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Elementary Science and Technology Teachers' Views on Problems Encountered in the Instructional Process

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Abstract

This research aims to explore the problems that teacher have experienced their opinion towards effectives and and functionality of teaching-learning process of Primary Science and Technology curriculum started to be implemented in 2004-2005 academic year in Turkey. The qualitative research design is used in this study. Research data are collected through interviews (semi-structured) with Science and Technology teachers who works at various primary schools in Kocaeli. The data are presented through classified as themes and codes. 75% of teachers have expressed that they realize their acquisition effectively. Teachers of Science and Technology course have indicated that they have a couple of problems such as crowded classes, insufficient labs and equipment etc. Additionally, teacher's opinions towards alternative evaluation methods of Science and Technology course are studied. 25% of teachers have expressed that the most important problem is shortage of time. They have also implied that they have usually used blackboard and book to perform on Science and Technology course.

Key Words

Science and Technology Course, Curriculum, Instructional Process.

Problem Statement

Constructive learning is the process of making connections between new and old learning, and integrating new information with the existing ones. However, this process should not be perceived as mere accumulation of information. When an individual genuinely constructs knowledge, he will be able to interpret and thus recreate it (Şaşan, 2002). The role of the teacher in this process is to guide the students (Martin, 2000).

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Science and technology is one of the fields that have adopted this contemporary approach. The science and technology curricula renewed in 2004 follows an approach that keeps the students active and at the center of instruction, and proposes that instructional strategies be identified and learning environments be rearranged to achieve this (Milli Eğitim Bakanlığı [MEB], 2005).

The teacher has a central role in the accomplishment of instructional practices specified in a curriculum. Teacher determination and belief in following the curriculum is critical to the achievement of the information level aimed in the activities.

The science and technology curriculum which was initiated in 2004 gives teachers new roles and responsibilities that go beyond the traditional. More precisely, teachers following these new curricula are expected to guide their students' learning, rather than transmit information to them.

A constructivist science teacher enables students to construct their knowledge by using scientific

process skills (Pilot, 2000). The teacher asks the students to interpret science concepts, use them to explain various phenomena, experiment and interpret the results. In constructivist science teaching, experiments are mostly designed to include a problem statement.

Understanding the problems that teachers encounter during the implementation of the science and technology course is necessary to achieve curriculum goals effectively. They found that the science and technology curriculum was "very" effective in scope, education status and evaluation. The same study revealed no significant differences among teacher opinions regarding grade level, gender, seniority and education level. The research conducted by Gallagher (2000), the teachers stated that can not to do practical works in their lessons and also the teaching of subject they prefer to use traditional methods.

A study focusing on teacher and students opinions about the science and technology course in schools with multigrade classes (Aydın & Çakıroğlu, 2010; Uygur & Yelken, 2010) showed that both parties had overall positive opinions about the science and technology curriculum, but stated that the new curriculum brought along a number of serious problems. The most common problem seemed to be the lack of equipment and infrastructure in village schools with multigrade classes, despite the requirement of the new curriculum that courses be primarily organized around experiments and laboratory work.

In a study on elementary teachers' views about the assignment process in the science and technology course (Ersoy & Anagün, 2009), it was found that teachers mostly gave assignments to reinforce classroom learning, and did not assign many tasks that required student creativity. In addition, teachers were found to experience problems with their assignments stemming from the Internet, students and parents.

In another study conducted to assess science and technology teachers' views about the instructional methods and techniques they used (Aydede, Çağlayan, Matyar, & Gülnaz, 2006), most teachers were found to use the lecturing method but support it with several student-centered methods or techniques such as question-answer, brainstorming, discussions, laboratories and problem solution.

In brief, a general outlook on previous studies shows that teachers' perceived problems include lack of information on modern methods and their practical implementations, as well as insufficient infrastructure (lack of materials, crowded classes) (Acat & Demir, 2007; Arslan, Avcı, & İyibil, 2008; Erdemir, 2007; Gelbal & Kelecioğlu, 2007; Gözütok, Akgün, & Karacaoğlu, 2005; Korkmaz, 2006; Okur & Azar, 2011; Parmaksız, 2004; Temiz, 2005; Yaşar, Gültekin, Türkkan, Yıldız, & Girmen, 2005).

Regardless how functional a curriculum is, it may be hampered by the lacks of implementors and implementation (Büyükkaragöz, 1997; Demirel, 2005).

In order to improve the curriculum of the science and technology course, it is therefore important to know not only the difficulties faced by teachers, the implementers of curricula, as they teach science and technology but also their proposed solutions.

Purpose of the Study

This study was conducted in order to identify science and technology teachers' thoughts, evaluations and views about the effectiveness of the instructional processes and the functionality of the curriculum at work.

Method

Based on the survey model, literature survey and interviews as data collection tools were employed in this study. Surveys as research tool aim to describe a past or present situation as it is. The topic of research is examined within its own conditions. This qualitative case study is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources (Bassey, 1999; Campoy, 2005; Cohen & Manion, 1997; Denzin & Lincoln, 1996; Patton, 1997).

A case study is defined by Stake (1995) as "the study of particularity and complexity of a single case, coming to understand its activity within important circumstances.

Universe and Sampling

This is a qualitative survey study aiming to identify the problems which arise during the implementation of the instructional processes specified in the science and technology curriculum dated 2004. The population of the study includes all science and technology teachers who were working at Ministry of Education elementary schools located in Kocaeli Izmit during the 2010-2011 school year. The study sample was selected by using the criterion sampling technique. The criterion was that all participants were science and technology teachers. The study

was conducted with a total of 52 teachers who were teaching science and technology in grades 6, 7 and 8 in 30 elementary schools in Izmit.

Instrument

The qualitative data of the study were collected by using semi-structured interview forms. The questions in these forms were prepared by reviewing studies on the evaluation of new curricula.

According to Bailey (1982), when compared to the quantitative data collection method of questionnaires, the interview method has the advantages of flexibility, higher response rate, nonverbal behaviors, control over the interview environment, order of questions, immediate reactions, confirmation of the source of data, completeness, and in-depth information.

Designed by considering the aims of the study, the form had 4 separate sections. The first one included the interview questions which aimed to identify teacher opinions about the instructional processes of the science and technology course. The interviews were semi-structured as additional questions were asked when necessary. Each question was designed to obtain different data.

The data obtained were analyzed by using the qualitative data analysis method of content analysis. In content analysis, similar data are gathered around certain concepts and themes, and then organized and interpreted in a way that readers can follow. In content analysis, the obtained data is first read by the researchers and appropriate codes are written. Themes are then formed by considering the similarities and differences between these codes. Finally, the codes and themes are organized and findings are defined.

In this study, the interview data were coded by using the QSR Nvivo 8.0 qualitative data analysis program. A total of 120 codes were identified from teacher interviews. The reliability of the coding is ensured by 80% agreement between codes of the researchers' and those of an outsider (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2008). The reliability measurement of the qualitative data was done by Miles and Huberman (1994):

Agreement Percentage = Agreement / (Agreement + Disagreement) x 100

As a result, 116 of the 120 codes proposed by the researchers were accepted. Regarding the appropriateness of the codes, an agreement of (116/120).100= 96.67% was reached.

In qualitative data analysis, the total number of teacher opinions in each theme may be different as participants make comments that fall under more than one theme.

In the second section of the form, a frequency table is presented to reveal what teaching materials, methods and assessment techniques teachers use while teaching the science and technology course, and their frequency. All interviews were transcribed by the researchers. Teachers' names were not used in interviews. The sample statements reflecting teacher opinions were given in "quotation marks". The science and technology teachers who participated in the study were coded as 1T, 2T, 3T, ..…20T. The qualitative data analysis method of content analysis was used in analyzing the data.

Results

In this study which gathered teacher opinions about the problems encountered during the instructional process of the science and technology course, half of the participants were female and the other half male. It was seen that 49.9% of the participants had 6-15 years' experience in teaching. Of the teachers who participated in the study, 71% were education faculty graduates. The percentage of teachers who had attended seminars about the science and technology curriculum was 55.7%.

The first question that the participants were asked concerned "how effectively they achieved the outcomes in the science and technology curriculum". To this question, 75% replied that they achieved the outcomes effectively. Among those who said so, 38.4% seemed to achieve this through activities. On the other hand, 34.6% of the participants stated that they were not able to effectively meet the outcomes of the curriculum. They mentioned "lack of technological equipment" as a reason for not being able to effectively meet the outcomes. Similarly, Öz (2007) found that big class size was a reason why outcomes were not effectively met. This finding is also corroborated by the studies of Arslan (2000), Doğan (2010), Çoruhlu, Er Nas and Çepni (2009), Tüysüz and Aydın (2009), Öz (2007), and Kırıkkaya (2009). The dates of these studies show that the problem has still not been solved since the year 2000, and teacher opinions suggest that crowded classes are still a reason why activities cannot be carried out effectively.

Another question directed to the participants was related to "the problems encountered in implementing the activities in the science and technology co-

urse". As a response, 46% of the teachers said that they did not have adequate time for all activities. The findings of Bozdoğan and Yalçın (2004) and Doğan (2010) were parallel to those of this study. The teachers in Doğan's study also stressed shortage of time by saying that "implementing various activities in the classroom takes too much time". Twenty-eight percent of the teacher opinions about implementing the activities in the science and technology course mentioned a problem stemming from lack of materials. Bozdoğan and Yalçın also report teacher complaints about lack of materials. Thus, it can be seen that the issues of crowded classrooms and lack of materials still remain over the years as primary problems. Another problem in the implementation of the activities in the science and technology course was "insufficient physical environments", which is also related to lack of equipment. Özkan (2001) and Doğan also wrote that the absence of a laboratory was mentioned by the majority of the teachers as a hindrance to implementing the activities.

Teacher opinions about the effective implementation of laboratory activities in the science and technology course showed that the suggestion with the highest frequency was that laboratories should have adequate equipment (40.3%). Teachers thus emphasized once again that the issue mentioned above is important to the success of this course. Another important suggestion was the improvement of the laboratory environment (30.7%). The participating teachers also stated that the success of laboratory work in the science and technology course depended on "individual work of students" (19.2%). This may be achieved by following the suggestions above. Another recommendation made by the teachers was that "students learn the laboratory culture". This finding is similar to those of Bozdoğan and Yalçın (2004) in that their participants also emphasized the need to teach students the laboratory culture, raise their awareness of equipment use and the importance of exercising care.

Regarding the insufficiency of the time given for instruction in the science and technology course, 51.9% of the teachers attributed it to the "intensity of the activity book". Bozdoğan and Yalçın (2004) also reported similar views.

In this study, the teachers were also asked if the traditional classroom environment was appropriate for the science and technology course. In response, 38.4% of the teachers said their classroom environment was not fit for student-centered instruction and 23% said the course needs to be held in the laboratory. Similar evidences are found by Aydede et al. (2006) and Aktepe and Aktepe (2009). According to research results, most of the teachers have primarily used verbal method as well as the student-centered method and techniques such as question-answer, brain-storm, discussion, laboratory, and problem solving.

The participants were also asked about their views on student activities in the science and technology course. In response, 21.1% stated that homework did not contribute to instruction. Similar findings have also been reported in Ersoy and Anagün's (2009) study. They found that the teachers who participated in their study were largely in agreement that assignments did not contribute to learning. In the present study, 15.3% of teachers thought positively about homework. They agreed that "Assignments that are at the right level for the students are useful". Of the teachers who mentioned student effectiveness, 5.7% believed that assignments did not work because they were done by parents. The issue of homework being done by parents also appeared in Ersoy and Anagün's study.

Regarding alternative assessment methods in the science and technology course, the most serious problem seemed to be shortage of time to teachers (25%). Overall, 19.2% of the teachers agreed that new assessment methods motivated students. On the other hand, 3.8% stated that new assessment methods contradicted with the Level Identification Examination. Arslan et al. (2008) and also reported similar views. Kilmen and Çıkrıkçı Demirtaşlı (2009) have observed that teachers can not realize the applications of alternative evaluation. It is claimed that the fundemantal reason of these failures is deficiency of the teachers' skills. The teaching programs of science and technology must be revised and necessary arragements should be performed according to these revisions to solve the problem. In order to resolve the teachers' deficiency about the subject, it can be applied to distant education or in-service education methods.

Concerning teacher views about possible classroom management problems while implementing the activities of the science and technology course, the question with the highest frequency was "difficulty of sustaining attention in crowded classrooms" (26.9%). This was followed by the problem of "noise during student-centered activities" (21.5%).

The teachers stated that they mostly used the blackboard and text books while teaching the science and technology course. Solmaz's (2007) study about the teaching methods used in science education and

student views on the implementation of these methods showed that the blackboard was used quite a lot and supplementary books and journals were used very often. A similar finding was also reached in a study by Çardak, Dikmenli, and Altunsoy (2008). They found that science teachers mostly used traditional instructional materials such as the blackboard. They often used question-answer (x=4,21), lecturing (x=3.94), and the sample case method (x=3.71). The assessment technique used most frequently by teachers was written exams (x=4.17), followed by performance assignments (x=3.84), visual work (x=3.76), project assessment (x=3.67) and oral presentations (x=3.57). A study by Çoruhlu et al. (2009) showed that the most frequently used measurement-evaluation techniques included performance assignments, project and poster assignments, along with the traditional techniques.

Conclusion and Recommendations

The issues emphasized in this study were crowded classrooms, lack of laboratories and equipment, and shortage of time for student-centered activities, which have unfortunately remained over the years as shown by similar study findings. In light of the findings of this study, the following recommendations may be made:

1. Centers may be established for the selection, use and repairs of laboratory equipment,
2. Education faculty departments such as science and physics education may be funded to encourage students to create physical materials and computer simulations in materials development courses, which can then be distributed to elementary schools,
3. Measures may be taken to minimize class size at schools,
4. Computer laboratories may be established at schools without laboratories so that simulated experiments can be made,
5. Shortage of time was mentioned as a problem in science and technology course activities. Thus, the course activity book may be simplified by eliminating unnecessary or repetitive activities

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