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VIEWS OF PRE-SERVICE TEACHERS RELATED TO THE MISTAKES ENCOUNTERED IN THE TEXTBOOKS WHICH THEY BENEFITED FROM IN PHYSICS COURSES

Ali Yildiz

Ataturk University, Kazim Karabekir Faculty of Education, Erzurum (TURKEY)
ayildiz@atauni.edu.tr

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ABSTRACT

The aim of this study is to investigate the views of pre-service mathematics teachers taking compulsory Physics-I (mechanics) and Physics-II (electricity) about the mistakes they encountered in the textbooks which they benefited from and the predictions of instructors teaching physics courses about these views. A total of 75 pre-service teachers, 28 males and 47 females, in the second year of their study in the primary school mathematics teaching program in an Education Faculty of a state university comprised the sampling of the research. A feedback form made up of three-open ended questions and "open-ended questionnaire interview" prepared by the researcher were used as a data collection tool. After the questions were asked to the pre-service teachers, an interview was carried out with 5 instructors teaching Physics-I and Physics-II courses and they were asked to indicate the percentages of the views written by the pre-service teachers in their responses to the open-ended questions. The research revealed that pre-service mathematics teachers stated negative views about the mistakes in the textbooks they benefited from in the physics course, the use of textbooks including mistakes and the effect of these books with mistakes on their motivation to study the physics course and these views were found to be at the rate of 62.6%, 81.4% and 57.8%, respectively. While pre-service teachers determined their views about the mistakes in the textbooks they benefited from in the physics course, the use of textbooks including mistakes, and the effect of these books with mistakes on their motivation to study the physics course, it was revealed that the situation which appeared as a result of which opinion they had at what rate was different from the predictions of the instructors teaching the course related to these views.

Key words: Physics, Reference Books, Mistakes, The Views of Per-Service Teachers

1. INTRODUCTION

A book involves the cultural background of humanity and serves to transfer it to the younger generation. When the primary goal of education is considered to be cultural transfer, the importance of books, especially textbooks, will be understood better [1]. Textbooks can be described as tools which include the knowledge, skills, methods and the habits to shape life and aesthetic taste as part of specific topics collected by human beings so far and present them to the performance of the young generation [2]. The research conducted in many countries in the world revealed that despite the advancements in technology, textbooks are still the main materials used in schools and they play an important role in education and teaching [1, 3].

Textbooks have been the oldest and most common printed materials used in education. The most important advantage of printed materials is that they give an opportunity to the individual to revise the knowledge many times and study independently. Textbooks are known to be the most important elements of education and teaching due to the effects they have on individuals, families, societies and nations [4, 5]. According to Kucukahmet [6], textbooks are very useful materials when looked from students' perspective and a student has an opportunity to revise what the teacher has taught at any time, place and pace with the help of them.

Textbooks are documents that examine and explain the topics included in education programs carefully and regularly as the source of knowledge and they lead and educate students within the objectives of the course [5]. They are also the primary tools that are used in the course, help the course to improve in the process and play a role in the development of the course towards knowledge and implementation and life. Textbooks are permanent products which are produced with great effort and have high functional values due to the existence of constant control during their preparation and organization, going through many processes for their development and requiring precise and careful work [7].

Lord [8] states that many studies reveal that science textbooks include irrelevant photographs consisting big mistakes, complicated presentations, experiments which are impossible to do, diagrams and illustrations which present impossible situations. The studies conducted [9, 10, 11] suggested that the pictures existing in the textbooks will help the students to understand the concepts, although visual elements do not promote learning due to lack of necessary relations between the text and the visual elements in many textbooks.

While textbooks which are considered to be the main teaching materials are prepared, minimum attention with regard to scientific content, educational design, visual presentation, language and expressions must be paid. The errors caused by misprinting in textbooks can be tolerated to some extent if there are not many errors; however, if educational problems (!) caused by other kinds of mistakes (e.g.; scientific, lack of knowledge, educational design) are taken into consideration, they are not forgiven easily because preparing a textbook takes a long time and its preparation process requires constant control, proofreading and improvement [5]. It was stressed in the studies conducted about the evaluation of physics topics in science textbooks that there are many errors in the sections and some sections must be certainly examined again, the pictures are not compatible with the text content, a relation between a picture and a text is not established on the pages, and the lack of proportion with the pictures used can damage the student's perception [12, 13, 14].

It was determined in the studies [15, 16, 17, 18] conducted that misconceptions may appear in all age groups, the individuals were resistant to changing these misconceptions, misconceptions impede the students' learning of science subjects and one of the causes of misconceptions is mistakes in the textbooks. Within this context, revealing and knowing the views of the primary school pre-service mathematics teachers studying compulsory mechanics and electricity in the education faculty about the mistakes they encountered in the textbooks used in the lessons are important for instructors who are going to teach physics at university, writers who write the physics textbooks, publishers and all departments concerning the textbook sector.

- ❖ To reveal the views of the primary school pre-service mathematics teachers studying compulsory mechanics and electricity at university about the mistakes they encountered in the textbooks they benefited from, the use of textbooks with mistakes and their effects.
- ❖ To seek an answer to the following question. "At what rate do the instructors teaching physics courses know the views of the pre-service teachers related to the mistakes they encountered in the textbooks they benefited from, the use of textbooks with mistakes and their effects?"

2. METHOD

2.1. The Research Design

Open-ended questions, designed to encourage the students to express their own ideas about the research topic freely and reveal their scientific ideas clearly, were used in this study which has qualitative designs [19, 20]. The research is a case study which is conducted qualitatively and aims at revealing the present situation thoroughly.

2.2. The Sampling of the Study

The sampling of the study was comprised of a total of 75 pre-service students, 28 males and 47 females. The pre-service teachers were in the second year of their study in primary school mathematics teaching department of the Education Faculty in a state university founded in 1957 in the 2012-2013 academic year.

2.3. Data Collection Tools and Analysis

Feedback form made up of three-open ended questions and "open-ended questionnaire interview" prepared by the researcher [21, 22] were used as data collection tools in the study. The research questions were analysed by the three instructors who were experts and experienced in their fields before the implementation and the necessary corrections and changes were made in accordance with their suggestions. The views of the pre-service teachers were obtained in writing with the feedback form made up of open-ended questions and a week later, interviews in accordance with the "open-ended questionnaire interview" were made with 6 people chosen randomly among the pre-service teachers who expressed their views in writing about the mistakes they encountered in physics courses (mechanics and electricity) they benefited from [21, 22]. While the analysis of the alternative responses given by the students were done, the answers written by the students were classified according to their connections and transferred to the related tables in the findings of the study section by taking into consideration the number of males and females separately so that it could be understood easily. Furthermore, after the questions were asked to the pre-service teachers, the interviews were carried out with five experienced instructors who had taught mechanics and electricity in the past, have taught during the term when the study was conducted and will probably teach in the following years. The instructors were asked to predict the percentages (4%, 10%, 15%,...) of which opinion the pre-service teachers had at what rate while they were expressing their view(s) related to the mistakes they encountered in the textbooks they benefited from in the physics courses in these interviews. An arithmetic average of the instructors' predictions about the views of pre-service teachers which they wrote for each question was calculated and they were presented in different columns of the tables which contained the views of the students. The necessary interpretations and explanations about the findings in the tables were made at the end of the tables.

3. FINDINGS AND INTERPRETATION

3.1. The Responses of the Pre-service Teachers to the Questions about the Mistakes They Encountered in the Textbooks They Benefited from in Physics Courses

Question 1) What do you think about the existence of mistakes in the textbooks you benefited from such as wrong formulas, misspelled expressions or the use of two concepts (direction and way, speed and velocity) in the place of each other?

Table 1. The participant responses for the question “What do you think about the existence of mistakes in the textbooks you benefited from such as wrong formulas, misspelled expressions or the use of two concepts (direction and way, speed and velocity) in the place of each other?”

Pre-service Teachers' Responses	Pre-service Teachers		Total	%	Predictions of Instructors (%)
	Female	Male			
I'm suspicious of everything in that textbook (formulas, expressions or diagrams).	15	3	18	24.0	13.0
I can't accept the mistakes made in the textbooks, and I take it as great irresponsibility.	10	7	17	22.7	14.0
I can't accept the mistakes made in the textbooks, and I take it as a great irresponsibility. I look at every expression, equation, or diagrams with suspicion.	6	1	7	9.3	17.6
I am confused.	3	1	4	5.3	13.0
I have a negative attitude towards the course.	1	-	1	1.3	1.8
There are always mistakes, but the most important thing is to make the fewest mistakes.	9	9	18	24.0	13.6
It is quite normal, I understand it.	1	5	6	8.0	6.6
It motivates me very well. It causes me to do more research because there is a need to search for other sources.	1	1	2	2.7	7.2
I always think it is unlikely that there are mistakes in the textbooks.	1	1	2	2.7	10.0
No response	-	-	-	-	3.0
Total	47	28	75	100	100

The statements in the first five lines of Table 1 reflect the negative views of the participants related to the mistakes in the textbooks they benefited from (62.6%). The negative views were distributed as follows: The students who are suspicious of everything in the textbook (24%), those who take mistakes as great irresponsibility (22.7%), the ones who do not accept the mistakes and take them as great irresponsibility and meanwhile, look at every expression, equation, or diagrams with suspicion (9.3%), those who are confused (5.3%), those who have a negative attitude towards the course (1.3%).

The pre-service teachers revealed their positive views related to the mistakes in the textbooks as follows: “There are always mistakes, but the most important thing is to make the fewest mistakes”, “It is quite normal, I understand it”, “It motivates me very well. It causes me to do more research because there is a need to search for other sources”, “I always think it is unlikely that there are mistakes in the textbooks” and these positive views were at the rate of 24.4%, 8.0%, 2.7% and 2.7%, respectively. It is revealed that the percentages of the predictions of the instructors and the views of the students are quite different from each other.

Question 2) What do you think about the use of textbooks which you benefited from in physics courses including mistakes with formulas, expressions, and diagrams?

Table 2. The participant responses for the question “What do you think about the use of textbooks which you benefited from in physics courses including mistakes with formulas, expressions, and diagram?”

Pre-service Teachers' Responses	Pre-service Teachers		Total	%	Predictions of Instructors (%)
	Female	Male			
I may look for another textbook.	14	9	23	30.7	27.0
I have lost my confidence in the textbook, so I may look for another textbook.	17	3	20	26.7	21.0
I have partially lost my confidence in the textbook.	7	6	13	17.3	14.0
I do not use that textbook anymore.	2	3	5	6.7	10.0
There always mistakes, but the most important thing is to make the fewest mistakes.	3	5	8	10.7	11.6
Despite everything, I still use the same textbook.	3	1	4	5.3	5.4
This is a normal situation, I understand it.	1	1	2	2.7	7.6
No response	-	-	-	-	3.4
Total	47	28	75	100	100

The statements in the first four lines of Table 2 involve the negative views of the pre-service teachers related to the reference books which they used in physics courses and included some mistakes (81.4%). The negative views were distributed as follows: “I may look for another textbook”, “I have partially lost my confidence in the textbook”, “Because I have lost my confidence in the textbook, I may look for another reference book”, “I do not use that textbook anymore” and these negative views were ranged at the rate of 30.7%, 26.7%, 17.3%, 6.7%, respectively. The reason for the negative views of pre-service teachers related to the reference books which they used in physics courses and included some mistakes being at such a high rate as 81.4% is that the view which

said, "I have partially lost my confidence in the textbook" (17.3%) has a great share. In fact, this response, when compared to other negative responses, is not very strict or negative. According to the response which says "I do not use that textbook anymore", it is quite close to the borderline which distinguishes negative responses from positive responses.

The pre-service teachers revealed their positive views related to the reference books which they used in physics courses and included some mistakes as follows: "There are always mistakes, but the most important thing is to make the fewest mistakes", "It is quite normal, I understand it", "Despite everything, I still use the same textbook" and it can be concluded that these positive views ranged at the rate of 10.7%, 5.3% and 2.7%, respectively. It is revealed that the percentages of the predictions of the instructors and the views of the students were partially different.

Question 3) How do the textbooks which you benefited from in physics courses and include mistakes such as wrong formulas, expressions and diagrams affect your motivation to study physics courses?

Table 3. The participant responses for the question "How do the textbooks which you benefited from in physics courses and include mistakes such as wrong formulas, expressions and diagrams affect your motivation to study physics courses?"

Pre-service Teachers' Responses	Pre-service Teachers		Total	%	Predictions of Instructors (%)
	Female	Male			
I'm confused. My suspicions about what is correct or wrong among what I read increases.	21	8	29	38.7	11.0
I'm confused. My suspicions about what is correct or incorrect among what I read increase and I have lost my motivation to study the physics course.	8	-	8	10.7	14.0
My motivation to study the physics course decreases.	-	4	4	5.3	13.6
I don't feel like opening the reference book.	2	1	3	4.0	11.6
This situation does not affect my motivation to study the course negatively.	8	6	14	18.7	16.0
It can be an excuse for those who don't like studying, but despite everything, I still continue to study with the same textbook.	3	4	7	9.3	6.8
This situation motivates me very well, and it helps me to search for other sources.	1	3	4	5.3	14.8
This situation does not affect my motivation to study. It can be an excuse for those who don't like studying. Despite everything, I still continue to study with the same textbook.	1	2	3	4.0	7.2
I still use the same book because it is better than the notes which other people take.	3	-	3	4.0	2.8
No response	-	-	-	-	2.2
Total	47	28	75	100	100

The statements in the first four lines of Table 3 represent the negative views of pre-service teachers about how the reference books which they used in physics courses and included some mistakes that affected their motivation to study their lesson (58.7%). However, the views on the positive borderline written for the third question attract attention due to their variety and naturalness. The responses which attract attention are arranged as follows: "The textbooks involving mistakes do not affect my motivation to study", "it can be an excuse for those who do not like studying, but I can confine to study with the same book despite everything", "it motivates me very well and it helps me to study other sources", "I use the same book because it is better than the notes taken by other people". In addition to the responses which stated that despite the mistakes in the reference books they did not affect the students' motivation to study very much and the responses which implied that due to using other sources, their research skills developed, the responses which stated that they preferred the textbooks with mistakes to the notes taken by the other students in the lesson were interesting and original. The rate of pre-service teachers who stated in different wordings that the physics textbooks which included some mistakes did not affect their motivation to study negatively is 41.3%. It is an important finding that 41.3% of pre-service teachers in total determined that the mistakes in the textbooks which they benefited from in physics courses did not affect their motivation to study. It is revealed that there was no parallelism or connection between the percentages of the predictions of the instructors and the views of the students for the third question.

3.2. Views of Pre-service Teachers Which Emerged during the Interviews Related to the Mistakes They Encountered in the Textbooks They Benefited from in Physics Courses

The pre-service teachers gave relative responses in the interviews carried out to the question which asked, "Specify your views related to the existence of mistakes in the textbooks you benefited from such as a wrong formula, a misspelled expression, or the use of two concepts in the place of each other, the use of textbooks including mistakes and their effects on studying lessons". It was revealed that the statements of students in the interviews verified and supported the views which they had stated in writing. These original views (positive-negative) are given below:

Mistakes cause incorrect learning. Incorrect learning brings failure. A mistake which can cause failure is not a situation to be ignored.

Mistakes lead to misconceptions. Because it is not easy to understand the physics course, information learned incorrectly can cause other information to be understood incorrectly, learned incorrectly or not to be learned.

Mistakes cause confusion, people to get suspicious and waste time.

The students act with suspicion towards all the books. They do not have confidence in books and their motivation to study decreases.

In my opinion, it is not a very big issue, but the existence of many mistakes can be annoying. In the worst case, I can study different sources.

Of course, it is really a bad situation to use different concepts in the place of each other from time to time or to learn them as if they are the same. Later, it could rather be difficult to learn them correctly because it is not possible to change something if they are embedded. However, I have not lost my confidence in the books. Therefore, as they are written by people, I allow a margin of error.

Two pre-service teachers determined in the interviews that the mistakes involved in the textbooks could cause misconceptions and it is difficult to correct misconceptions and this reveals that there was parallelism between the findings of the studies conducted [15, 16, 17, 18] and the findings of the existing study and they supported each other. It is interesting that one of the pre-service teachers who is aware that the textbooks involving mistakes might cause misconceptions appreciates the mistakes in the textbooks with his view which states that "However, I have not lost my confidence in the books. Therefore, as they are written by people, I allow a margin of error."

4. RESULTS AND DISCUSSION

As a result of the analysis of data obtained from the first and second questions of the study which were asked to investigate qualitatively the views of the pre-service teachers taking compulsory physics courses (mechanics and electricity) related to the mistakes they encountered in the textbooks they used in the courses and the use of books, 62.6% of the students stated negative views about the mistakes in the physics textbooks and 81.4% determined negative views related to the use of books containing mistakes. The reason for the use of books with mistakes at such a high rate as 81.4% is that the view which said, "I have partially lost my confidence in the textbook" (17.3%) has a great share because this response is not as strict as the other negative responses. The statement "I have partially lost my confidence" can be interpreted as I still confide in them, or I do not completely feel lack of confidence. Although 58.7% of the pre-service teachers stated that the books involving mistakes affected their motivation to study negatively in the responses written for the third question, it is interesting that 41.3% wrote original answers which implied that despite the mistakes in the book, their motivation to study was not affected negatively and implied that due to using other sources, their research skills developed and they preferred textbooks with mistakes to the notes taken by the other students in the lesson. It is an important finding that 41.3% of pre-service teachers in total determined that the mistakes in the textbooks which they benefited from in physics courses did not affect their motivation to study negatively. It can be stated that the pre-service teachers were partially used to the mistakes in the textbooks they used in physics courses such as formulas written incorrectly, concepts used in the place of each other from time to time, incorrect or incomplete definitions, units written incorrectly [5, 8, 23] and their motivation to study did not decrease but was actually affected positively. This judgement can be reached by looking at the responses of the pre-service teachers such as "The textbooks involving mistakes do not affect my motivation to study", "it can be an excuse for those who do not like studying, but I can continue to study with the same book despite everything", "it motivates me very well and it helps me to study other sources", "I use the same book because it is better than the notes taken by other people".

It is revealed in the study that while the pre-service teachers determined their views related to the mistakes they encountered in the textbooks they benefited from in physics courses, the use of textbooks with mistakes and their effects on their motivation to study physics, the situation which emerged related to which views they had at what rate was different from the predictions of the instructors who taught the course about these views. Although all of the pre-service teachers answered the three questions, the instructors predicted that there would be subjects who did not answer the questions.

It is indispensable that when translation mistakes [23] are added to the existing mistakes such as wrong formulas, wrong expressions, wrong descriptions and wrong diagrams [5, 8, 12-14], textbooks can be regarded as important sources of misconceptions. It is important that the person who is going to translate the book must have the command of the field of the book and the language written. The writers who prepare the textbooks, the publishing companies and the people who are going to translate them into other languages are expected to implement all the steps of a process that a book should go through patiently by maintaining a calm attitude. Conducting similar studies to reveal the views of secondary and high school students related to the mistakes they encountered in their textbooks, the use of books with mistakes and their effects can make important contributions to this field.

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