

**Fen ve Teknoloji Dersi Öğretim Programındaki
Yapılandırmacılığa Dayalı Öğelerin Öğretmenler Tarafından
Uygulanışı: Nitel Bir Çalışma ***

**Application of Constructivist Principles in Science and Technology
Curriculum into Practice by Teachers**

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Extended Summary

Purpose: The purpose of this study is to determine how constructivist principles, which has been brought forward in curriculum of Science and Technology Course, are reflected to the practice by Science and Technology teachers.

Method: This study employs the evaluative case study method which is included in the classification made by Meriam (1998). The study also employs the maximum diversity sampling, a purposeful sampling method. While determining the teachers in the study group, consideration was given to their professional experience, diverse educational background and graduation from different faculties and programs. The teachers were observed in the classroom in order to establish how and to what extent they were able to reflect the constructivist aspects of the Science and Technology Course Curriculum (STCC). The observations were made by using semi structured observation forms and video recording system. The observation form consisted of the following parts: role of the student, learning status, role of the teacher and measurement-evaluation. Content analysis method was used in the data analysis.

Results: The data obtained from observations shows that the f=317 of the student behavior (47.2%) that was expected to be demonstrated in a constructivist

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environment was not demonstrated in the classroom at all, and that the f=280 (41.7%) was demonstrated superficially so as to reflect the traditional approach. It was further established that the f=198 of the learning status (35.4%) was not materialized in the classroom at all and that the f=269 (48%) was demonstrated superficially in line with the traditional approach. With respect to the behaviors expected to be demonstrated by the teachers, however, it was found that the f=687 (51.1%) was not demonstrated in the classroom at all, while the f=369 (27.5%) was demonstrated superficially so as to reflect the traditional approach, and that f=264 (19.6%) was tried to be demonstrated in line with the constructivist approach without success. It was established that the f=342 (61.1%) of the measurement and evaluation status was not observed in the classroom at all, while the f=125 of the same (22.3%) was demonstrated superficially in line with the traditional approach.

Discussion and Conclusion: The study found that there was a discrepancy between the targeted STCC and the actual STCC applied by the teachers. The reasons for such discrepancy were discussed based on the findings obtained from the observations.

It was established based on the classroom observations that the students were more often than not passive throughout the learning-teaching process. It can be argued that this led students to increasingly become the passive receivers of knowledge. Only the Teacher 6 made an effort to get the students involved in the learning process in the classroom and help them construct the knowledge in line with the constructivist approach. While in the classes conducted by the Teachers 1, 2, 3, 4, 5 and 7, the students were not able to defend their opinions against each other, and thus had a limited interaction with each other, the interaction mostly took place between the teacher and students in keeping with the traditional approach. It can be argued that the lack of initiative on the part of the teachers to have students involved in experiments and activities where they would be at the forefront and to use in-class discussions in an efficient manner have prevented the demonstration of such behaviors. It was observed in the classes conducted by the Teacher 6 that the entire classroom involved in in-class discussions while conducting a group study and that both the group members and the remaining students in the class shared their opinions about the subject being discussed. Moreover, it was found that the efficient use of in-class discussions in the classes of Teacher 6 led to the increase in the interaction between the students. According to the observations made in the classrooms, it was only in the classes of this particular teacher that the students were able to form their hypotheses and assumptions by asking their own questions and testing them.

The constructivist approach suggests that the students should be actively involved in the learning process and take responsibility for their own learning in order to make learning more efficient and meaningful (Özmen, 2004). Yet it was found that the teachers other than Teacher 6 failed to deliver a meaningful learning process by enabling the active participation of the students. In constructivist approach, students are directed towards a complex but interesting target problem.

Such target problem should present a realistic and practical value in terms of students' learning status (Şimşek, 2004). However, according to the observations, the students were not instructed to deal with problems from real life.

Constructivist approach emphasizes the importance of previous knowledge in the learning process (Köseoğlu and Kavak, 2001; Özmen, 2004; Şimşek, 2004). It was established, based on the classes observed, that the teachers attempted to take into account the students' previously learned knowledge but they were not very successful in doing so. Creating a cognitive contradiction -one of the most important aspects of the constructivist approach- was not observed at all in the classes conducted by the Teachers 1, 2, 3, 4, 5 and 7. The Teacher 6, on the other hand, verbally creates a cognitive contradiction in his classes but he goes on to explain it by himself after having asked questions to the students about the subject, which is in keeping with the traditional approach.

Constructivist approach emphasizes the importance of active learning methods including problem based learning, cooperative learning, project based learning and inquiry based learning (Yurdabakan, 2011). It was found that none of the teachers in the study employed such methods and techniques in their classes. It was observed that the Teachers 1, 2, 3, 4, 5 and 7 extensively used the verbal lecturing, Q&A and exercise methods in their classes. Güneş et al. (2012) suggest that the science and technology teachers mostly prefer the question-answer and verbal lecturing methods. The use of various instructional materials in science education makes teaching more interesting, captivating, efficient and economical (Akpınar and Ergin, 2005). However, it was established that the Teachers 3, 4, 5 and 7 did not use such materials at all when conducting their classes. It can be argued that this prevented the students' interaction with various instructional materials and therefore resulted in the lack of interest on the part of the students towards the subject being taught. It was established that the Teachers 1, 2 and 6 used such instructional materials in various different classroom activities in an effort to keep the students interested.

In constructivist approach, both the teacher and students ask each other open ended questions. Moreover, the students are given some time to reflect on the questions (İşman, Baytekin, Balkan, Horzum and Kıyıcı, 2002). It was established that the Teachers 3 and 5 did not ask open ended questions to the students; the Teachers 2, 4 and 7 included open ended questions in their classes; and the Teachers 1 and 6 frequently asked open ended questions to the students. However, it was also established that the teachers did not give the students enough time to reflect on the questions with the only exception of Teacher 6, who gave sufficient time for his students to reflect on the questions for a significant part of his observed classes.

In constructivist approach, a teacher tries to find out the students' way of understanding the subjects and identify how they structure the new knowledge in their minds before attempting to impart his knowledge (İşman et al., 2002). According to the observations, the Teachers 1, 3 and 4 mostly started expressing their own opinions before taking the students' opinions first. It was established that

the Teachers 2 and 6 tried to have the students explain the fundamental knowledge of the subject being instructed. It was seen that the Teachers 5 and 7 mostly started expressing their own opinions before taking the students' opinions first. According to the constructivist approach, technology should enable learners to develop their own knowledge, engage in active learning, improve their problem solving skills and come with alternative solutions (Özmen, 2004). The classrooms of Teachers 1, 2, 3 and 4 did not include any technological equipment. The Teachers 1 and 3 used the information and communication technology (ICT), available in various locations of their schools, for presentation purposes. The Teacher 6 used the ICT for various different purposes such as making presentations, creating a platform for discussion and transforming intangible concepts into tangible ones. Moreover, it was observed that he also used such equipment for enabling students to conduct studies. It was seen that the Teachers 5 and 7, in particular, frequently used the ICT in their classes yet they failed to use that equipment in such a way as to maintain active participation of the students. Therefore, neither the presentation of the student textbook activities on the board through a projector nor the videos shown as part of the vitamin curriculum of the National Education inspired the idea of a constructive educational approach.

Constructivist approach not only involves a product and behavior oriented (summative) approach but it also involves a (formative) evaluation approach that takes into account the process along with the product itself (Özdemir, 2010). According to the observations, the Teachers 3, 4 and 5 extensively used such evaluation methods and techniques as question & answer, multiple choice, short answers and true/false. The use of student textbooks in the classes conducted by the Teachers 1, 2, 6 and 7 led to the conclusion that they also employed such alternative measurement and evaluation techniques as diagnostic tree structured grid in addition to the traditional measurement and evaluation techniques. However, it can be argued that the Teachers 1, 2 and 7 failed to succeed in using such techniques in line with the constructivist approach despite their efforts, while the Teacher 6 managed to use the same significantly in line with the constructivist approach. Two issues come to the fore in this study. The first issue is about the use of alternative measurement and evaluation techniques such as diagnostic tree and structured grid. Some of the previously conducted studies suggest that teachers very rarely, if not ever, use such techniques. However, as mentioned above, it was established that the Teachers 1, 2, 6 and 7 actually employed such techniques in their classes as part of the student textbook. Another significant issue involves the teachers' performances and project duties. Some of the previously conducted studies (Gömleksiz, Yıldırım and Yetkiner, 2011; Sağlam-Arslan et al., 2009; Yazıcı, 2012) found out that teachers tend to use their own performances and project duties more than other methods and techniques. However, the present study found that the teachers did not include their own performances and project duties in their classes and did not have students create product files. According to the observations, the students were not asked to evaluate themselves or each other. Only in the classes of the Teacher 6, the students were asked to evaluate each other in accordance with the traditional approach. Similar results were also achieved by Gelbal and Kelecioğlu (2007) and Karakuş (2010).