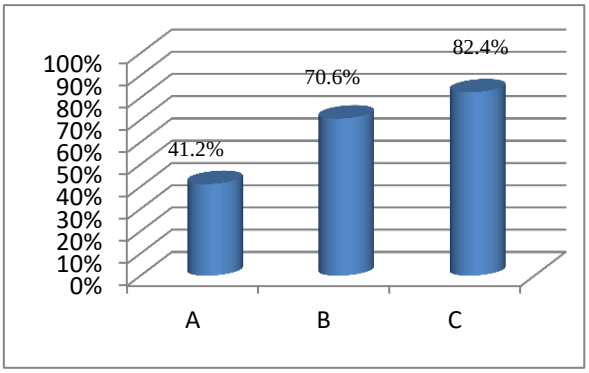

Figure 2. Graph of Percentage of Total Conceptual Mistakes in Textbooks

Notes:

A : Teaching Book by Erlangga

B : Teaching Book by Yudhistira

C : Teaching Book by Grasindo

Based on the total mistakes of the concept identified in each book, it is known that book C is the book with the highest number of conceptual mistakes that is with the percentage of conceptual mistakes as much as 82.4%. The second is a book B with a percentage of conceptual mistakes of 70.6%. The last one is book A with a percentage of conceptual mistake of 41.2%. Basically, conceptual mistakes of category Oversimplifications, Overgeneralizations, and Undergeneralizations are not a total misconception as to which concept is expressed by scientists. But the concept can affect students' understanding of the wholeness and correctness of the concept. Therefore the concept should be expressed properly, both according to the level of education, according to the concepts conveyed by experts, as well as according to the applicable curriculum.

Book C as the book with the largest number of conceptual mistake, is known to present the immune system material as sub-material. Many aspects of the immune system material are not fully described and presented in the book. There are also aspects presented outside sub material but still in one material. This aspect is elaborated with a different explanation / meaning than the translation of the term according to the experts on the immune system material. The book-making factor which is not based on the standard of the curriculum content makes the conceptual mistake in this book quite fatal, especially with the percentage of conceptual mistake which reaches 82.4 %. Therefore the action should be done not only the improvement of the concept as a whole but also needs to be withdrawn so that the book is no longer used as a reference book in student learning so that this can reduce the risk of misconception in students.

Book B as the book with the largest number of conceptual mistake after book C, presents immune system material as sub chapters. This book presents many interesting pictures that can help the students in understanding the concept. However, almost all the images presented on the immune system material are images that do not fit the concept of education for high school students of class XI. Moreover, some aspects of immune system material are not fully explained, and some are not presented in the book. The book-making factor adapted to the 2006 ISI Standards curriculum (KTSP) makes this book contains fewer conceptual mistakes than book C, with a percentage of 70.6%. Therefore the action that must be done is the withdrawal of the book for the improvement of the content on some aspects.

Book A as a book with the fewest conceptual mistakes in this study is the same as book B, which presents the immune system material as a sub chapter. This book presents many concepts according to the experts. However, in some aspects, the concept is described not according to the concept according to the expert. AS in book B, the book compilation factor adapted to the ISI Standards of the 2006 curriculum (KTSP) makes this book contains conceptual mistakes the least. Therefore the action that must be done is

simply done a review of the concept while the teaching-learning process is underway so that students can avoid the mistakes of the concept contained in the book.

The results of this study are in line with the results of research revealed by Kholifah, et al. (2015, 14) in the journal: material specific and non-specific body defense mechanisms and antibody functional and antibody functionaries are proven by a low percentage of conceptual conception. In addition, the results of the analysis also showed that the material which is not understood by the students is the material of the body's defense mechanisms, antigens and antibodies and the impact of the weak immune system. Students have difficulty in understanding the concept because the immune system material presented contains a conceptual mistakes.

The material of immune system in the textbook should be based on the criteria of instructional materials according to BSNP covering four aspects, namely the feasibility of content, language, graphics and presentation (technique, material and learning) and based on the principles as expressed by Susilo (2009) relevant (appropriateness), consistency and adequacy (adequacy). The relevant principle of the immune system material means the material is prepared based on the message of the educational curriculum and adapted to the intellectual development of the target students. The principle of consistency in immune system material means the material is presented in accordance with the number of aspects that exist in the immune system material as listed in appendix 1, while the principle of adequacy in the immune system material means that the material presents all the concepts on every aspect that becomes the indicator of the complete competency standard no less and not too excessive.

CONCLUSION

Based on the results of research misconceptions in textbooks Biology SMA XI class, especially on immune system material that has been done, it can be formulated conclusion as follows:

1. Mistakes of the concepts contained in the textbook of Biology for senior high school class XI about the immune system in this study includes four categories: Oversimplifications, Overgeneralizations, Undergeneralizations, and Misidentifications.

2. The percentage of immune system concept mistake in books A, B, and C in the Oversimplifications category were 23.5%, 41.2% and 58.8%, respectively; Overgeneralizations categories are as follows: 5.9%, 17.6% and 0%; Undergeneralizations categories are as follows: 5.9%, 0%, and 11.8%; and Misidentifications categories were: 5.9%, 11.8% and 11.8%, respectively.

Based on the results of research that has been done, suggestions can be given as follows:

1. The need for similar research on all textbooks to prevent and overcome misconceptions among learners.
2. 2. Teachers need to direct students to choose a quality textbook, compiled based on the latest curriculum and contains materials appropriate to the level of education. As well as before the teaching-learning process takes place, the teacher must read the book that students use for the ongoing process of teaching and learn teachers can immediately correct the mistakes of the concept contained in the book that students use as a handbook.

3. For writers who want to write a book, it is expected to always update the information and use quality reference books.
4. For publishers, it is necessary to provide experts from each field to check on each book to be published. Good for grammatical checking in writing, book content, pictures presented, and examples of the problem.

5. For the government, it is necessary to call for strict rules for all learners, educators, librarians, or booksellers to no longer use, store or sell books that have been identified to contain conceptual mistakes to prevent misconceptions among learners.

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