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An Analysis of the Learning Activities Covered in the 5th Grade Science Textbooks Based on 2005 and 2013 Turkish Science Curricula

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Abstract

The aim of this study is to analyze the learning activities covered in 5th grade elementary science textbooks which depend on 2005 and 2013 elementary science curricula. Two elementary science textbooks depends on 2005 science curriculum and two elementary science textbooks depend on 2013 science curriculum were researched. The study is a qualitative research and the data were analysed through the document analysis technique. The findings revealed that textbooks based on 2005 science curriculum includes more activities. In addition, these activities were found to be designed to evaluate student learning. There was no preparation for workbooks in 2013 science curriculum. Based on the findings obtained some suggestions are developed about the design of the textbooks.

Key words: Science education; textbook activities; qualitative research

Introduction

Science textbooks are significant teaching and learning materials which introduce science and related concepts to students and guide their learning. The textbooks play important roles to increase students' interests and understanding related to science and to improve their knowledge about subjects. Based on advances in science and technology, textbooks should be updated. MEB (ministry of Turkish education) is center to identify educational policies and therefore textbooks are selected by MEB in Turkey. MEB controls the consistency between textbooks and curriculum.

In 2005, science curriculum was changed by MEB (MEB, 2005). The new curriculum depended on constructivist approach. Therefore, the content of the science textbooks was developed depending on this new program, too. In addition, workbook was also prepared. The ultimate goal of this workbook was to increase students interests and their motivation related to the course. In 2013 the MEB changed the content of the science education course. The course's name was science and technology and new name is science (MEB, 2013). In addition, new curriculum is based on inquiry-based learning method and workbooks are not used no longer. Moreover, MEB also banned the recommendation of any supplementary material or book to the students in all courses (MEB, 2014). Therefore the importance of textbooks are increased. In this context, the experimental activities and other learning activities covered in the textbooks are major ways and tools for students to learn the subjects .

Review of the Literature

There are various points to be considered in the development of the textbooks for the science and technology course. For instance, pre-studies should be conducted in regard to the analysis, visits, observations or experiments. In regard to the activities and experiments necessary steps should be taken, the steps to be followed in the procedures should be given and necessary warning should be given in order to realize time and equipment savings. It should be also emphasized that the communication between teacher and students is significant to achieve the course objectives. All these points should be given in guide books (Kaptan, 1998).

In the study which analysed the effects of the learning activities covered in elementary science and technology textbooks on student learning, it was found that five of sixteen teachers reported partly positive effects of the learning activities on student learning whereas eleven teachers regarded them totally effective. Those teachers who reported partly positive effects of the learning activities indicated that the reasons for such a partial effect

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are due to irrelevancy of the activities, not being totally understood by students and not being interesting (Aydın and Çakıroğlu, 2010).

Classical experimental work is the best known form of practical work and is most commonly used for teaching science and chemistry in elementary schools (Herma, Grmek & Dinevski, 2014). Science teaching in primary schools is based on the understanding of physical, chemical, and biological contents. So the starting-point for realizing these objectives during the teaching and learning of science is experimental and problem research-based learning. Most of the scientific concepts and their connections, especially chemical because of their triple nature can be illustrated or deduced from experimental work (Glažar, Devetak, Strgar & Naji, 2006). In the delivery of the course material to students experiments are of great importance. Therefore, those experiments and learning activities covered in the textbooks should be carefully designed. Experimental activities in the textbooks developed for students and teachers should be designed based on the laboratory usage techniques (Aydođdu and Candan, 2012).

Importance of the Research

As stated above the MEB also banned the recommendation of any supplementary material or book to the students in all courses. The idea behind it; textbooks including science textbooks are necessary for students' learning. Is the idea really as it is planned by MEB?

This study analysed the learning activities covered in the science textbooks, which are reviewed and regarded as suitable for the science course by MEB. Based on this analysis relevant suggestions are given. The study is important since it reveals the insufficient parts for activities in science textbooks. The aim of this study is to analyze the learning activities covered in 5th grade elementary science textbooks which depend on 2005 and 2013 elementary science curricula in Turkey. In parallel to the aim given above, the study tries to answer the following research questions:

1. What are the major deficiencies in the learning activities of MEB science textbooks which were used in 2012?
2. What are the major deficiencies in the learning activities of science textbooks developed by the private (Semih) Publication, which were used in 2012?
3. What are the major deficiencies in the learning activities of MEB science textbooks which were used in 2013?
4. What are the major deficiencies in the learning activities of science textbooks developed by the private (Evren) Publication, which were used in 2012?

Method

The study was designed as a qualitative research. In qualitative research the data are mostly collected through observations and document analysis. In the study the data were analyzed through document analysis. In the document analysis, course materials can be examined which contain information about the facts to be studied (Yıldırım and Şimşek, 2011). In document research, the issues involve locating materials, often at sites far away and obtaining permission to use materials (Creswell, 2007).

In the study four textbooks were analysed in terms of the learning activities. Two of them were used for the 5th grade in the science and technology course during the school year of 2012-2013. These two textbooks were written based on the science curriculum published in 2005. One of the textbooks was written by MEB and the other one by a private publisher. Both textbooks were regarded as suitable for use in the course. The other two were used for the 5th grade in the science course during the school year of 2012-2014. These two textbooks were written based on the science curriculum published in 2013.

Results

This part presents the findings of the study and answers the research questions given above.

Findings about the first research question

In MEB science and technology textbook there are seven units. This number is consistent with the number mentioned and required in the educational program. As can be seen from Table 1, there are different numbers of

activities in each unit. Similarly, the number of the objectives varies in each unit. The total number of activities in the textbook is 76. It is 107 in the study guides (see Table 1).

Table 1. 2012 Science and technology textbook written by MEB

| Unit number | Unit title | Number of sections in the unit | Number of objectives | Number of activities | Number of the learning activities in the book |
|-------------|--|--------------------------------|----------------------|----------------------|---|
| 1 | Let's solve the problem of our body | 4 | 22 | 4 | $8+3+1+3=15$ |
| 2 | Recognising the change of matter | 4 | 46 | 20 | $8+3+2+9=22$ |
| 3 | Force and movement | 3 | 21 | 10 | $1+2+4=7$ |
| 4 | Electricity in our Life | 2 | 16 | 5 | $2+7=9$ |
| 5 | The world, the sun and the moon | 3 | 19 | 6 | $4+3+4=11$ (1 activity) |
| 6 | Let's visit and know the world of living being | 6 | 33 | 13 | $1+ 8+ 3+ 3+ 1+ 10=26$ (1 activity) |
| 7 | Light and sound | 7 | 39 | 18 | $3+1+3+2+2+1+5=17$ |
| | Total | 29 | 196 | 76 | $5+102=107$ |

In each activity, safety symbols are given at the beginning. The rules to be followed are included in the instructions. However, there is no instruction about how to use various equipment such as protective gloves, nitric acid, eye glasses among the others. The learning activities are numbered. However, the thermometer used in the activities is not specified. It is not stated that a pair of scissors used in the activity should not be extremely sharp and rusty. The length of equipment such as connection cable and meter is not given. In addition, it is not indicated that protective aprons should be used and that connection cables should be touched by hand.

Findings about the second research question

Table 2 shows that in the science and technology textbook written by Semih publishers and used in 2012, there were seven units. This number is consistent with the number mentioned and required in curriculum. There are different numbers of activities in each unit. Similarly, the number of the objectives is 196 as mentioned in curriculum. The total number of activities in the textbook is 70 whereas it is 130 in the workbook.

The dimensions and amount of the materials used in the learning activities are not explained. Although safety symbols are included, there is no mention of caution while using the chemicals. The question of who (whether students or teacher) should carry out the activities is not answered. In those learning activities, which should be carried out by the students, it is not specified whether they are conducted individually or in a group. In addition the thermometer to be used is not specified in terms of its type. There is no caution of the likely danger of using a pair of scissors. The capacity of becherglas is not specified such as 50ml, 100ml, 250ml. and it is not indicated that it should be refractory.

Table 2. 2012 Semih publications data of Science and Technology textbook

| Unit number | Unit title | Number of sections in the unit | Number of objectives | Number of activities | Number of the learning activities in the book |
|-------------|--|--------------------------------|----------------------|----------------------|---|
| 1 | Let's solve the problem of our body | 3 | 22 | 7 21 | |
| 2 | Recognising the change of matter | 4 | 46 | 19 | 30 (29+1) |
| 3 | Force and movement | 3 | 21 | 5 | 9 |
| 4 | Electricity in our Life | 2 | 16 | 5 | 9 |
| 5 | The world, sun and moon | 3 | 19 | 4 | 11 |
| 6 | Let's visit and know the world of living being | 7 | 33 | 18 | 29 |
| 7 | Light and sound | 6 (A+B) | 39 | 12 | 21(20+1) |
| | Total | 28 | 196 | 70 | 130 (128+2) |

Findings about the third research question

As can be seen from Table 3, in the science textbook written by MEB and used in 2013 for the 5th grade students there are seven units. Each unit has different number of sections. The number of objectives was reduced and it is 44 in the textbook analysed. There are 58 learning activities in textbook. In the units there is no explanation about the concept of experiment. The rules to be followed are given in the introduction part. The learning activities do not include safety symbols. Warnings about materials are not well and fully specified. The amount of the materials required is not given. The materials used in producing the test tubes are not given, too.

Table 3. 2013 Science textbook written by MEB

| Number of units | Unit title | Sections covered in the unit | Number of objectives | Number of activities |
|-----------------|--|------------------------------|----------------------|----------------------|
| 1 | Let's solve the problem of our body | 3 | 13 | 16 |
| 2 | Measuring the magnitude of the force | 2 | 2 | 5 |
| 3 | Change of the matter | 4 | 6 | 11 |
| 4 | Light and sound | 5 | 7 | 10 |
| 5 | Let's visit and know the world of living being | 2 | 3 | 6 |
| 6 | Electricity in our daily life | 2 | 3 | 2 |
| 7 | Mysteries of the Earth's crust | 4 | 10 | 8 |
| | Total | 22 | 44 | 58 |

Findings about the fourth research question

In Evren publishers' science textbook based on new science curriculum in 2013, there are seven units. As can be seen from Table 4 there are 44 objectives and each unit has different number of sections. There are 37 learning activities. Both safety symbols and safety warning are given incompletely. The order of the references to the materials is random. The experiments are not numbered. It is observed that the safety symbols given and the materials used in the activity are not consistent. There is also some misconceptions in the definitions of the materials used in the activity (i.e., it is stated that there are four weights with 50 gram; the word weight should be mass. The amount of the materials used in the learning activity and experiments is not specified (for instance, 10 N dynamometer). It is not mentioned about who (students or teacher) will carry out the experiment. In regard to the group work in the process of experiment the number of student groups is not specified. There are incomplete instructions about the experiments and the learning activities. The types of the thermometers used in the experiments are not specified (for instance, whether a mercury thermometer or an alcohol thermometer will be employed).

Table 4. 2013 Science textbook developed by Evren Publishers

| Number of units | Unit title | Sections covered in the unit | Number of objectives | Number of activities |
|-----------------|--|------------------------------|----------------------|----------------------|
| 1 | Let's solve the problem of our body | 3 | 13 | 2+3+2=7 |
| 2 | Measuring the magnitude of the force | 2 | 2 | 1+3=4 |
| 3 | Change of the matter | 4 | 6 | 1+2+1+4=8 |
| 4 | Light and sound | 5 | 7 | 2+0+1+3+5=11 |
| 5 | Let's visit and know the world of living being | 2 | 3 | 2+1=3 |
| 6 | Electricity in our daily life | 2 | 3 | 2+2=4 |
| 7 | Mysteries of the Earth's crust | 4 | 10 | 0+0+0+0=0 |
| | Total | 22 | 44 | 37 |

Comparison of the learning activities in the textbooks used in 2012 and in 2013

Table 5: A comparison of the contents of the textbooks used in 2012 and in 2013

| Program | Differences in units | Sections | Topic |
|---------|---|--|---|
| 2012 | The world, the sun and the moon (This unit is not covered in the textbooks used in 2013) | All sections are covered in the book, | All topics are covered only in the textbooks used in 2012 |
| | Force and movement | * Forces requires contact and contact-free forces * Magnetism | Gravity Force, Magnetic force |
| 2013 | Mysteries of the Earth's crust (This unit is not covered in the textbooks used in 2013) | All sections are covered in all textbooks, | All topics are covered only in the textbooks used in 2013 |
| | Measuring the magnitude of the force | Measuring the magnitude of the force | Force meter: Dynamometer |
| | Light and sound | Shadow | There is no topic of partial shadow |

As can be seen in Table 5 the textbooks written in 2012 and in 2013 were compared in terms of unit differences, sections and topics covered. In the textbooks used in 2012 there is the unit of the world, sun and moon, which is not covered in the textbook used in 2013. Even though the unit of force and movement is covered in the textbooks used both in 2012 and in 2013, the content of the unit is different. Because in the textbooks used in 2012 the topics about the forces, which require contact and contact-free forces as well as magnetism are covered, but these topics are not covered in the textbook used in 2013. The unit of mysteries of the earth's crust is not covered in the textbooks used in 2012, but it is included in the textbook used in 2013. Although the unit of light and sound is covered the textbooks used both in 2012 and in 2013, the content of the unit is different. The textbooks used in 2013 do not cover the topic of partial shadow.

Discussion

In 2012 two science textbooks were used for the 5th grades in all public schools in Turkey. One of the textbooks was written by MEB and the other one by a private publisher. These textbooks were written based on the science and technology curriculum, which was developed in accordance with the principles of the constructive approach. The number of units and objectives in both textbooks is found to be the same. However, the number of sections in them varies. More specifically, it is twenty-nine in the textbook by the MEB while it is twenty-eight in the textbook by the private publisher. In addition, the number of the learning activities in both textbooks is also different in that in the textbook written by MEB there are a total of seventy-six learning activities while there are seventy learning activities in the textbook written by a private publisher. The number of the learning activities in the workbooks also differs. In MEB workbook, there are 107 learning activities whereas there are a total of 130 learning activities in the workbook by the private publisher.

In 2013 two science textbooks were qualified to be used for the 5th grades in Turkey. It was found that the textbooks one of which was written by MEB while the other one by the private publisher have the same titles for the units and the same number of units, sections as well as objectives. However, the number of the learning activities covered in the textbooks varies. More specifically, in the textbook written by the MEB there are a total of fifty-eight learning activities while there are thirty-seven learning activities in the textbook written by a private publisher.

The textbooks used in 2012 and in 2013 differ in terms of the number of the learning activities. It can be argued that, those textbooks used in 2012 which were written in accordance with the constructive principles are richer in terms of the learning activities covered. In addition these textbooks are accompanied with workbooks which are not given with the textbooks used in 2013. It is reported that some of the learning activities covered in the textbooks for the science and technology course are not fully carried out (Yangın and Dindar, 2007, Yıldız-Duban, 2013). There are some changes in the science textbooks written in 2012 and in 2013 in terms of topics covered. Some of the units and topics are left for the sixth grade.

In the textbooks used both in 2012 and in 2013 the rules to be followed during the learning activities and the experiments are generally given in the introductory sections. However, the rules for the specific learning activities and the experiments were found not to be specified. In other words, some significant characteristics such as the amount of the materials to be used, their type, how to use them were not given in a required manner. It can be argued that the learning activities covered in the textbooks analysed were not developed following the necessary techniques for the lab use.

In the textbooks used in 2012 there were some misconceptions related to the process of the learning activity and the process of experiments. Such misconceptions were not observed in the textbooks used in 2013. However, in the textbooks used in 2013 it was found that there was inconsistency between the picture of the material to be used in the activity and its visual representation in some of the learning activities. Science textbooks in subjects such as biology should provide students with scientifically sound information so that they learn correct basic knowledge for making informed decisions (Kim and Kim, 2013).

In the interviews with the science and technology teachers it was found that only a few of them (three out of sixteen participants) were well prepared for the learning activities whereas most of them (thirteen participants) were partly prepared for the activities (Aydın & akırođlu, 2010). The reasons for partial preparation were given by the teachers as follows: “sometimes objectives and the learning activities are inconsistent; there are problems about the procurement of the materials used in the activity; and there are time constraints in order to complete the activity.” (Aydın & akırođlu, 2010). On the other hand, a common trend in the textbooks used in 2012 and in 2013 was that who would carry out the activities was not specified. In addition, the number of students in the groups was not specified in the experiments which required group work. It is significant that some of the learning activities included in the textbooks should be designed taking into consideration the processes out of school environment.

In the science textbooks which will be used in the future that some significant characteristics such as the amount of the materials to be used, their type, how to use them are given in a required manner. It is significant that some of the learning activities included in the textbooks should be designed taking into consideration the processes out of school environment. In the textbooks used in 2013 it was found that there was inconsistency between the picture of the material to be used in the activity and its visual representation in some of the learning activities. Arrangements can be made again for the solution of this problem in the science textbooks. Mismatch between the materials to be used in activities with the image itself. It is suggested that safety symbols can be used cautiously in every activities and experiments in the science textbooks. There is no workbook for the textbooks used in 2013 as a result of the decision of MEB mentioned above. The lack of study guides is a disadvantage for students. Because such guides provide the students with the opportunity to consolidate their learning through various learning activities. So it is suggested that workbooks can be prepared which have activities and experiments for science textbooks.

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