A study on evaluation of the biology projects submitted to the TUBITAK secondary education research projects contest from the Bursa Region

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Abstract

This study evaluates, through the employment of scientific methods and techniques, a total of 107 Biology projects submitted by secondary education students to the Bursa Region Coordinatorship of TUBITAK (a region which encompasses the municipalities of Afyonkarahisar, Balikesir, Bilecik, Canakkale, Eskisehir, Kutahya, and Yalova). The projects were submitted to research project contests held between the years of 2009 and 2012. The projects were assessed in terms of which subjects they focused on, and the following criteria were employed in their evaluation: originality, creativity, consistency, contribution, utility, applicability, usefulness, clarity of results, and the selection and the use of technical instruments and apparatuses. Some suggestions have been put forward so as to solve the most common problems in projects such as originality, creativity and applying scientific method. In addition, the theoretical and technical methods used in the evaluation and the selection of the projects were elaborated upon and, as an additional step, the suitability of the measurements and the evaluative operations employed within the evaluative process was discussed.

Keywords: Biology project, Scientific criteria, Secondary education.

Introduction

The scientific world of our time progresses rapidly, which in turn necessitates the implementation of various changes in pedagogical methods. The individual (whose general position has hitherto been passive) has begun to play an active role in terms of attaining and conveying information. This change in the learning patterns of individuals has also been reflected in the pedagogical methodology in current use. One of these methods is project-oriented learning, which is an effective tool used in solving interdisciplinary (math, science, social sciences etc.) problems (Dede and Yaman, 2003; Kufrevioglu, Baydas and Goktas, 2011).

Projects are collective or individual studies wherein students may freely participate and which are designed for the solution of a problem pertaining to the acquisition of a skill or the comprehension of a notion. That a student may independently decide how and in what order he/she may solve the given problem is the fundamental characteristic of a project (Dede and Yaman, 2003; Korkmaz and Kaptan, 2001). The problems may either be persistent problems which the students previously faced (but were unable to solve), as well as brand new problems which were never encountered before (Dede and Yaman, 2003). Project preparation is of vital importance in the solution of such problems. Project design process includes all actions from the emergence of idea through writing out, developing, implementing, and evaluating it as well as generating new ideas based on it (İçelli et al., 2007). Within this process, students plan their learning processes in line with particular goals individually or in group, do research, work in cooperation, take responsibility, collect information, and organize the collected information (Yurtluk, 2005). It is mostly under the responsibility of students to reach and properly use the information (Demirhan and Demirel, 2003). A product is created during or after the project, and the individual acquires new information and/or experience which he/she will use in life (Blumenfeld et al., 1991; Blumenfeld et al., 1994; Marx et al., 1997; Thomas, 2000). For the last few years, projects have been gaining increasing acceptance in both public and private education, and their results are often shared with the public. Such projects employ scientific methods and techniques, and may focus on both curricular and extracurricular subjects. One of these activities is the research project contest carried out by TUBITAK. These contests, as Okan (1989) also says, are the first contests which make use of the project technique in Turkey.

The Scientific and Technological Research Council of Turkey (TUBITAK) holds the "Research Project Competition for Secondary Education Students" every year to encourage secondary education students to carry out study in the fields of basic research and social studies, to steer their studies, and to contribute to their scientific development. The 46th competition is carried out in 2015. The competition covers the 9th, 10th, 11th, and 12th grades of secondary education institutions. 50 projects selected in 12 regional exhibitions become entitled to participate in the final exhibition held in Ankara, the capital city of Turkey. The projects selected for the final exhibition are about Computer, Biology, Physics, Chemistry, Mathematics, Geography, Psychology, Sociology, Turkish Language and Literature, and History. The yearly distribution of the projects invited to the final exhibition varies by the project nature and the number of initial applications. The projects are evaluated by academicians who are specialized in relevant fields. In evaluation, attention is focused on criteria such as originality and creativity in defining and approaching the project problem; preparation of the project plan; appropriateness of the materials and methods employed in the project for the problem; skill of, attention to, and diligence in the design and investigation of the problem; continuing the efforts from the definition to the solution of the problem; the establishment of cause and effect relationships in the examination of the results and the clarity of such relationships; quality in report-writing; and reference to the organizations, institutions, and sources from which help has been received.

As is known, scientific research has certain characteristics. Cohen, Manion, and Morrison (2000) who touch upon these characteristics state that research must be systematic and controlled, include deduction and induction, and be subjected to investigation for the ideas and views indicated in it to be tested, and its results must be discussed by scientists for its accuracy to be accepted or rejected (cited in Ekiz, 2009). Considering these characteristics which are supposed to underlie scientific research, the criteria by which projects are evaluated are of great importance. As indicated by Özer and Özkan (2011), the evaluation of research projects must be made based on the following criteria: originality of the project; accuracy of the knowledge; determination of the problem; working plan of the project; distribution of tasks in the group; determination of the need; literature review; the fitness of the tools suggested for experiment and observation for purpose; explanation of the testing procedure; selection of proper statistics; data analysis; presentation of the findings; interpretation of the findings based on relevant sources; recommendations for future work; providing references; answering the questions during presentation; presenting the subject in such a way that it attracts the attention of the audience; supporting the presentation with materials appropriate for the objective; language use and coherence of explanations in the presentation; making the presentation in the prescribed time; and the collaboration and harmony of group members during the presentation.

Güngör et al, (2013) provided project evaluation criteria under eight main titles (1-Determination of Problem, 2-Originality and Creativity, 3-Scientific Method, 4-Consistency and Contribution, 5-Usefulness, 6-Implementability, 7-Literature Review, 8-Result) and put some sub-scales under these titles. It is clear that these criteria include all the characteristics which a scientific project has to bear. In this regard, the present study mainly aims to evaluate 107 biology projects that were submitted to Bursa Regional Coordinator's Office by secondary education students between 2009 and 2012 within the scope of the "Research Project Competition for Secondary Education Students" held by TUBITAK on the basis of scientific research methods and techniques, to determine the quality of these projects, and to identify their status relative to those in Bursa Region and those in Turkey as a whole. Among other aims of the study are to help those students and teachers who are to engage in projects in the subsequent years manage and finalize the project process better and to demonstrate certain deficiencies.

Method

Document analysis, which is a data collection method for qualitative research, was used for evaluating the biology projects joining the "Research Project Competition for Secondary Education Students" held by TUBITAK-BIDEB (The Science Fellowships and Grant Programmes) based on the criteria of determination of problem, originality and creativity, scientific method, consistency and contribution, usefulness, implementability, literature review, results. Document analysis is a research method used for making valid and reliable inferences out of texts (Krippendorff, 2004). It involves the analysis of written materials that contain information about the phenomenon or phenomena that is/are subject to research.

The Sampling procedure

The projects joining the national "Research Project Competition for Secondary Education Students" regularly held by TUBITAK-BIDEB in Turkey every year are evaluated based on project reports by biology juries in 12 different regional scientific boards cross Turkey. The projects which are found suitable for exhibition through such preliminary evaluation are invited to exhibitions held in regional scientific boards. The students preparing those projects invited to exhibitions are interviewed by juries during exhibitions. At the end of regional exhibitions, regional finalists are determined. The finalists of 12 regions are invited to Turkey Final Competition where the projects are re-evaluated. In this way, the best projects in Turkey are selected by discipline.

In the present study, research universe consists of biology projects joining the above-mentioned competition, and research sample consists of 107 biology projects that applied to the competition in Bursa Region, which is one of the 12 regions, between 2009 and 2012 with an application form and a project report. The biology projects were divided into sub-groups based on subject areas through analysis of the keywords used in project reports (Figure 1).

Research tool

Data sources of the present study are (1) the application forms filled in by project owners during application to the competition and (2) the project reports. The application forms were used for determining the provinces from which most projects were submitted by year and the distribution of such years by year and school type.

The project reports were evaluated through content analysis based on the predetermined criteria (determination of problem, originality and creativity, scientific method, consistency and contribution, usefulness, implementability, literature review, results). Each evaluation criterion was taken as a category, and whether or not a document included the relevant category was investigated via Secondary Education Project Evaluation Chart. The evaluation instrument developed by Güngör et al., (2013) was used in evaluation. This chart consists of 8 main items and 23 sub-items. 8 main items are as follows: The Determination of Problem (DP), Originality and Creativity (OC), Scientific Method (SM), Consistency and Contribution (CC), Usefulness (U), Implementability (I), Literature Review (LR), and Result (R). The items in the chart were answered with the following responses: "Yes" (2), "Partly" (1), "No" (0). The expert opinions and recommendations were taken concerning the Secondary Education Project Evaluation Chart in order to ensure scope validity of the scale.

The projects were evaluated on the chart in accordance with predetermined criteria by two different experts. The qualitative data thus obtained were quantified via content analysis. A normality test was performed on the data obtained from the expert evaluators. The results can be found in Table 1. The SPSS 18.00 was used in the normality analysis of the data obtained after evaluating 107 biology projects, as well as in the compatibility tests between the evaluators. Moreover, the f and % values were calculated for the qualitative data.

Kolmogorov-Smirnov test demonstrated that data did not display a normal distribution (Özdamar, 2011). Thus, Kendall's tau-c coefficient was used for interpreting the research data.

Table 1. The analysis of normality of the data obtained by expert evaluators

Criteria	N	Mean	SD	Kolmogorov-Smirnov Z	p
a) The determination of problem	214	2.68	0.126	0.150	0.00*
b) Originality and creativity	214	0.75	0.068	0.292	0.00*
c) Scientific method	214	5.47	0.271	0.216	0.00*

d) Consistency and contribution	214	2.20	0.116	0.172	0.00*
e) Usefulness	214	1.64	0.118	0.207	0.00*
f) Implementability	214	0.65	0.042	0.311	0.00*
g) Literature review	214	2.15	0.124	0.162	0.00*
h) Result	214	2.21	0.091	0.221	0.00*

*p<0.05

According to Table 1, the data obtained from the expert evaluators do not fit normal distribution. For continuous data which do not display a normal distribution, the Kendall's tau c cofactor was used for the correlation between the expert evaluators. The consistency values between the expert evaluators were calculated with the Kendall tau c cofactor, based on the total scores from every section. The meanings of Kendall’s tau-c coefficients are as follows:

>0.50 : High-level correlation,

0.36-0.49 : Significant correlation,

0.20-0.5 : Intermediate level correlation,

0.10-0.19 : Low-level correlation,

< 0.10 : No correlation.

There is a high correspondence between the scores of expert evaluators pertaining to the criteria of *The Determination of Problem* (τ_c= 0.769), *Originality and Creativity*(τ_c= 0.666), *Scientific Method* (τ_c= 0.825), *Consistency and Contribution* (τ_c= 0.799), *Usefulness* (τ_c=0.693), *Implementability* (τ_c= 0.510), *Literature Review*(τ_c= 0.759) and *Result* (τ_c= 0.898).

Results

In the present study, 107 biology projects participating in secondary education students to the Bursa Region Coordinator ship of TUBITAK-BİDEB were evaluated. The distribution of the projects applying to competition between 2009 and 2012 by years is given in the Table 2.

Table 2. The number of projects in biology

Biyoloji Alanındaki Yarışma Süreci	The Number of Projects				Total
	2009	2010	2011	2012	
Comer To Regional Science Board	25	19	27	36	107
Invited To Bursa Regional Exhibition	8	9	5	9	31
Invited To Turkey Selections	1	1	1	2	5
The Award-Winning By Being Placed In The First Fifty In Turkey Selections	1	1	1	2	5

According to the Table 2, 31 of 107 projects coming to the Regional Science Board were invited to Bursa Regional Exhibition. Of these projects, 5 projects were found worthy of being exhibited in Ankara for competition across Turkey. All the relevant projects won nationwide prizes.

Table 3 lists the distribution of the school types in current secondary education by municipality. From the data in the table it may be inferred that public schools have a share of 93.08%, whereas private high schools make up 6.92%. Among the public schools, it is seen that Vocational High Schools have a share of 44.02%, Anatolian High Schools 18.37%, Science High Schools 2.67%, and regular high schools 20.6%. Among private schools, private Science High Schools have a share of 1.45% whereas private Anatolian High Schools have 0.97%, and private regular high schools have 4.5%.

Again according to Table 3, it is seen that 73 out of 107 biology projects (68.2%) hailed from public schools, whereas the remaining 34 (31.8%) were submitted by participants from private schools. As for private schools, 33 projects (30.8%) came from Anatolian High Schools, 6 (5.6%) from regular high schools, 17 (15.9%) from Science High Schools, and 16 (14.9%) from Vocational Schools. These ratios show that although the number of public schools was higher than other organizations, the participation was lower at these schools. These data also show that the number of project applications is not proportional to the number of schools.

Table 3. The distribution of the projects submitted to TUBITAK regional science committees by municipality and school type (as well as the official distribution of the school types)

School Types			Cities									Official Data %
			Afyonkarahisar f(%)	Balikesir f(%)	Bilecik f(%)	Bursa f(%)	Canakkale f(%)	Eskisehir f(%)	Kutahya f(%)	Yalova f(%)	Total f(%)	
Public Schools 73 – 68.2%	Vocational Schools	Vocational High Schools	0	1 (0.9)	0	1 (0.9)	0	1 (0.9)	0	0	3 (2.8)	1.58
		Anatolian Technical High Schools, Vocational High Schools, Industrial Vocational High Schools	0	1 (0.9)	0	1 (0.9)	0	0	0	0	2 (1.9)	10.9
		Anatolian Medical Vocational High Schools and Medical Vocational High Schools	0	1 (0.9)	0	0	0	0	0	0	1 (0.9)	5.6
		Anatolian Imam Hatip (Religious) High Schools and Imam Hatip (Religious) High Schools	0	0	0	1 (0.9)	0	0	0	0	1 (0.9)	9
		Military High Schools	0	0	0	4 (3.7)	0	0	0	0	4 (3.7)	0.12
		Police Schools	0	0	0	5 (4.7)	0	0	0	0	5 (4.7)	0.12
		Other	0	0	0	0	0	0	0	0	-	16.7
	Regular High Schools		1 (0.9)	0	0	4 (3.7)	1 (0.9)	0	0	0	6 (5.6)	20.6
	Multi-Program High Schools		0	0	0	1 (0.9)	0	0	0	0	1 (0.9)	6.69
	Anatolian High Schools		4 (3.7)	3 (2.8)	1 (0.9)	14	0	11 (10.3)	0	0	33 (30.8)	18.37
	Science High Schools		0	1	2	0	0	10	4	0	17	2.67

				(0.9)	(1.9)			(9.3)	(3.7)		(15.9)	
	Social Sciences High Schools		0	0	0	0	0	0	0	0	-	0.73
Private 34 - 31.8%	Anatolian High Schools		0	1 (0.9)	0	9 (8.4)	0	0	2 (1.9)	0	12 (11.2)	0.97
	Science High Schools		1 (0.9)	0	0	9 (8.4)	0	0	0	0	10 (9.3)	1.45
	Private High Schools		4 (3.7)	1 (0.9)	0	2 (1.9)	0	0	5 (4.7)	0	12 (11.2)	4.5
Total			10 (9.3)	9 (8.4)	3 (2.8)	51 (47.7)	1 (0.9)	22 (20.6)	11 (10.3)	0	107 (100)	100

The distribution of the submitted projects by year and school type is given in Table 4. According to the table, the greatest number of Biology projects came from Anatolian High Schools (30.8%) and Science High Schools (15.9%). Private schools are at 31.7%. It is remarkable that regular high schools have significantly low application numbers (5.6%). According to the Table 3, the biggest number of applications was in 2012 in which 36 (33.6%) projects were submitted, and the fewest number of applications was in 2010 in which just 19 (17.8%) projects were submitted. On the other hand, it is understood that the highest number of applications came from Private Schools in 2012 (31.7%), from Public Schools in 2011 (21.2%), from Science High Schools in 2009 (6.5%), and from Anatolian High Schools in 2011 (14%). Based on the numbers, it is understood that there is a disorder in applications. As can be seen from Table 4, it is remarkable that the number of applications from science high schools have been dropping every year, whereas this number is on the rise for regular high schools.

In Turkey, educational activities are mostly university entrance exam oriented in science high schools which admit students with high scores. Out-of-school activities such as project competitions are considered just a loss of time and an obstacle to preparation for university entrance exam by science high students and their parents. These kinds of activities are subjected to alternative assessment and evaluation by teachers working in regular high schools, which include students with a relatively lower achievement, so that they contribute to educational process. Teachers in these schools give a performance grade to their students based on such activities. In addition, with an agreement between the Ministry of National Education and

TUBITAK, a decision has been made to give fee to project advisors; and the Ministry of National Education has called teachers and students to join project competitions, which may be the reason why the number of project applications from public schools has increased (Table 4).

Table 4. The distribution of the submitted projects by year and school type

	School Types		2009	2010	2011	2012	Total f(%)
Public Schools	Vocational Schools	Vocational High Schools	1 (0.9)	0	1 (0.9)	1 (0.9)	3 (2.8)
		Anatolian Technical High Schools, Vocational High Schools, and Industrial Vocational High Schools	2 (1.9)	0	0	0	2 (1.9)
		Anatolian Medical Vocational High Schools, and Medical Vocational High Schools	0	0	0	1 (0.9)	1 (0.9)
		Anatolian Imam Hatip (Religious) High Schools, and Imam Hatip (Religious) High Schools	1 (0.9)	0	0	0	1 (0.9)
		Military High Schools	1 (0.9)	1 (0.9)	1 (0.9)	1 (0.9)	4 (3.7)
		Police Schools	0	0	1 (0.9)	4 (3.7)	5 (4.7)
		Other	0	0	0	0	0
	Regular High Schools		0	1 (0.9)	1 (0.9)	4 (3.7)	6 (5.6)
	Multi-Program High Schools		0	0	1 (0.9)	0	1 (0.9)
	Anatolian High Schools		2 (1.9)	8 (7.5)	15 (14)	8 (7.5)	33 (30.8)
	Science High Schools		7 (6.5)	5 (4.7)	3 (2.8)	2 (1.9)	17 (15.9)
	Social Sciences High Schools		0	0	0	0	0
Private Schools	Anatolian High Schools		0	0	3 (2.8)	9 (8.4)	12 (11.2)
	Science High Schools		3 (2.8)	2 (1.9)	1 (0.9)	4 (3.7)	10 (9.3)
	Private High Schools		8 (7.5)	2 (1.9)	0	2 (1.9)	12 (11.2)
Total		25 (23.4)	19 (17.8)	27 (25.2)	36 (33.6)	107 (100)	25 (23.4)

Based on the distribution by provinces, it is seen that the biggest number of applications came from the following provinces: Bursa (47.7%), Eskişehir (20.5%), Kütahya (10.3%), Afyonkarahisar (9.4%), Balıkesir (8.4%), Bilecik (%2.8), Yalova (0%), and Çanakkale (0.9%).

Based on the gender distribution of the students designing projects, it is seen that 21 (%11.23) females/23 (%12.3) males designed projects in 2009; 21 (%11.23) females/9 (%4.81) males designed projects in 2010; 23 (%12.3) females/23 (%12.3) males designed projects in 2011; 28 (%14.97) females/39 (%20.86) males designed projects in 2012. When we inspect the gender distribution of all projects between 2009 and 2012, it is seen that 94 of them are from boys (50.27%) whereas 93 (49.73+) are from girls.

It is understood that there were more projects about Microbiology (23.4%), Plant Development and Physiology (23.4%), Human Anatomy and Physiology (13.9%), Ecology (11.3%), and Economic Botany (%6.5) in comparison to other sub-subject areas (Figure 1).

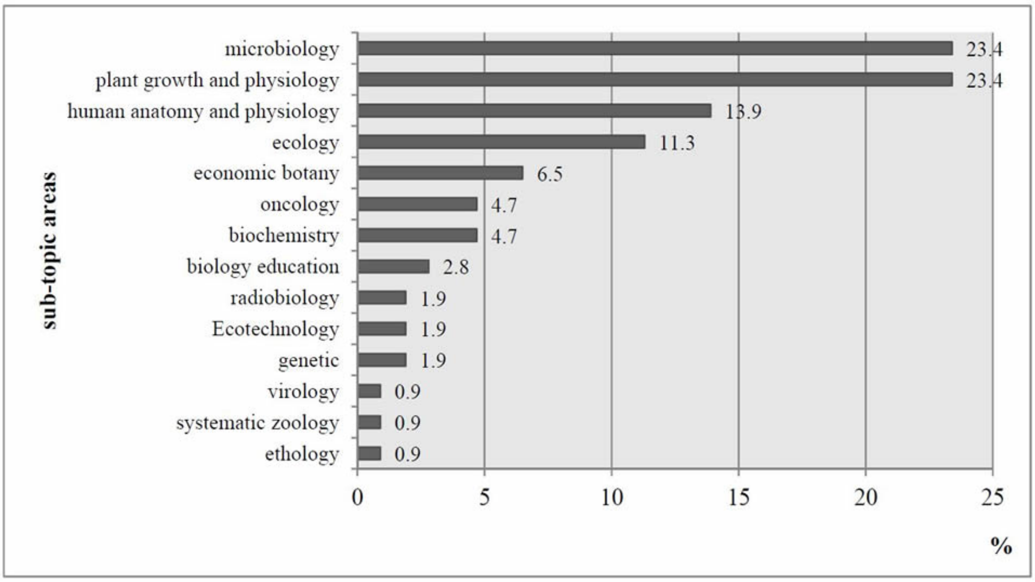

Figure 1. The distribution of biology projects by sub-subject areas

The Table 5 presents the findings obtained from the Secondary Education Project Evaluation Chart. The results were interpreted by taking the average of two different expert evaluators.

According to the Table 5, the subject and problem were clearly determined in 50.5% of 107 projects, and partly determined in 34.5%. 38.8% of students provided a partial clear definition of the problem intended to be solved through project. However, 35.0% of students failed to provide any clear definition. It was seen that sub-problems were not determined in 67.8% of the projects.

It was found that 53.3% of the projects did not have original subjects, and 85% did not have a creative nature.

Table 5. The secondary education project evaluation chart

Criteria	2009-2012			
	YES (%)	PARTLY (%)	NO (%)	TOTAL (%)
a) The Determination of Problem				
1) Problem was determined.	50.5	34.5	15.0	100
2) Problem was clearly defined.	26.2	38.8	35.0	100
3) Sub-problems were determined.	8.8	23.4	67.8	100
b) Originality and Creativity				
1) Subject is original.	10.3	36.4	53.3	100
2) A method different from the previous ones is used for dealing with the subject.	2.8	12.2	85.0	100
c) Scientific Method				
1) Hypothesis was established.	32.7	25.7	41.6	100
2) A plan was developed for the method to be followed.	33.2	48.1	18.7	100
3) Method contained necessary variables for testing the hypothesis.	25.7	33.6	40.7	100
4) Experimental processes were carried out.	36.5	32.7	30.8	100
5) Sufficient data were collected.	19.2	36.9	43.9	100
6) Data analysis was properly performed.	15.8	43.5	40.7	100
d) Consistency and Contribution				
1) There is a consistency between purpose and result.	42.5	37.4	20.1	100
2) There is a consistency between problem and sub-problems.	20.6	35.0	44.4	100
3) Provides a new approach to impart a new method or field.	4.7	11.7	83.6	100
e) Usefulness				
1) It can be used for different scientific and technical fields.	9.3	29.9	60.8	100
2) An added value can be introduced to economy.	9.3	33.2	57.5	100
3) Benefits can be provided to society.	9.8	42.5	47.7	100
f) Implementability				
1) It can be used to solve other problems	4.2	55.1	40.7	100

related to the field results have been presented.				
g) Literature Review				
1) Necessary sources were reached.	22.0	53.3	24.7	100
2) Sources were used in the Project Report.	20.6	35.5	43.9	100
3) Sources were associated with the project subject.	10.8	18.7	70.5	100
h) Result				
1) The project was finalized.	52.8	35.5	11.7	100
2) Data were correctly interpreted.	15.0	46.8	38.2	100

When we examine the scientific method used for solving the problems detected in the projects it was determined that no hypothesis was established in 41.6% of the projects, 33.2% of the projects had a plan concerning the method to be followed for reaching a solution, 18.7% did not develop any plan concerning the method to be followed for reaching a solution, and 40.7% had methods not containing the variables required for testing the project hypothesis. It was concluded that 36.5% of students performed the experimental processes as required by projects, but 30.8% did not perform such processes. 43.9% of students failed to collect sufficient data at the end of these processes. The proper analysis of the collected data was partly conducted by 15.8% of students. 40.7% of students failed to conduct a proper analysis of the collected data.

Based on the examination of the consistency between purposes and solutions, it is seen that there was just a consistency between purpose and solution in 42.5% of the projects. 44.4% of the projects failed to ensure a consistency between problems and sub-problems. 83.8% of the projects did not introduce any new method to literature, and 11.7% partly achieved it. Based on the examination of the usage of the projects in different scientific and technical fields and usefulness for economy and society, it is seen that 60.8% of the projects did not have any feature to be used in different scientific and technical fields, 57.5% would not create any added value for economy if they were implemented, 9.3% would provide a partial added value for economy if they were implemented, and 47.7% did not provide any benefit to society. It was seen that 4.2% of the projects put forward solutions that could be used for solving the problems about related fields.

Based on the examination of the projects in terms of literature review and report writing, it is seen that 22.0% of the projects reached necessary scientific sources, 53.3% partly reaches such sources, and 43.9% did not use such sources in the project report. The percentage of those who were unable to associate the attained sources with the project topic was 70.5%. 52.8% of the projects were finalized. In 15% of the projects, obtained data could be interpreted by establishing a cause and effect relationship.

Kruskal-Wallis test was carried out for determining whether there was any year-dependent significant difference between the results introduced by 8 criteria included in the Secondary Education Project Evaluation Chart (Table 6). This test is a non-parametric alternative of the inter-group one way analysis of variance. This analysis allows making a comparison of three or more groups that have continuous variables.

Because the level of significance in the three criteria (utility, applicability, and source scanning) were lower than 0.05, it may be said that these three criteria displayed significant difference over years (Table 6). The group medians for the following criteria show a similar distribution over years: the determination of the problem, creativity and originality, the scientific method used, results, consistency, and contribution.

Table 6. The results of analysis of the criteria included in the evaluation chart for biology projects event for secondary school students by years

Criteria	df	The Value of Kruskal-Wallis	p
a) The determination of problem	3	5.142	0.162
b) Originality and creativity	3	2.425	0.489
c) Scientific method	3	0.955	0.812
d) Consistency and contribution	3	4.178	0.243
e) Usefulness	3	28.959	0.000*
f) Implementability	3	13.597	0.004*
g) Literature review	3	12.508	0.006*

*$p<0.05$

The year-dependent means of the criteria included in the chart were calculated. The related results are given in the Table 7. Based on the mean ranks, it is seen that *Scientific Method* was more successful in 2009, *Literature Review* was more successful in 2010, *Usefulness* was more successful in 2011, *Literature Review* was more successful in 2012; but *Usefulness* failed in 2009 and 2010, *Literature Review* failed in 2011, *Scientific Method* failed in 2012.

Table 7. The mean ranks of the criteria included in the evaluation chart for biology projects event for secondary school students by years

	Year	N	Criteria							
The Mean Ranks	**2009**	25	53.76 c	53.1 h	51.12 d	48.06 g	48.04 b	43 a	38.64 f	35.92 e
	2010	19	66.55 g	57.92 h	57.39 c	54.92 b	54.45 f	51.13 a	48.34 d	36.21 e
	2011	27	74.43 e	68.48 f	64.31 d	60.3 b	59.02 a	56.76 c	51.98 h	39.69 g
	2012	36	62.24 g	60.63 e	59.39 a	54.07 h	53.57 f	52.93 b	51.25 d	50.31 c

In addition, when we examine these projects in terms of their mean rank, it is seen that they have been: successful in the following criteria: Scientific Method in 2009, Literature Review in 2010, Usefulness in 2011, Literature Review in 2012, unsuccessful in the following criteria: Usefulness in 2009 and 2010, Literature Review in 2011, Scientific Method in 2012 (Table 7).

Conclusion

The project works that are not based on scientific terms, concepts, and approaches do not only cause loss of time and effort for non-interesting subjects, but also make teaching difficult by causing a misunderstanding of many concepts. Craven and Hogan (2008) have indicated in their study that students do not fully grasp the conceptual infrastructure which undergirds project efforts. We must not allow this kind of an educational difficulty to be made worse through new project efforts. This in turn brings into question the scientific acquisitions of institutions. Supporting the place of a well-prepared project in the current structure of science and technology in a justifiable manner and through literature studies, reasoning over the hypotheses of it, and determining the conceptual and theoretical framework of it well increase the originality of the project. It should be noted that the methods chosen should be compatible with the purpose, support the suggested solution approach, and contain necessary variables. There should be appropriate infrastructure facilities for the project to be carried out. In addition, the project should be prone to obtaining broad results that can be employed in different fields, and have a capability to generate solutions to the problems of society.

When the projects were revised in accordance with evaluation criteria, it was seen that projects were mostly below the desired level or the level expected from related age groups, and the subjects were not processed well and planning was not good in the projects in which advanced level project subjects were selected. Moreover, the fields to which some subjects were close could not be determined by guidance counselors or related jury members until the final stage.

Based on evaluation by scientific criteria, Table 5 indicates that a partial success was achieved in the determination of problem (50.5%), the planning of method (33.2%), and the consistency between the purpose and solution of problem (42.5%) This partial success implies that the effort made for projects and assignments was not sufficiently understood and effectively implemented at educational institutions and organizations. If what was indicated in the related regulations and other instructions had been performed, higher values could have been obtained.

The subjects selected for projects should motivate students to study, provide them with skills to use tools and equipment, be about real life, pave the way for different studies, give an opportunity for them to develop their mental and physical abilities, cover desired activities, be freed from useless endeavors, should be worth of investment in the tools, equipment and references employed, and result in a proper output (Gözüm, et al., 2005).

Establishing a hypothesis is one of the most important stages of scientific research. Based on the evaluations made by experts in accordance with project evaluation criteria, it is seen that 41.6% of the projects are unsuccessful in making a prediction for the solution of problem and determining the way to be followed for reaching solution. If school administrators and other institutions and organizations make an effort in the matter of project management and support students and teachers, more successful results can be obtained (Özer and Özkan, 2012).

It was determined that the methods employed in most of the projects (40.7%) did not contain the variables necessary for testing the project hypotheses, and that the experimental processes required by the projects were not carried out (30.8%). It was observed that teachers and students were incompetent about scientific process skills despite high-level expectations in the MEB legislation. A serious lack of attention to utility and applicability is also the case.

Another problem is about proper data collection. It was understood that there were significant deficiencies in both recording the collected data (43.9%) and analyzing such data (40.7%). However, it is not technically difficult to eliminate this deficiency.

It goes without saying that originality has a special place in projects. If a project is based on research culture and problem-solving demands, it is needed to meticulously abide by a scientific research method, carefully plan such method, duly manage the process, and prepare result report. In consideration of the originality values of 107 Biology projects under examination, it is seen that those with the highest originality values only have an originality value of 10.3%, which points to another basic deficiency of the projects under examination. It was seen that although there was a partial consistency between the purposes and solutions of the projects, there was no consistency between the problems and sub-problems (44.4%). It was found that there was no search for a new method or for implementing a known method in another field within the scope of the projects under examination (83.6%). This situation evidently resulted from the deficiency in effective construction and association of scientific methods.

It was determined that majority of 107 projects did not have any feature to be used in different scientific and technical fields, did not contribute to economy and society, and did not have any capability to put forward any broad and usable result related to their fields.

It is remarkable that the level of use of the sources reached through literature review within project report was quite low (20.6%). This is obviously a very important deficiency. It means that the existing knowledge base about the project subject was not reached or effectively used. Accordingly, there is a deficiency about reaching the information, using the information, and associating the information with project outputs, which results from lack of mental preliminary preparation about the subject. It is thought that reminding our teachers of the fact that it is necessary to consider the research subject and knowledge and findings in the literature together through appropriate environments and conditions will make important contributions to advancement.

Another result obtained in the present study is that while 52.8% of the projects were finished completely, 35.5% were finished partially. In the prepared projects, there were serious problems about putting forward a product. One more result is that there was difficulty in interpreting the cause and effect relationship only in 15% of 107 projects.

In addition, when we examine these projects in terms of their mean rank, it is seen that they have been: successful in the following criteria: Scientific Method in 2009, Literature Review in 2010, Usefulness in 2011, Literature Review in 2012, unsuccessful in the following criteria: Usefulness in 2009 and 2010, Literature Review in 2011, Scientific Method in 2012. What this phenomenon indicates is that there has been no tendency towards a significant, continuous progress in the relevant time period.

Since it is necessary to conduct and finalize projects in coherence, the experts, teachers, and officials who are to take part in the selection of competition projects must act sensitively and carefully. This is why; it is required to ensure the use of the points such as originality, problem selection, hypothesis, consistency, scientific contribution, implementability, social benefit, and general effect as criteria in the evaluation of projects, and to teach that project preparation, implementation, and finalization refers to a process that must be conducted within the framework of scientific research methods and techniques. The selectors not having the above-mentioned competence should not be assigned. A separate teaching or recall is needed for each one of these criteria.

There are differences in the distribution of the projects by school types and years. The biggest number of project applications was made in 2012 in which 36 projects (33.6% of all projects under examination) were submitted. The fewest number of applications were made in 2010 in which 19 projects were submitted. Although it is possible to say that the programs and encouragements of the authorities on the projects were not influential over the years, which can be understood from the figures belonging to years. It is very clear that the inadequacies of teachers in terms of preparing, managing, and leading projects exert an enormous influence on this matter. Kufrevioglu et al. (2011) have reached similar results in their studies, reaching the conclusion that the problems faced during the preparation of the project stem from an ignorance of the project-building process (and the management thereof).

The fact that the private schools which have 6.92% of secondary school students have a share of 31.8% in all project applications is caused to a considerable extent by that an effective teacher and family support is provided at these schools and the projects are subjected to an elimination beforehand. It is understood that a special effort is made for students to participate in project competitions, which means that students at these schools are more motivated for participating in scientific activities. This situation strengthens the impression that the same scientific support and encouragement as well as assistance required for project design and management are not provided at public schools. Although the ratio of public schools in the region is 93.08%, the ratio of participation in scientific research and project activities is just 68.2%. The study conducted by Argon and Yılmaz (2006) where the dimensions having an effect on the educational processes at primary schools were examined demonstrated that "administrators" had the highest influence, and "students" and "school environment and parents" had the lowest influence. Non-inclusion of the environment where the school is located in educational processes through school activities causes students to be educated through a process where students are not integrated with environment. The study conducted by Gür and Batır (2009) determined that the students receiving education at public schools and their parents did not find adequate this free service of the state, thus spent much money for private educational institutions and training centers. This situation shows that there are important problems in the inclusion of students in active educational processes at these educational institutions.

Although private secondary schools make up 6.92% of all secondary schools located in 8 provinces, it is clear that the students of these schools are prepared by their teachers for participating in these kinds of activities more, and their wishes for participating in scientific activities receive more support by their institutions in comparison to their peers at public schools. The effective reflection of this support in tools, materials, self-confidence, original thinking, and reporting is easily understood from the evaluated projects. These results are closely related to project design in the context of the use of scientific methods besides the reflection of outlook on research, motivation and socio-economic level in education (Çeken, 2011, 2012). The teachers taking part in provincial and regional science boards for evaluating the projects submitted to competitions need to acquire realistic and consistent evaluation criteria as well as the qualifications to implement such criteria through an effective in-service training. It is understood that the projects sent from schools were prepared without complying with particular criteria, and that the goal was to increase the number of the projects sent. Although some studies conducted abroad demonstrate that public school students are more successful than private school students (Cutts and Moseley, 2001: p.375), the situation in Turkey is contrary to this finding (Köse, 1997, 261-270; Erdoğan, 2002: p.4). The student selections of private schools have a similar effect on these results.

It is seen that 73 projects (68.2%) came from public schools, 34 (31.8%) from private schools. Among public schools, 33 (30.8%) came from Anatolian High Schools, 6 (5.6%) from regular high schools, 17 (15.9%) from Science High schools, and 16 (14.9%) from Vocational High Schools. 8 projects were considered to be worthy of being exhibited on a regional level in 2009, 9 in 2010, 5 in 2011, 9 in 2012. Following nationwide competition, 1 project was deemed worthy of being exhibited in Ankara in 2009, 1 in 2010, 1 in 2011, 1 in 2012. In the exhibition in Ankara, all five projects won awards within the scope of nationwide competitions. 25 project applications were made to the project competition in 2009, 19 were made in 2010, 27 were made in 2011, and 36 were made in 2012. A total of 107 projects were submitted to the Secondary Education Research Projects Contest held by TUBITAK from the Bursa region, over the years from 2009 to 2012, on the subject of biology. Out of these, 31 projects were considered to be worthy of being exhibited by the scientific committees of the Bursa region after the first round.

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The projects in the field of biology are mostly about plants and environment. The fact that the studies on animals and certain microorganisms are considered harmful for human health and inconvenient in terms of animal rights has an important role in the prominence of the subject of plants. Project designs in the field of biology inspired by daily life can be regarded as a realistic approach. The fact that tools and equipment were easily supplied and plants were good experimental materials caused 23.4% of the submitted projects to be about Plant Physiology and Development, which was followed by Microbiology (23.4%), Human Anatomy and Physiology (13.9%), Ecology (11.3%), and Economic Botany (6.5%). Total ratio of the biology-related subjects mentioned under the aforesaid five sub-titles is 78.5%. The fact that the projects about Oncology, Biochemistry, Biology Education, Radiobiology, Ecotechnology, Genetic, Virology, Systematic Zoology, and Ethology constituted 21.5% of all projects shows that some project subjects were selected completely independently from the Science and Technology curriculum. This situation should be regarded in the sense that it requires an additional good preparation for research subjects. On the other hand, the diversity of subjects in biology provides participants with important conveniences in project design.

Suggestions

The following recommendations should be taken into consideration by the relevant authorities in order to increase the participation of high schools in Biology projects, to generalize the research culture, to eliminate the differences of participation between schools, to accommodate participation ratio to schooling rate, to raise the scientific and technological level of projects, and to make schools, teachers, students, and parents to be more interested in this matter:

1. Cooperation should be ensured between administration, teachers, students, and parents to provide participation in project competitions in accordance with the numbers of public schools,
2. The local reasons for low level of participation from public schools should be determined, and necessary measures should be taken,

3. Teachers and students should be provided with foreknowledge concerning project planning, content, method, and report writing,
4. The main problems projects should be selected from daily life; necessary time should be given to teachers serving as project managers; these teachers should be financially supported by school administrations,
5. Tool and equipment support should be provided to the students who prepare projects by school administrators, teachers, families, and other organizations,
6. The people or institutions that conduct, exhibit, organize, and publish scientific activities at high school level should be introduced to participants,
7. Encouraging students to do research or conduct a project should be turned into a consistent educational policy at public high schools,
8. The exaggerated desire to guide and manage at private schools should not turn into an instrument of pressure, fear, intimidation, or tedium in the course of time,
9. The fulfillment or non-fulfillment of particular rules or the degree to which such rules are fulfilled during project management should be determined through a project evaluation chart,
10. Ateliers, laboratories, libraries, and internet should be kept available for students to access when they want or need while designing or implementing a project,
11. Project subjects should be realistic and based on scientific data bases; scientific reality and imaginariness should not be confused; imaginariness and other similar approaches should be kept out of attention by both guiding counselors and students,
12. A particular attention should be paid to the preparation of management and work flow plan for projects that are practical and will end up with an output through experimental activities,
13. It should be taken into consideration that the evaluation criteria are not different from the criteria featured in the implementation of scientific research methods,
14. Experts, consultants or teachers chosen for evaluating projects should be informed that they must be objective, obey confidentiality principle, perform an evaluation or ranking in accordance with the sub-titles included in the chart, and ensure a careful and meticulous evaluation. If necessary, these experts, consultants, or teachers should be supported via an in-service training,

15. Project proposals should come from students in consideration of the fact that a process managed through instructions alone cannot make the expected contribution to the improvement of cognitive and affective skills of students,
16. The development of critical thinking, discussing, and questioning skills of students should not be suppressed in competition projects.

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