Journal for the Education of Gifted Young Scientists, 9(1), 1-14, March 2021
e-ISSN: 2149- 360X
jegys.org

Young Wise Publishing
youngwisepub.com

Research Article

The place of interdisciplinary relationships in science projects of the gifted students in Turkey[1]

Ramazan Çeken[2]*

Science Education Department, Faculty of Education, Aksaray University, Turkey

Article Info

Received: 07 December 2020
Revised: 26 January 2021
Accepted: 08 March 2021
Available online: 15 March 2021

Keywords:
Gifted students
Integrated disciplines
Interdisciplinary relationships
Project based learning
Student projects

Abstract

Instructional design is essential for human cognitive development, and interdisciplinary relationships of those settings have an important role on human cognition. Such instructional settings including various disciplines are current issues in educational researches. As seen in Turkish Science Education Curriculum (TSEC), some relationships between science and environment have been stated and emphasized for mental structures. Learning with projects can help to explore those mental processes. The gifted students can learn effectively and more rapidly than their fellows by the way of such interdisciplinary learning practices. Since these relationships in the curriculum provide the gifted students and the teachers making integrations with disciplines, the project based learning practices include various integrations. Therefore, this documentary study was conducted to student projects selected in a project competition carried out by the gifted students throughout Turkey to explore such interdisciplinary relationships. For the purpose of determining these relationships in student practices made by the Science and Art Centers' (SAC) students accepted as gifted ones, a total of 76 projects were subjected to the content analysis. With the result of categorization process, they focused on two disciplines to overcome with their problems in general. They prefered to make relationships between firstly biology and chemistry and secondly biology and physics to find valuable answers to their daily life problems. They used the both disciplines' topics more than other traditional area of science education called as physics. They could make less integrations on physics topics with other disciplines as compared with the connections made between biology and chemistry. Additionally, they could make only 4 connections with geology and geography. Although the 56 of the gifteds' projects have an interdisciplinary viewpoint totally, only 20 of them include only one scientific disciplines. Such frequencies are important for PBL as it can be a way of coping with the integration problems doing the practices in gifted education spesifically and science education in general.

To cite this article:
Çeken, R. (2021). The place of interdisciplinary relationships in science projects of the gifted students in Turkey. *Journal for the Education of Gifted Young Scientists*, *9*(1), 1-14. DOI: http://dx.doi.org/10.17478/jegys.837227

Introduction

Concept of giftedness has been defined variously by many civilizations. As it has been a long debated topic, it has become more flexible to include uniqueness in individuals such as creativity, memory, and motivation. The traditional concept of giftedness did not include such features (Al-Sahabatat, 2013). There is more than one discipline in the concept of giftedness, as it is an interdisciplinary topic. It is effected by multiple developmental factors, such as individual characteristics and environmental features (Goudsblom, 2019). Although it is typically associated with school centered viewpoint, the gifted students have academic and nonacademic features (Worrell, 2019). Spit and

[1] This paper was partically presented as an oral presentation at The International Congress on Gifted and Talented Education (IGATE'19) on 1-3 November, 2019, İnönü University in Turkey.
[2] Assoc. Prof., Science Education Department, Faculty of Education, Aksaray University, Turkey. E-mail: ramazanceken@aksaray.edu.tr Orcid No: 0000-0003-3584-7132

Rispens, (2019) define the giftedness is having the right traits and the right social and natural environment. Additionally they claim if the logical capacities of them do not get the opportunity to develop, they will not be defined as gifteds.

They learn effectively and more rapidly than their fellows, presumably due to the differences in neurophysiology which affect efficiency in communication of neurons (Solé-Casals et al. 2019). Such differences on mental structure of them required some additional integrations on learning instructions. Therefore curriculum development for gifteds is an important concern for the governments.

A curriculum development model for the gifted children is the CLEAR model based on five foundational levels: **C**ontinual formative assessment, clear **L**earning goals, data-driven learning **E**xperiences, **A**uthentic products, and **R**ich curriculum (El-Abd, Callahan, & Azano, 2019). The last step of mentioned model is mainly based on an interdisciplinary viewpoint as it clearly includes integrated designations in related curricula. For instance, a strong emphasizing on STEM disciplines are being located in currently used the TSEC with an interdisciplinary and integrated viewpoint (MNE, 2018).

Integrated Viewpoint in TSEC

As seen in TSEC, some relationships between science and social and natural environment have been stated and emphasized. The current definition of this integrating process is called as interdisciplinary learning. Some concepts in TSEC need to be handled in line with this perspective. As a critical example in science education, the Project Based Learning (PBL) which is used in science learning and as well as social disciplines widely has some interdisciplinary background mentioned in each degree in TSEC.

A curriculum is a series of educational and instructional practices which the students must do experiences by developing the skills to a better understanding and doing those activities (Bobbitt, 1918). As the distinctions are not obvious and some strong connections exist among those seperations, the grades in curricula are continuously changeable for an updating that includes the stages of such concepts. The instructional designs explained in this section differ from many of them in that they are very closely tied to our information structures and human cognitive architecture (Sweller, 1999).

This idea is not a constant one impressing the student centred learning processes in science courses. Since the effect and flexibility of the post-modern or contemporary viewpoints, science education curriculum includes and methodologies need to be taken account of critiques of contemporary science education and its strategies (Gough, 1998). Bruner's idea including the fact that it is quite possible to teach any topic *effectively in some intellectually honest form to any child at any level of development* would encourage the researchers to think of such knowledge in a new perspective (Doll, 1993). This viewpoint has a relation with the PBL practices as the nature of them contain a logical understanding way.

Gifted Students' PBL Practices in SACs

Enrichment education program is one of a used model of the gifted students and the SAC is a governmental organization responsible for the development of logical, social and emotional skills in Turkey. Students are selected by a two-steps examination at elementary level and they are called as gifted students. This model includes a five-step education practices known as *Orientation, Pull-Out Classes, Recognizing The Individual Skills, Developing The Special Skills* and *Making Projects*. PBL practices have a wide use in the last three steps.

According to Hamilton's idea (1990) including that the curriculum activities is closed to the school practices, the science education curricula need to be developed addressing the internal scope and sequence such as the external effects (Pinar et al. 2008). These connections in such curricula provide educators, teachers and adults making integrations with useful experiences and practices in time. This is an attempt which can also be suitable for the cognitive development during the integrated instructions of the gifted students in SACs. Therefore, this study primarily focused on interdisciplinary viewpoints on their science projects.

The Study Problem

The study's main objective is to reveal whether there are relationships between the scientific disciplines in the gifted students' science projects or not. This goal can be achieved by answering the following questions:

- Problem:Are there any relationships between the scientific disciplines in the gifteds' student projects?
- Sub-Problem 1. Are there any integrations in those projects having interdisciplinary viewpoints?
- Sub-Problem 2. Are there any non-integrated disciplines in those projects?

Method

Research Design

This documentary design study aims at monitoring the integrations in the gifted students' science projects. It includes a qualitative strategy as it mainly summarizes the integrated contents of their projects. The relationships between the scientific disciplines were identified in line with content analysis technique. Categories and frequencies were determined in line with this data analysis process and an example of each one was given under the explantaions.

The content analysis of project documents is a technique which is used for written data such as official and archival sources (Lichtman, 2010). It can also be administered to any subject in which the researchers desire a means of categorization and often quantifying the data. This document analysis study is a characteristics of that qualitative way of study (Bogdan & Biklen, 2007). It includes the determination of the objectives, definition of the related terms, specifying the analyzing unit, locating the relevant data, rationale development, development of the sampling plan, formulation of the coding categories, validity, reliability and data analyzing (Frankel & Wallen, 2006).

Documents

This data analysis technique on the official publications was used as the researcher decided to point out the integrated contents. The SACs' projects located in official catalogues under the tittle of *Project competition for secondary school students' researches on mathematics and science: "This is My Product Project Competition for Secondary School Students" (for 6-8th grade)* These projects in related documents are suitable and sufficient to make a comparison between primarily and secondly used topics by using this technique.

The relationships used in the student projects were determined and written on the tables. The SACs' projects having integration and non-integration can be seen on it. The data analysis is a ruquirement for understanding whether there is a connection between scientific disciplines or not. The SACs' projects having integrations can be seen on Table 3. The data for non-integrated disciplines can be seen in Table 8.

For a general emphasizing on *interdisciplinary viewpoint in The SACs' projects* in catalogues, the related official publications of The Ministry of National Education (MNE) of Turkey were analysed at part of *integrated topics* or *contents*. The documents were subjected to a content analysis to reach valuable and useful categories. The integrated contents which were listed by the researcher used whether there is a relationship between *the main topic* and *secondly mentioned subjects*. Content analysis of identifying whether there are some relationships between the primarily emphasized disciplines such as biology, chemistry and physics, and secondly cited ones such as astronomy, geology and geography have important places in these data analysis process. For a clear understanding of integrated and non-integrated data, the researcher followed the steps as follows.

Data Collection Tools

Determining The Objectives: Project catalogues were used to find out the relevant data about *integrated and non-integrated science projects of The SACs' students*. Statements written by the gifted students in such documents from 6 through 8 grades were checked to determine the relevance between primarily and secondly mentioned topics belonging to the two scientific discipline at least. The researcher decided to use the official publications as those sources can be sufficient to reach some useful viewpoints on the main purpose and secondly handed topic in these PBL practices. All the documents are official because they were published by a governmental organization called as The MNE.

Defining The Related Terms: The important words in this study are *integrated and non-integrated science projects* and *The SACs' students' mentioned topics* or *contents primarily and secondly*. As these terms are the summary of the mentioned aim, it is clear that one can understand the nature and working conditions of this PBL practice given as a sample of activity based learning process. In line with the objectives of this research, project documents regarding the *integrated and non-integrated contents in science projects of The SACs' students'* are examined in each project published from 2006 through 2014. Only 76 of the PBL practices were analysed as The MNE finalized the project competition studied in this researh.

Developing a Sampling Plan: In this study, since the official documents' contents can be useful for the aim of this study, only the documents of science projects are sampled from 6 through 8 grades. The researcher selected The SACs' science projects as they can clearly include the integrations. For this reason, this documentary research has the capability of identifying these relationships between the traditional scientific disciplines such as pysics, chemistry, biology, geology, astronomy and geography. As seen on the data of this study, it is understood that *when* and *how* the data were collected (Hatch, 2002; Bogdan & Biklen, 2007) and it is relative to the assumption of this research and it's problems are answerable. Additonally, this qualitative technique is easily and clearly applied on qualitative data obtained from official documents.

Prosedure of Coding and Identifying The Categories: The number of each projects determined for this study was given by the researcher in orderly beginning from the yeaar of 2006 through 2014. As these project competition was carried out by the The MNE, the researcher decided to examine the gifted projects from 2006 through 2014. Additionally, each project code includes the provincial information with its final-quarter figures mentioned on the published catalogues. The code of each the PBL practice rearranged using some definitive parts.

An example of this coding determination process are given in the Table 1.

Table 1.

Coding Process of Each Project

Number	Year	Province Made in	Catalogue Number	Project's Code
1	2006	Adana	621	1(2006)Adana621

An example given in the Table 1. for this coding process means that it is the first project determined and examined in this study and, this project was made by a gifted student in Adana. The catalogue's number of it finishes 621.

The researcher chose the *categories* after the *definitions of words* searching on *integrated and non-integrated disciplines in science projects* and *primarily and secondly mentioned topics*. 76 projects were subjected to content analysis, totally. The analysing unit is *primarily and secondly used topics or contents in each project*. The process of analysis was made by the researcher and an experienced science teacher seperately. The process of defining terms and categorization were repeated by them twice. The final decision of categorisation was made by the use of such comparison data obtained from the both.

The written data for the PBL practices was examined in the basis of their agreement on the topics belonging to the *one* or *two scientific disciplines* mentioned above. The integrated topics' frequencies based on the written data were calculated and these connections were identified as interdisciplinary relationships. For the validity and reliability process of this study, two steps were followed. For validity, the researcher collected and categorized the data after six months later again to make a useful decision.

The researcher compared the findings with an expert opinion, an experienced science teacher for this study, for reliability and found the agreement percentage as 0.90 and 0.74. The first one is about the agreement level for the determination of the main topics or contents in each PBL practice. Both the researcher and the science teacher have an agreement on the main topics to a large degree and it is calculated as 0.90. The second percentage is about the main topics' disciplines. At this stage, the agreement level was found as 0.74. Although the views of the two experts are concurrent for identifying the main topics of the PBL practices to a large grade, the agreement level on the topics' of scientific disciplines has less score than the first percantage. The categories were made in line with this comparison result. The board of the project competition selected the 76 of projects made by the gifted students at the final step.

The number of projects submitted provincial, regional and finally in each year are written in Table 2. The gifted students projects were collected from the official catalogues published from 2006 throughgh 2014 (MNE, 2006; MNE, 2007; MNE, 2008; MNE, 2009; MNE, 2010; MNE, 2011; MNE, 2012; MNE, 2013; MNE, 2014).

Table 2.

Frequency on The SACs' Projects from 2006 through 2014

Year(Total)	Total Applications	Selected Projects in 12 of Regions	Finally Exhibited Projects	Frequency of Projects
2006 (6)	5116	741	65	2
2007(7)	13922	959	62	14
2008(8)	18313	902	62	10
2009(9)	31866	1045	67	12
2010(10)	33264	1004	68	6
2011(11)	63247	1048	65	7
2012(12)	63247	1048	65	7
2013(13)	78887	968	66	7
2014(14)	42494	941	68	11
Total	**350356**	**8656**	**589**	**76**

The submited projects were subjected to selection process firstly in provinces and secondly in regions. The final decision were made in capital city, Ankara, to find out the top first 100 student projects. Each catalogue of years were

published from 2006 through 2014. The coding number of the selected project were written on the catalogues and such published booklets were used for the categorization process.

Results

In this part, whether there are relationships between the scientific disciplines in gifted students' projects. For this aim, the integrated and non-integrated disciplines or topics are being debated by two sub problems.

Sub Problem 1: Are there any integrated disciplines in those projects having interdisciplinary viewpoints?

The findings point out that the total of 76 projects carried out by the gifted students published in project catalogues. Whether such PBL practices have integrations with each other or not can be seen in Table 3. As stated above section, only one of the integration for each project were examined in the study. Therefore, you can see only one of an interdisciplinary relationship between the two scientific disciplines.

Table 3.

The SACs' Projects Having Integration

Year	Frequency	Integrated Disciplines (Categories)					
		Physics Chemistry	Physics Biology	Physics Geology	Chemistry Biology	Biology Geology	Physics Geography
2006	1	1					
2007	9		3	1	4	1	
2008	9	2	3		4		
2009	7		4	1	2		
2010	5		1		4		
2011	6				6		
2012	6	1	1		4		
2013	6		2		3		1
2014	7		2		5		
Total	**56**	**4**	**16**	**2**	**32**	**1**	**1**

As seen in Table 3., integrated PBL practices' frequency is 56, whereas non-integrated projects one is 20. As a clear understanding from this data, it is obvious that the gifted students are capable of making projects in an integrated perspective. Such integrations are mainly based on relationships between the basic disciplines traditionally known as physics and chemistry and biology. They can use *biological* (49) and *chemical* topics (36) in projects more than *physics* practices (23). It is understood from the Table 3. that the compared data obtained from the reseacher and the science teacher is including *six categoris* representeting the relationships betveen the scientific disciplines. According to these findings in Table 3., it is obvious that there are six integrated categories called as *physics-chemistry, physics-biology, physics-geology, chemistry-biology, biology-geology* and *physics-geography*. Table 4. includes the first category cited as the category of *physics-chemistry*.

Table 4.

The Category of Physics-Chemistry: The Relationships Between Physical and Chemical Topcs

Projects' Code	Projects' Main Topics or Contents (At Least Two Ones)	Related Disciplines (At Least Two Ones)	
		Physics	Chemistry
1(2006)Adana621	Solar Energy, Using Formaldehide for Renewable Energy	Solar Energy	Formaldehide
18(2008)Amasya186	Learnig Elements with A Periodic Table	Simple Electricity Circuits	Periodic Table
20(2008)Kırşehir382	Automatic Sewer Pipeline	Automatic system	Waste Water
57(2012)Tokat363	From Garbage to Fiberboard	Pressure	Garbage

As seen in Table 4, it is uderstood that four of the projects include both physical and chemical topics in an integrative way. As stated on it, one can claim that each project's main topics includes the contents located in physics and chemistry. Both the researcher and the science reacher are agree with the ide that *solar energy, simple electricity, automatic systems* and concept of *ptessure* are the contents of physical topics as well as *formaldehide, periodic table, waste water* and *garbage* are the subjets of the chemistry. A sample for this category can be seen in Picture 1.

Picture 1.

An Echological and Technological Apartment Building Model

An interdisciplinary viewpoint can be seen in the Picture 1 belongs to a PBL practice coded as *1(2006)Adana621* which is under The Category of *Physics-Chemistry*. An echological and technological apartment building model with *solar energy* and *formaldehide* was made and suggested by a gifted student. Both of the topics were handled in this project for designing a renewable energy system which is a well-known topic of *physics* and reducing the formaldehite percentage called as a *chemistry* topic by the plants in the house. Therefore, this picture represents the characteristics of the Category of *physics-chemistry*. As seen in the Table 4, the gifted students used not only *physical* topics but also *chemical* contents for making connections with daily life such as *renewable energy, solar energy, automatic mechines* etc. Another integrations with The Category of *Physics* and *Biology* can be seen in Table 5.

Table 5.

The Category of Physics-Biology: The Relationships Between Physical and Biological Topics

Projects' Code	Projects' Main Topics or Contents (At Least Two Ones)	Related Disciplines (At Least Two Ones)	
		Physics	Biology
3(2007)Adana095	Online Microscope	Optic	Cellular Structure
11(2011)Manisa074	A Hothouse Model Suggestion	Thermal Insulation	Environmental Protection
15(2007)Trabzon602	Automatic Hothouse	Solar Energy	Growing Plants
19(2008)Bayburt627	Echological Apartment Building	Thermal Insulation	Environmental Protection
24(2008)Tokat528	From The Stem of Cherry through Fiberboard	Pressure	Plant of Cherry
25(2008)Van830	Cheap and Clean Energy	Solar Energy	Environmental Protection
28(2009)Afyonkarahisar370	Isolation with Felt	Thermal Insulation	Material Made from Wool
31(2009)Isparta921	Echological Hothouse	Solar Energy	Environmental Protection
36(2009)Tokat369	Hothouse Heating Naturally	Heat or Energy with Biogas	Animal Husbandary
38(2009)Uşak149	Automatic Mechine for Closing The Tabs	Electric Motors	Water Saving
41(2010)İzmir315	Automatic Curtain with Renewable Energy	Energy and Aotomatic Mechine	Environmental Protection
52(2012)Amasya645	Health and Microorganisms	Light	Microorganisms
55(2012)Sakarya	From Agricultural Wastes through Heat Insulation	Heat Insulation	Agriculture
62(2013)Düzce	Heat Insulation with Maize	Heat Insulation	Plant of Maize
72(2014)Kayseri086	Heat Insulation with Wall Overgrown with Ivy	Heat Insulation	Plant of Ivy
74(2014) Sakarya312	Renewable Energy with Nickel	Energy Saving	Environmental Protection

As seen in the Table 5., it is uderstood that 16 of projects include both *physical* and *biological* topics in an interdisciplinary way. The topics such as *optic, thermal insulation, solar energy, concept of pressure, heat or energy, electric motors, automatic mechine* and *energy saving* are called as ıphysic's subjects, whereas the contents regarding *cellular structure, environmental protection, growing plants, environmental protection, plant of cherry, material made from wool, animal husbandary, water saving, microorganisms, agriculture, plant of maize* and *plant of ivy* belong to chemistry. Each PBL ptactice mentioned in Table 5. includes at least an interdisciplinary relatonship regarding these topics located in the disciplines of *physics* and *chemistry*. This viewpoint can be seen in the Picture 2 which is a sample of The Category of *Pysics-Biology* category belongs to a gifted student's project coded as 72(2014)Kayseri086.

Picture 2.
Heat Insulation with Wall Where The Plant of Ivy is Overgrown

A house model was suggested by a gifted student for *heat insulation* with wall where the *plant of ivy* is overgrown by the houseowners. Thermal insulation is a topic of *physics* and plant of ivy is a *biological* content. For this location of both topics in such PBL practice, it can be deduced that it surely has an interdisciplinary viewpoint. Integrating the mentioned *physical* and *biological* topics is a useful way for the gifted students since they want to make valuable explanations for their daily life problems handled in this PBL practice. Similarly, the viewpoints on integrating both *biology* and *chemistry* can be seen in Table 6.

Table 6.
The Category of Biology-Chemistry: The Relationship Between Biological and Chemical Topcs

Projects' Code	Projects' Main Topics or Contents (At Least Two Ones)	Related Disciplines (At Least Two Ones)	
		Biology	Chemistry
6(2007)Bayburt366	Production of Madder Root	Root	Production of A chemical Compound
8(2007)Denizli105	Soda Water with Grape Molasses	Grape	Soda Water
9(2007)Denizli383	Dental Treatment with Schweden Bitter	Dental Treatment	Schweden Bitter
12(2007)Manisa107	Syrup with Potato	Potato	Syrup
17(2008)Adana838	Natural Treatment of Bacteria	Bacteria	Organic Compounds
21(2008)Kırşehir195	An Indicator with Mahonia	Plant of Mahonia	Indicator
23(2008)Sakarya044	Recycling of Paper	Recycling	Paper Production
26(2008)Van381	Healty Tin Box for Drinks	Health	Substances
27(2009)Adana467	Detergent with Fruits	Fruit	Detergent
30(2009)Amasya128	Killing Microorganisms with Euphorbia cyparissias (Cypress spurge)	Microorganisms	Production A Chemical Substance
39(2010)Adana496	Organic Cake with Fruits	Fruits	Organic Compounds
40(2010)Bayburt556	Production of Madder Root	Root	Organic Compounds
43(2010)Tokat079	Production of A Drink with Grape Seeds	Grape Seeds	Organic Compounds
44(2010)Yozgat178	Effects of Barium on Planth Growth	Planth Growth	Barium
45(2011)Adana890	Fermentation with Plants	Plants	Fermentation
46(2011)Elazığ674	Antibacterial Effect of Trout Salvia	Trout Salvia	Antibacterial Liquid
47(2011)Eskişehir391	Determining The Fruit Corruption with Iodine	Fruit Corruption	Iodine
48(2011)Kastamonu851	Awareness of Environmental Pollution Using Allium cepa and daphnia	Allium cepa	Waste

50(2011)Ordu218	Hazelnut Fertilizer	Hazelnut	Fertilizer
51(2011)Siirt473	Fertilizer with Corn Silk	Corn Silk	Fertilizer
53(2012)Malatya780	Recycling of Iridium	Recycling	Iridium
54(2012)Muş938	Waste Against Bacteria	Bacteria	Waste
58(2012)Yalova467	Removing The Dyestuffs from Waste Water Using Some Plants	Plants	Waste
59(2013)Adana983	Germination with Fermentation	Germination	Fermentation
60(2013)Balıkesir141	Effects of Boron on Cell Devision	Devision	Boron
61(2013)Düzce358	An Indicator from Grape	Grape	Indicator
64(2013)Sinop621	Echological Battery	Echology	Battery
66(2014)Ankara765	From Decaying Plastic Waste Through Soil	Soil for Plants	Plastic Waste
67(2014)Elazığ362	An Organic Insecticide with Walnut Leaves	Walnut Leaves	Insecticide
69(2014)Kastamonu127	Painkiller with Milky Plants	Plants	Organic Compounds
70(2014)Kayseri894	Echological Lifesaver	Echology	Organic Compounds
71(2014)Kayseir482	From Walnut Leaves through Sausage	Walnut Leaves	Organic Compounds

The gifted students prefered the integrated contents on *biological* and *chemical* topics written in the Table 6. more than other relationships handled in the other categories. They chose the topics or contents from both disciplines to give answers to their problems of their PBL practices. *Root, grape, dental treatment, potato, bacteria, plant of mahonia, recycling, health, fruit, microorganisms, grape seeds, planth growth, plants, trout salvia, fruit corruption, Allium cepa, hazelnut, corn silk, germination, devision, echology* and *walnut leaves* are biological contents and *chemical compound, soda water, Schweden bitter, syrup, indicator, paper production, substances, detergen, chemical substance, barium, fermentation, antibacterial liquid, iodine, waste, fertilizer, iridium, fermentation, boron, indicator, battery, plastic waste* and *insecticide* are chemical topics. The gifted students used topics located in both disciplines called as *biology* and *chemistry*. For this reason, each integration can reflect the interdisciplinary viewpoint. An interesting connection made between *biology* and *chemistry* introduced to the readers i the following Picture 3.

Picture 3.
An Experimental Design for Investigating The Plant Growth

The PBL practice coded as 44(2010)Yozgat178 was done by an experimental design as the gifted student aimed at investigating the plant growth percentage in a comparison way. As seen in Picture 3., whether the *mineral of barium* have an important role on the *plant growth* or not is the main problem of this student project. The mineral of barium is a *chemical* topic though plants are an important unit of *biology*. Using the topics regarding the both disciplines leads us to the idea that this PBL practice has an interdisciplinary viewpoint as the gifted student aims at connecting the plant growth with a chemical substance. The coders additionally identified some rarely integrated disciplines such as *geology* and *geography*. These integrations were located in the Table 7.

Table 7.

The Categories of Physics- Geology, Biology Geology and Physics Geography

Projects' Code	Projects' Main Topics or Contents (At Least Two Ones)	Related Disciplines (At Least Two Ones)			
		Physics	Geology	Biology	Geography
11(2007)Manisa074	Hothouse with Thermal Water	Heat Insulation	Thermal Water		
14(2007)Tokat	Protecting The Soil			Environmental Protection	Erosion
37(2009)Trabzon047	Alarm System for Landslide	Alarm System with Electricity	Landslide		
65(2013)Yozgat314	Thermal Water with Solar Energy	Solar Energy			Geographical Position

As stated in Table 7, it is understood that the gifteds' PBL practices have some connections with geological and geographical topics such as *thermal water, landslide, erosion* and *geographical directions*. These topics were used in an integrative way to bring the scientific concepts and daily life togather. An example of the relationship between physical an geological topics is located in Picture 4.

Picture 4.

A Hothouse Model with Thermal Water

A PBL practice coded as 11(2007)Manisa074 under the tittle of a hothouse with thermal water was made by the gifted students. They used both *thermal water* and *heat insulation* for their hothouse model. Additonally they are planning this renewable energy project such as building floors designed as double–layer. Therefore this project has an integration with *physics topics* known as heat insulation and solar energy and *geological topic* such as planning the *installation* of building.

It can be deduced from the categories mentioned in Sub Problem 1., the gifted students made interdisciplinary connections in 56 of 76 the projects. They used more biological contents than other disciplines' topics. They prefered to bring biology and chemistry in 32 projects, biology and physics in 16 ones and biology and geology in only one. Totally, they used biological topics in 49 projects, chemical topcs in 36 ones. They integrated chemical, biological and geographical contents with physics in 23 of those PBL practices. As a result of this data, it is clear that they prefer biological and chemical topics than physics for interdisciplinary relationships. They made 20 of the 76 projects focusing on only one topic or discipline. Sub Problem 2 includes the data for those non-integrated projects.

Sub-Problem 2. Are there any non-integrated disciplines in those projects?

The main purpose of this study is to understand the integrated disciplines in the gifteds' projects. Therefore, the relationship between *physics* and *chemistry, physics* and *biology, physics* and *geology, chemistry* and *biology, biology* and *geology* and *physics* and *geography* were handled in 56 projects. The rest ones were examined whether they have non-integrated topics or not. Table 8. shows the data for those disciplinary projects.

Table 8.

Non-Integrated Projects' Main Disciplnes

Year (Frequency)	Projects Focused on Only One Discipline					
	Physics	Chemistry	Biology	Astronomy	Geology	Geohraphy
2006 (1)	1					
2007(9)	5					
2008(9)	1					
2009(7)	5					
2010(5)			1			
2011(6)		1				
2012(6)			1			
2013(6)			1			
2014(7)	3	1				
Total (56)	15	2	3	0	0	0

Projects carried out by only one discipline were based on physics to a large degree. Although students used Physics content in 15 of 20 the projects, they used only biological or chemical contents in five ones. The total of 20 science projects have not got an interdisciplinary viewpoint as each one has focused on only one scientific discipline. Such 20 of disciplinary projects mainly based on physics contents (15) to a large extend. Only two of them have a relationship with chemical contents and 3 of the biological projects focused on only one concept in a discipline.

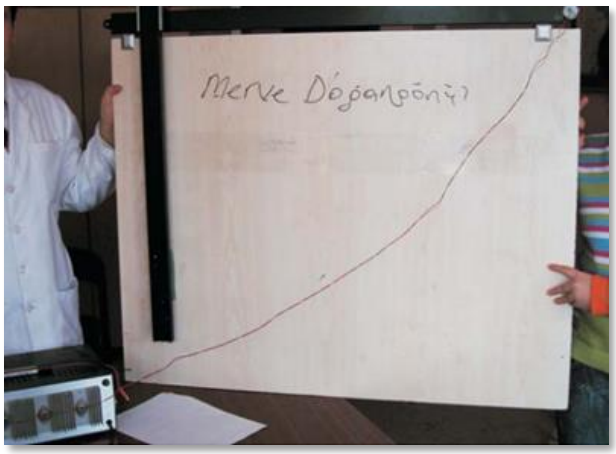
It is understood from the explanations made for 56 of the PBL practices include the interdisciplinary relationships as each one has the topics belong to two or more scientific disciplines. Although the gifted students could make integrations with 56 of the projects, they could make only 20 of the PBL practices focusing on basically only one traditional disciplines such as physics, chemistry and biology. As seen on Table 9. the gifteds made projects using only one topic of a discipline mentioned below.

Table 9.

The PBL Practices Focusing on Only One Topic

Projects' Code	Projects' Main Topic or Content (Only One)	Related Discipline (Only One)		
		Physics	Chemistry	**Biology**
2(2006)Trabzon041	Magnetic Ball	Electricity		
4(2007)Adana112	A Project for Disabled People	Electricity		
5(2007)Amasya645	Automatic Light with Photocell	Electricity		
7(2007)Bursa040	A Burglar Alarm with Laser Light	Electricity		
16(2007)Yozgat191	An Automatic Board Cleaner	Electricity		
22(2008)Malatya724	Using Frequency Modulation	Electricity		
29(2009)Amasya346	A Secure Car with Camera	Electricity		
32(2009)Kırıkkale941	A Smooth Lumbering	Electricity		
33(2009)Manisa154	An Economical Furnace	Electricity		
34(2009)Ordu753	Lighted Bens	Electricity		
35(2009)Sakarya390	Escalator for Disabled People	Electricity		
37(2009)Trabzon047	An Alarm for Landslide	Electricity		
73(2014)Kırşehir296	A Bcycle with Automatic Gearbox	Movement		
75(2014)Tokat315	Designing A Heat Conserving Glass	Heat		
76(2014Yozgat703	A Braking System with Turbulent	Movement		
49(2011)Malatya461	The effects of Heavy Metals on Cellulose		Metals	
68(2014)Elazığ404	Using Phenolphtalein		Phenolphtalein	
42(2010)Kütahya614	Examining The Fruit Produciton Rate			Fruit
56(2012)Siirt251	The Effect of Pomegranate on Cell Division			Cell
63(2013)Manisa849	Production of Insectiside			Insects

Table 9. indicates that 20 of the PBL practices were made by focusing on only one topic located in each discipline such as physics, chemistry and biology. It is understood from the findings located in the Table 9 that the gifted students could not make a reltionship between two or more disciplines as the learning activities include only one kind of topic or content and therefore, they prefered only physical topics in 15 of projects. This is a critical result for underlying that the gifted students prefered the non-integrated viewpoints on physical content to biological and chemcal topics to a large scale. It is also a useful result for emphasizing how the physics topics can be used effectively in disciplinary practices which have not got integrated viewpoints. An example for this disciplinary PBL project can be seen in the Picture 5.



Picture 5.

An Automatic Board Cleaner with Electricity

An interesting PBL practices made by the gifteds coded as 16(2007)Yozgat191 and it is determined a *physics* learing activity based on the topic of *electricity*. They aimed at designing an *automatic board cleaner using electrical equipments*. It can be understood from the Picture 5. that they focused on only one scientific discipline and therefore it is only a learning activity of physics discipline.

Sub Problems 1 and 2 lead us to the idea that the gifted students used biology and chemistry to a large grade as compared with physics, astronomy, geology and geography. As a comparison data obtained from the Table 3., it is clear that only 4 of 56 projects are related to topics of geology (3) and geography (1). The SACs' students could not make a connection with astronomy during the designing process of projects. All of 20 The SACs' projects do not have a relationship with astronomy, geology and geography.

As a result of Sub Problem 1, it is understood that they were used integrations to a large degree. According to the results of the second Sub Problem, it is clear that they could not make relationships between physics and other disciplines mentioned in Table 8. This result has a relation with why the gifted students prefer biological and chemical topics more than physical contents and why they could have less interdisciplinary viewpoint on physics then the biologicy and chemistry.

As a result of these findings, it is understood that topics located in biology and chemistry are the main concern for the The SACs' students during identifying an integrated problem on their PBL practices. They prefer to the both disciplines' topics more than other traditional area of science education called as physics. They could make less integrations on physics topics with other disciplines as compared with the connections made between biology and chemistry. Additionally, they could make only four connections with geology and geography.

Discussion and Conclusion

This section is based on an evaluation of estimated results in the previous section on the document analysis of gifted students' science projects in Turkey.

There has been conducted to some researches on the effects of PBL practices on the students' attitudes. As a brief conclusion of these researches, the students can learn the scientific concepts more effective than traditional learning practices. However these insufficient explanation of that comparison need to be supported by a social viewpoint. Therefore, the scientific, social and educational viewpoint of the PBL practices can make an effect on the students' success and attitudes.

What is the real relationship of social development and science education? This main problem is related to the daily life problems practicing in courses. Today the authority of the teachers is an important obstacle for the effective

way of learning. It is known that effective learning is the construction of the knowledge in mental structure biologically, physically, sociologically and culturally.

In an educational viewpoint, constructivist learning theory has a common use in this postmodern age as well as in Turkish curricula. Learning with PBL practices are related to the construction of the concepts being difficult to understand and having a relationship between science and everyday life. If the social effects on the PBL practices identified by the researchers, the students will learn the scientific concepts with its social, cultural and psychological relationships.

Students are expected to use the suitable technology such PBL practices to gather, interpret and analyse the data. They read about some science topics and investigate the scientific believes. They use technology to further developments of their learnings of scientfic subjects (Loughran, Smith & Berry, 2011). This integrative viewpoint on such practices can be basics for cognitive understanding of knowledge.

The Bruner's curriculum model is crucial for the circulation the knowledge (Doll, 1993), which the children learn gradually (Bruner, 2003). As it indicates a general perspective, it not absolute that the effect and flexibility of the post modern or contemporary viewpoints achieve a more democratic science (Gough, 1998). Bruner's viewpoint includes *teaching any subject to any child at any level of development* is a similar idea with the mentioned viewpoint to a large degree (Doll, 1993).

The Hamilton's ides (1990) determining the interdisciplinary role of the curriculum instructions is one of a basics of the gradual learning (Pinar et al. 2008). Since the relationships in the curriculum provide the gifted students and the teachers making integrations with disciplines, The PBL practices can include various integrations. This documentary based study apparently identifies such *integrated contents mentioned primarily and secondly* in science projects of the gifted students.

Although 56 of the projects include the interdisciplinary viewpoint totally, only 20 of the gifteds' projects focused on only one scientific discipline. Such frequencies are important for PBL as it can be a way of coping with integration problems in practices in science education. These simple and clear the PBL practices from 6 through 8 grades are useful strategies for the daily topics mentioned on the TSEC in accordance with the Bruner's spiral curriculum model, eliminating the difficulties and obstacles based on some inadequate interdisciplinary relationships.

The result of this study have a parallelism with some researches' results determining that children are prefer biological topics more than physical subjects (Williams et al. 2003). It is known that the students (Guido, 2013) consider physics as a problematic subject. Although it needs additional supports, the students can use physics to understand their other fields of science education. An interdisciplinary practice restructured and made by Crouch & Heller (2014) to introduce physics in biological context. The result of their study leads us to the idea that learning biology with physics occurs most effectively.

If the teachers or the students have troubles or obstacles for integrating the science topics, they can plan to integrate those disciplines from an everyday life viewpoint. The gifted students made all of the 76 the PBL practices to find valuable sollutions to their scientific problems. It can be a critical starting point for the difficult, boring and complex topics of science disciplines in gifteds' science education.

Recommendations

The similar perspective mentioned in this chapter can be a basic solution to the problematic viewpoint how we can integrate science and other disciplines. A traditional viewpoint on science education indicate that this educational discipline mainly based on three scientific areas such as physics, chemistry and biology however currently examined activities called as the PBL practices are not only focusing on the mentioned traditional disciplines but also accepting the relationship between astronomy, geology and geography with social disciplines. Therefore, the nature of the PBL practices include integratings, connections and relationships in an interdisciplinary viewpoint.

Limitations of Study

Collecting the data only from the project catalogues is a limitation of this study. For a deeper understanding why the gifted students prefer the topics or contents in their science projects, the integrated data can be collected from the owner of the projects directly. Therefore, the gifted students and the advisor teachers' viewpoints on the process of this competition can be analysed for further studies.

Acknowledgments

The author, whose name is listed immediately below, certifies that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest (personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

Biodata of Author

Ramazan Çeken obtained PhD in science education from the university of Gazi, Turkey 2007. He is an associated professor in science education at Aksaray University, Turkey, Facylty of Education, department of science education since 2016 until now. His research interests include interdisciplinary education, integration, hans-on science, teacher education, curriculum studies. **Affilation:** Science Education Department, Faculty of Education, Aksaray University, Turkey **E-mail:** ramazanceken@aksaray.edu.tr **Orcid No:** 0000-0003-3584-7132

References

Al-Sahabatat, A. M. (2013). A review of the contemporary concepts of giftedness and talent. *International Interdisciplinary Journal of Education, 2*(12), 1336-1346.

Blatt, F. S. (1986). *Principles of physics.* (Second Edition). Boston: Allyn and Bacon, Inc.

Bobbitt, F. (1918). *The curriculum*. Boston: Houghton Mifflin Company.

Bogdan, R. C. & Biklen, S. K. (2007). *Qualitative research for education* (Fifth Edition). Boston: Pearson Education, Inc.

Bruner, J. (2003). *The process of education* (Twenty-Seventh Printing). USA: Harvard University Press.

Crouch, C. H. & Heller, K. (2014). Introductory physics in biological context: an approach to improve introductory physics for life science students. *American Association of Physics Teachers, 82*(5), 378-386. Retrieved from: https://cutt.ly/6kdqYpr

Doll, W. E. (1993). *A post-modern perspective on curriculum*. New York and London: Teachers College, Columbia University.

El-Abd, M., Callahan, C., & Azano, A. (2019). Predictive factors of literacy achievement in young gifted children in rural schools. *Journal of Advanced Academics, 30*(3), 298-325.

Goudsblom, J.C.M. (2019). *Identifying dutch gifted children and their learning needs in the dutch primary school context.* University of Twente, Master Thesis. Retrieved from: https://essay.utwente.nl/77999/

Gough, A. (1998). Curriculum toward new identities. In W. F. Pinar (Ed.), *Beyond eurocentrism in science education: promises an problematics from a feminist poststructuralist perspective* (pp. 185-209). New York: Garland Publishing, Inc.

Guido, R. M. D. (2013). Attitude and motivation towards learning physics. *International Journal of Engineering Research & Technology (IJERT), 2*(11), 2087-2094.

Frankel, J. R. & Wallen, E. N. (2006). *How to design and evaluate research in education* (Sixth Edition). Boston: McGraw-Hill Companies.

Hatch, J. A. (2002). *Doing qualitative research in education settings*. New York: State University of New York Press.

Lichtman, M. (2010). *Qualitative research in education* (Second Edition). Los Angeles: Sage Publications, Inc.

Loughran, J., Smith, K., & Berry, A. (2011). *Scientific literacy under the microscope*. Rotterdam: Sense Publishers.

MNE (2006). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE(2007). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2008). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2009). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2010). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2011). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2012). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2013). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2014). *Project competition for secondary school students' researches on mathematics and science: This is my product.* Ankara: The Ministry of National Education of Turkey.

MNE (2018). *Turkish science education curriculum.* Ankara: The Ministry of National Education of Turkey. Retrieved from: http://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=325

Pinar, W. F., Reynolds, W. M, Slattery, P. & Taubman, P. M. (2008). *Understanding curriculum: An introduction to the study of historical and contemporary curriculum discourses* (Seventh Printing). New York: Peter Lang.

Solé-Casals, J., Serra-Grabulosa, J. M., Romero-Garcia, R., Vilaseca, G., Adan, A., Vilaró, N., Bargalló, N., & et al. (2019). Structural brain network of gifted children has a more integrated and versatile topology. *Brain structure & function, 224* (7), 2373-2383. https://doi.org/10.1007/s00429-019-01914-9.

Spit, S. & Rispens, J. (2019). On the relation between procedural learning and syntactic proficiency in gifted children. *Journal of Psycholinguistic Research, 48*(2), 417-429. https://doi.org/10.1007/s10936-018-9611-6.

Sweller, J. (1999). Instructional design. *Australian Educational Review, 43*. Retrived from: https://eric.ed.gov/?id=ED431763
Williams, C., Stanisstreet, M. & Spall, K. (2003). Why aren't secondary school students interested in physics? *Physics Education. 38* (4), 324-329.
Worrell, F. C., Subotnik, R. F., Olszewski-Kubilius, P. & Dixson, D. D. (2019). Gifted students. *Annual Review of Psycohology, 70*, 551-576.