

**EXPLORING THE CHALLENGES THAT SCIENCE
TEACHERS FACE IN PROJECT-BASED SCIENCE TEACHING**

Eylem Bayir, Hasan Ozyildirim

ABSTRACT:

Bringing up scientifically literate individuals is the primary aim of science education. One of the most important instructional model to provide students being scientifically literate is project-based teaching. Project-based learning is a model that organizes learning around projects. This model of teaching engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks. In this complex process, teacher has many roles such as coach, facilitator, guide, advisor and mentor. In order that teachers successfully carry out their roles, their challenges which they face in this complex process should be identified, and ways of solution should be developed. In this study, it is aimed to explore the challenges which science teachers faced in project-based learning. The cases of this study comprises thirty science teachers who guides groups of students in preparing projects for national competitions of science projects. Data which were collected through the 6-question open-ended questionnaire were analyzed by using content analysis methodology. According to data, they evaluated their challenges in project-based learning in term of four scopes: curriculum, inadequacies of students, physical inadequacies, inadequacies of teachers. It is concluded from this study that science teachers need in-service education about project-based learning and teaching.

Key words: Project-based learning, science education, teacher education

INTRODUCTION

Bringing up scientifically literate individuals is the primary aim of science education. One of the most important instructional model to provide students being scientifically literate is project-based teaching. Project-based teaching is a model that organizes learning around projects. The assumptions underlying the project-based science teaching are based on a social constructivist viewpoint (Blumenfeld et al., 1996). In this teaching model, it is assumed that students need to find solutions to real problems by asking questions and refining questions, designing and conducting research, gathering and analyzing data, and making conclusions. This process models the work that a scientist does when

doing science. In the project preparation process, just like scientists, students ask questions and try to find answers that will help them to explain their own world (Gültekin, 2005; Bell, 2010). The students put out some products and they share what they do with their environment as well as the scientists share the research results with others. Cooperation and communication are seen as essential in this process (Diehl et al., 1999; Krajcik et al., 1999). Project-based teaching focuses on researching students' real problems as an example of "learning by doing" and has the potential to increase students' knowledge of the subject field and their ability to think (Krajcik et al., 1994). Project-based science teaching helps students develop meaningful insights into scientific ideas and their own learning (Ladewski et al., 1994). The prepared projects are also bridging the scientific concept and the principle of daily life experiences (Krajcik et al., 1994). Students develop characteristics such as creativity, open-mindedness and imagination that are the essential qualities of successful scientists. From all these perspectives, project-based science teaching has emerged as a teaching approach to developing a learning environment that reflects the nature of science (Krajcik et al., 2003). Although there are strong gains of project-based learning for students, it is stated in the literature that teachers have challenges in implementing this pedagogy (Krajcik et al., 1994). In this complex process, teacher has many roles such as coach, facilitator, guide, advisor and mentor. In order that teachers successfully carry out their roles, their challenges which they face in this complex process should be identified, and ways of solution should be developed. Stake and Easley (1978) argue that teachers need to take into account the challenges they encounter when applying project-based teaching and support them in order to cope with these challenges; otherwise the adoption of project-based learning by teachers would not be possible even in the long run.

In accordance with the philosophy of the science curriculum used in our country, it is demanded that the teachers have students to prepare various projects within the scope of science lessons. In addition, various project competitions or exhibitions carried out nationally in our country encourage teachers have their students to prepare various projects. All of these situations show that teachers can not stay away from project execution. Despite the being of above-mentioned strong gains of project-based learning as well as the demands and the incentives throughout the country, the challenges faced by teachers during the project preparation process can cause teachers to stay away from this pedagogy practice. For this reason, it is important to investigate the challenges faced by science teachers in process of having students to prepare project, and to determine

their solution proposals to these challenges. For this purpose, it is aimed in this study to determine the challenges faced by science teachers in process of having students to prepare project, and to find out their solution proposals to these challenges.

AIM OF THE STUDY

In this study, it is aimed to explore the challenges which science teachers faced in project-based teaching.

SAMPLING OF THE STUDY

The sampling of this study comprises thirty science teachers who guide groups of students in preparing projects for national competitions of science projects.

INSTRUMENT

The data were collected using a 6-question open-ended questionnaire on teachers' challenges in having students to prepare project.

ANALYSIS OF DATA

Qualitative data collected by means of the open-ended questionnaire measurement tool were analyzed by using content analysis methodology.

FINDINGS

When the obtained qualitative data are analyzed by using the content analysis methodology, it is revealed that the teachers have four types of challenges in their experiences in having students to prepare projects. These; challenges related to the inadequacies in science curriculum, challenges related to the inadequacies of students, challenges related to the physical inadequacies and challenges related to the inadequacies of teachers. Each kind of challenges coming up in the result of content analysis of the teachers' statements is assigned as a code. The codes and the categories under the codes are given in Table-1, Table-2, Table-3 and Table-4 as follows:

Table-1: Code-1 and Categories Belonging to Code-1

<i>Code 1: Challenges Related to the Inadequacies in Science Curriculum</i>	
<i>Categories (2)</i>	Being inadequate of the attainments on project preparation in the science curriculum.
	Inadequate lecture hours for science teaching at school is a problem for the project preparation process.

Table-2: Code-2 and Categories Belonging to Code-2

<i>Code 2: Challenges Related to the Inadequacies of Students</i>	
<i>Categories (11)</i>	The lack of infrastructure of students about the answer of questions such as “What is project, how is a project planned? How to prepare a project?” (One of the most time-consuming steps to get students to understand what a project is)
	Not having of students enough knowledge about how to conduct research.
	Inability of students in effectively using of materials, tools library, internet, environment for projects.
	Not knowing of students how to make presentations of projects after projects are completed.
	Having of students prejudice against the projects involving experimental work.
	Waiting of students from their teachers to determine the themes of their projects.
	Problems of division of labor and responsibility in project groups.
	Not having of students enough time for projects outside of class hours.
	The low level of motivation of students to research or to think for determining the themes of projects.
	Not being aware of students that creativity is important in projects.
	Requesting of students from their parents to prepare almost whole of their project.

Table-3: Code-3 and Categories Belonging to Code-3

<i>Code 3: Challenges Related to the Adequacies of Teachers</i>	
<i>Categories (5)</i>	Feeling themselves inadequate in their knowledge in specific subjects of science(for example how is the iodine analysis done in the soil?).
	Feeling themselves inadequate in identifying and finding working themes for projects (one of the most time-consuming steps).
	Feeling themselves inadequate in determining the suitability of projects for student level.
	Feeling themselves inadequate in supporting students in projects that require computer technology.
	Feeling themselves inadequate in finding the original project topics of the teachers.

Table-4: Code-4 and Categories Belonging to Code-4

<i>Code 4: Challenges Related to the Physical Adequacies</i>	
<i>Categories (5)</i>	Material/tools inadequacy for preparing projects.
	Financial impossibility for preparing projects.
	Not being suitable laboratory/other place for preparing projects.
	Not attaining the sources of information to be used for the project in the immediate vicinity.
	Not being internet connection in all schools or houses of students.

Content analysis of teachers' expressions revealed that the suggestions of teachers to solve these challenges is in the following categories (Table-5):

Table-5: Code-5 and Categories Belonging to Code-5

<i>Code 5: Suggestions of Teachers for the Challenges</i>	
<i>Categories (6)</i>	Teachers should be given in-service trainings on the process of project preparation by academicians at universities.
	Schools should cooperate with universities during process of project preparation.
	Teachers candidates should be given lessons for the process of project preparation in their undergraduate education.
	Guide books on project preparation should be distributed to teachers.
	There should be a separate lesson in project preparation at school.
	Project study rooms should be established at schools for students.

RESULTS AND DISCUSSION

When the findings are examined, it is revealed that the science teachers linked the challenges experienced by them in having students to prepare project to the science curriculum, to students, to themselves and to physical conditions. With respect to the inadequacies in science curriculum; the lecture hours for science teaching at school and the attainments on project preparation are the two points that that teacher focused on. Teachers feel themselves inadequate in many ways. However, all the aspects that teachers find themselves inadequate are based on the lack of knowledge in various subjects. Additionally, teachers identified many aspects about students' inadequacies in project preparation. These aspects are mostly related to the lack of knowledge and motivation of the students. In fact, it can be said that the deficiencies in the students are the situations teachers may be responsible for, and that it is possible to solve them by the teachers. It has also emerged that teachers assess physical inadequacies in terms of material, financial and access to information resources. These results are in line with the results of studies on the challenges teachers experience in project-based teaching in the literature (Blumenfeld et al., 1994; Edelson et al., 1999; Hertzog, 1994; Krajcik et al., 1994; Krajcik et al., 1998; Ladewsk, et al.,1991; Marx et al., 1997; Rosenfeld et al., 1998).

In the context of the findings, it is concluded from this study that the demand for the elimination of these challenges is mostly related to the in-service training and the cooperation of the universities with the schools. It has been revealed that the in-service training programs about project-based learning and teaching to be carried out by the cooperation of university-national ministry of education / provincial directorates of

national education for science teachers have to be implemented. The literature also shows that there is a need for professional development courses in this regard in order to overcome the challenges faced by teachers in project-based teaching (Marx ve diđ., 1997). Provision of facilities at schools such as project study rooms, separate lessons for project preparation and guide books on project preparation are other solutions of the participating teachers for the challenges. As a result, the two most fundamental ways of solving the problems on project-based teaching experienced by teachers are in-service training for teachers and the provision of physical facilities.

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Author Info:

Eylem Bayir, Associate Professor, Doctor
Trakya University, Edirne, Republic of Turkey
eylembudak76@gmail.com

Hasan Oyildirim, Assistant Professor, Doctor
Trakya University, Edirne, Republic of Turkey
hozyildirim@gmail.com