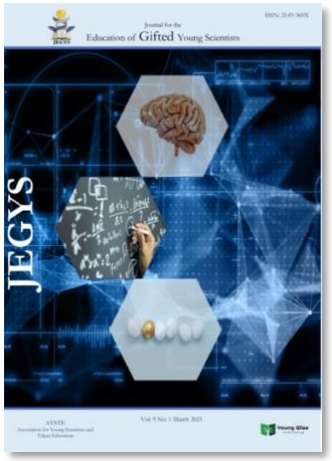

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From the Editor

New era for the JEGYS

Hasan Said Tortop[1]

Association for Young Scientists and Talent Education, Turkey

Abstract
JEGYS has aimed to combine the gifted education with the science education since first issue. JEGYS continued to develop by creating a new academic field. It brought the concept of "advanced science education" to the academic literature. Now, it presents a series of innovations and developments to its writers and readers in order to keep up with the change in every field in the world. It takes importance the first steps in publishing by updating the principles of strict academic review, broad country participation, visibility and transparency in its editorial policy. In this article, these topics are discussed in details and with examples.
Keywords: Academic social media, editorial, JEGYS, improvement, transparency, visibility

Dear Authors, Readers, Reviewers, Editors

JEGYS was established in 2013 with the idea that training scientists can only be possible with the education of gifted individuals. Science education policies need to be combined with the education policies of gifted children. JEGYS started its publication with the idea that "Science education should be given to everyone, but the theories and practices of gifted education should be used to train the young scientists".

Throughout our publication life, we have passed through difficult times. We made an effort to publish the articles of authors in developed countries where **gifted** and **advanced science education**. With the support of valuable academicians in our editorial board, we made JEGYS an international journal. It makes us very happy that JEGYS is one of the few journals in the world that publishes on the education of gifted. I would like to thank our editorial board members and JEGYS family for their efforts in this process. Prof. Dr. Albert Ziegler, Prof. Dr. Hanna David, Prof. Dr. Franz Mönks (deceased), Prof. Dr. Gillian Roehrig, Prof. Dr. Andrew Johnson, Dr. Milan Kubiatko, Dr. Abdurahman, Prof.Dr. Kirsi Tirri, Dr. Alberto Rocha, Prof.Dr. Vilma Vialle, Dr. Suhail Alzoubi, Dr. Abu Yazid Abu Bakar, Dr. Pakkapong Poungsuk always gave their support.

In the new period of JEGYS, we continue to monitor and increase the readability and visibility of our academic journal in the world. For this, we use a program called Flag Counter. In each publication period, we will evaluate country-based increases with our editorial board. As seen in Figure 1, our website was visited from 91 countries in a short period of 15 days. This is a great success for JEGYS. JEGYS, which publishes articles in a partially specific field, is followed by academics from many countries of the world.

Figure 1.

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Flag Counter Program Data for Worldwide Monitoring of JEGYS (13 March, 2021; time 12:32 at Turkey)

The issues we will take importance to in the new period are as follows; publishing research on **advanced science education** for gifted, talented and highly achiever students, submitting reports showing the average duration of referee evaluation, increasing book reviews and interviews, announcing special issues, reaching more readers and academics. Our evaluation process continues in the ERIC index, which is the most important index in the field of education in the world. We continue to make improvements in subjects such as increasing the country distribution of authors, improving referee processes, and increasing the quality of English grammar of articles.

Table 1.
March 2021 Issue Article Review Process Data

Articles ID	Reviewers number	Review Time (Average)	Contributions to Field	Countries
837227	2	60 days	Project compettions	Turkey
821700	2	120 days	Science camp	Malaysia
792203	2	150 days	Sport talent	Slovenia
864104	2	60 days	Education policy/system	Poland
754104	2	240 days	Differentiation	Turkey
817277	3	120 days	Thinking skills	Indonesia
864399	3	60 days	Creativity	Bahrain
Total	At least 2 reviewers	116 days	Gifted education	6 different contries

As seen in Table 1, articles from 6 different countries were published in the March 2021 issue, with at least 2 referee evaluation and review processes that lasted an average of 116 days, all of which would contribute to the topics in gifted education. Thanks to our referees in this review process. Academicians who want to work as referees can send an e-mail to editorjegys@gmail.com. The late referee turnaround times and the response rate of the appointed referees are 50%. The assignment of referees who can make meticulous and high-quality reviews in about 1 month is one of the issues we will focus on the most in this new period.

JEGYS is currently working with 7 editors. Again, we make our announcement to the academicians who want to work as editors by adding their CV to the e-mail address.

We made our special issue announcement. Special Issue Call (STEM for Gifted) Last date to submission: October 15, 2021. STEM education has proposed a unifying discipline approach as of its first appearance. However, besides the interdisciplinary approach, a metadisciplinary approach is also recommended in the education of gifted students. The meta-disciplinary approach is not yet included in STEM education. However, the thesis that STEM education is aimed at general and normal students has not been proven yet. Our opinion is that STEM education is for gifted students. To support this, it is to publish "STEM for Gifted" as a special issue in 2021. We are calling authors studying in this field for articles for this special issue, the relationship between birth order and creativity in gifted children was investigated.

In the new era of JEGYS, we provide readers with easy access to the Academic Social Media for writers. In addition, we enable readers to see the author's abstract with the video he reads. One of our authors in this issue did this as an example. Based on feedback, we will design the next issue of articles in this format. JEGYS will continue to be a pioneer in academic publishing with innovations that provide the social visibility of authors.

Research Article

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

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Keywords:
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Integrated disciplines
Interdisciplinary relationships
Project based learning
Student projects

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Academic Social Media of Author

Abstract Video from the Author

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 preferred 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.

Figure 1.

Author's Academic Social Media Plugin on the First Page of the Article

In March 2021 issue; first article; the projects prepared by gifted students in competitions have been examined in terms of interdisciplinarity, second article; the STEM skills development aspect of the science camp for preschool students was examined, and this research is a very valuable research in terms of examining science camps in pre-school period, fourth article; an examination of football talent at primary level has been conducted in Slovenia, fifth article; the problems of the Polish education system during the pandemic period and the situations of gifted children in this process were examined, sixth article; the effect of using differentiation in the education of gifted children on the development of their creativity was examined, seventh article; learning styles and motivation in gifted children have been investigated.

In this issue, it is seen that all seven articles are research articles. We state that we are honored to publish articles guiding gifted students and advanced science education. We thank you for your contribution and support to JEGYS, which is the most followed platform by academics, policy makers and educators study in gifted and advanced science education.

Best regards

Dr. Hasan Said Tortop
Editor-in-Chief of the JEGYS

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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.
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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.

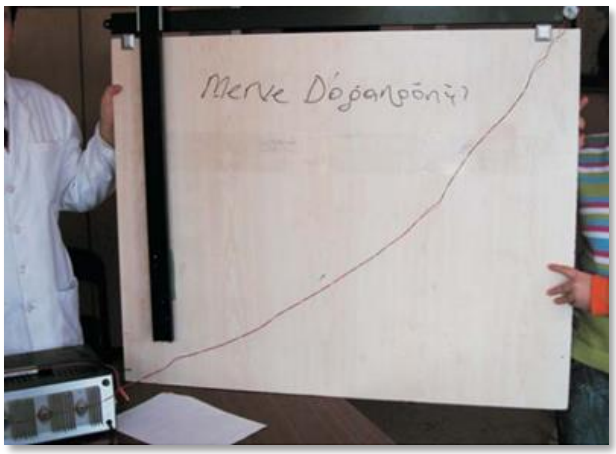
It is understood from the explanations made for 56 of the PBL practices include the interdisciplinary relationships as each one has the topics belong to two or more scientific disciplines. Although the gifted students could make integrations with 56 of the projects, they could make only 20 of the PBL 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.

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Research Article

Effect of science camp for enhancing STEM skills of gifted young scientists

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Abstract

Programs and educational practices that enable gifted students to conduct science activities and develop themselves in engineering fields are rapidly increasing in Malaysia. One of them is the science camp to improve STEM skills. This study investigates the effectiveness of science camp (Junior Science Camp) towards young children's understanding and knowledge about science. One hundred and three children aged four to six years old participated in the three-day camp. Mixed research model was used in this research. Data were collected by Junior Science Camp Scientist Test (JSCST) as pre and post-test, parent evaluation of the camp. Questions in the pre and post-test were on the content in the five camp modules: I am an engineer, I am a scientist, I am a chemist, I am a forensic scientist, and I am a natural scientist. Data from the open-ended question in the survey (parent evaluation) were used to triangulate the quantitative data from the pre and post-test. Findings showed that the camp was effective in enhancing the young children's (preschoolers') understanding about science and increasing their knowledge about science and STEM fields. Implications of this study are related to the design of future science camps and also the methodology and instruments of future research.

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Introduction

The importance given to science education and raising young scientists is an important feature of developed countries. In high school and university education in science education, Malaysia has ensured that this area is largely (60%) in the curriculum. Nevertheless, the target has yet to be achieved, besides it was determined that there was a decrease in the interest of students in the field of science (Halim & Meerah, 2016). Numerous policie, obstacles, and strategies formulated by Malaysian governments especially the Ministry of Education to deal with this issue. Quality of teaching has been cited as one of the factors that determining of the students' interest holistically in science at early years (Halim & Meerah, 2016). Saleh (2014) study findings showed that most of Malaysian high school students think that Physics activities are not atractive and enjoyful. Exciting and motivating teaching strategies might help in promoting interest in learning science. Responding to this, in year 2019, Pusat GENIUS@Pintar Negara, Universiti Kebangsaan Malaysia in collaboration with National Child Development Research Centre (NCDRC) at Universiti Pendidikan Sultan Idris took the initiative to organise a Science, Technology, Engineering and Mathematics (STEM) camp to young children with high ability. The most authentic way of introducing science to young children is to let them make their own

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discoveries and conduct activities and experiments as real scientists. Thus, science camps might be a great chance for this kind of science learning and discovering. Gagne (2000) in the Differentiated Model of Giftedness and Talent defined giftedness as potential that places an individual in the top 10% of same-age peers in a particular domain. Gagne´ emphasized that a developmental process of formal and informal learning is needed for these abilities to be transformed into talents or systematically trained abilities (achievement). Gagne´ highlighted that both the characteristics of the and the environment are crucial catalysts in the process of talent development. Therefore, the camp is conducted as an effort to provide enrichment activities for young children with high ability. Porter (2005, p. 148) defined enrichment for young gifted children as "the provision of broader, deeper or more varied educational experiences". Early identification of gifted young children, suitable and challenging educational programs are crucial for the attainment of gifted young children's full potential.

Leblebicioglu et al. (2019) define science camps as educational activities which are voluntary and held outside of school settings, and provide planned and structured activities. The participants receive certificates after completion of the camps, and the camps are evaluated to gauge its effectiveness. They empahsise that science camps must provide both formal and informal learning experiences to the participants.

Literature Review

Studies on science camp for young children

Studies on science camps provided some insights about the effects on the participants. For example, Gulsen Leblebicioglu, Metin, Yardimci, and Cetin (2011) investigated Turkish children's stereotypical images of scientists in a science camp where a team of scientists interacted formally and informally with twenty-four 6th and 7th grade students. The objective of the camp was to acquint the participants with the nature of science and scientists. Data on the children's images of scientists were from the analysis and discussion of their drawings of a scientist. Their images were challenged through the introduction of three non-stereotypical scientists. Draw a Scientist Test (DAST) as pre- and post-test was used to investigate the change in the children's images of scientists. The participants were also interviewed about their drawings. The findings suggested that the stereotypical images found in the pre-test were scientists were depicted as males and old. However, almost equal numbers of male and female scientists were sketched in the post-test, and they were portrayed as middle aged or young. The researchers concluded that the camp has been effective in making the children to grasp the human nature of scientists that both genders could be scientists, and not necessarily one needs to be old to be a scientist.

Hirça (2014) on the other hand, studied the result of a science camp which emphsised on the Nature of Science (NOS) instruction (explicit-reflective method) with on 30 Turkish gifted students. The open-ended Views of NOS Questionnaire used to assess the changing of students' NOS views. The pretest results determined that half of the gifted students were either at the transitional level or the informed level of the NOS. Findings after the science camp showed that the most of gifted students' NOS views advanced to the transitional view. This study may indicate that science camps for gifted students are very useful in supporting development in an important issue such as the nature of science.

Borgerding and Kaya (2019) conducted a study to investigate preschoolers's view about organisms, their environments, and justifications for linking organisms and their environments during the learning experiences in a week-long summer science camp at a preschool in the United States of America. The focus of the camp was on the concept of biological adaptation where the preschoolers's thinking about organisms, their environments, and the association between organisms and their environments was elicited. 53 preschoolers aged three to six enrolled in two iterations of a week-long summer science camp. Data collection involved 53 preschoolers aged three to six through daily sticker-sorting assessments and interviews with individual preschooler after the camp. Scores from the preschoolers's sticker placements and the reasons for stationing organisms in the selected environments were the data. Findings showed that age, environment, and organism-related trends play a role in the preschoolers' ability to decide the correct environments for the organisms, and influence their justifications for positioning organisms in specific environments. These findings add on to existing literature on preschool evolution education by drawing attention to what preschoolers are able to understand, and the rationalization they provide. Based on the findings, they proposed for developmentally-appropriate science education instruction for preschool children. As this study did not focus on student learning and the effects of instruction in this learning, the researchers suggest that future studies could investigate the influence of instruction in changes in children's ideas. Future studies could also realate these changes to camp experiences.

Metin and Leblebicioglu (2011) reported findings regarding effectiveness of science camp on Turkish children's conception of science. 24 children (11 girls and 13 boys) attended the ten-day science camp. Science teachers took part in the science camp. These educators carried out activities to support the development of students' research skills and collaboration skills throughout the science camp. In the subsequent days, the participants conducted guided-inquiry about the nature in small groups. NOS activities were carried out throughout the camp. The students are divided into groups. Each group prepared a poster and presented it to their families on the last day of the camp. In order to find out the effectiveness of the science camp in introducing science and its specific aspects, Views of Nature of Science Version D (VNOS D) was used as pre- and post-test. The findings showed that science camp program had positive effects on children's conceptions of science where they reported more scientific perspective. The NOS activities gave chances for them to learn more about scientific processes. Some of the participants showed more progress and were able to give more detailed expressions in defining science. In this science camp, students became aware of the details of the process and product parts of science. It has been stated that providing science education through nature and science camps is effective due to its characteristics such as active participation and exploratory thinking.

Results from previous studies on science camps for children and students showed that science camps have been effective in increasing children's understanding of nature of science and scientists, improved students' understandings of NOS, and brought positive effects on children's conceptions of science. Most of the studies in the literature related to science camp for children were from the western contexts and Turkey. Studies in Malaysia on science camp, especially for young children with high ability were scarce. Thus, this study was conducted to investigate the effectiveness of science camp to enhance STEM understanding and knowledge for young children with high ability.

Identification of gifted and talented children and providing appropriate and challenging educational experiences for them is firmly placed on the education agenda in many countries such as the UK and the US (Koshy & Robinson, 2006). However, the needs of the younger gifted children (those whose age is from 4 to 6 years old) have been neglected. In Malaysian context, Phillipson, Kaur, and Phillipson (2003) highlighted that gifted education was not given much priority in the education system, not only within the local community but also at the ministry level. However, recent literature (Ch`ng, 2014; Chan, 2018; Yassin, Ishak, Yunus, & Majid, 2012) on gifted education in Malaysia showed that Malaysian Ministry of Education has been reviving gifted and talented programmes for Malaysian students aged 13 to 17 years old. However, the identification and provision of appropriate educational experiences for younger children are still limited. Thus, Pusat GENIUS@Pintar Negara, the only government gifted school in Malaysia has taken the initiative to carry out the Junior Science Camp for younger gifted children.

Research Problem

Thus, this study is carried out to investigate the effect of science camp for enhancing stem skills of gifted young scientists. The main research question is 'Does the science camp (Junior Science Camp) has an effect towards the young children's understanding and knowledge about science?' The second reserach question is 'What are the parents' opinion of the camp?'

Method

Research Design

This study employed a quantitative method of inquiry to answer the research questions (Creswell & Creswell, 2003; Nardi, 2018). This survey research involved acquiring information from the parents' of the young gifted participants of the science camp.

Participants

The parents or caregivers were asked to sign a consent form for their children to be involved in the camp. The participants were from various family background. The demographic profile of the participants is shown in Table 3 below.

Table 1.

Demographic Profile of the Participants

Age(Years old)	4 years old		5 years old		6 years old		Total
Residential area	Urban	Rural	Urban	Rural	Urban	Rural	
Male	2	0	8	3	24	7	44
Female	2	2	16	4	27	8	59
Total	4	2	24	7	51	15	103
	6		31		66		

As can be seen in Table 1, 103 pre-school students living in rural and urban areas were selected for the study according to the stratified and criteria sampling method. Attention has been paid to the fact that the students are 4, 5 and 6 years old and they live in rural and urban areas.

Research Instruments

Junior Science Camp Scientist Test

The data collection tools included pre and post-test, and the questionnaire on the camp effectiveness. Both data collection tools were developed by the the committee members of the camp. To complement the quantitative data, an open-ended question was added in the questionnaire to determine the opinions' of the parents of the pre-school students who attended the science camp about its effectiveness and also to collect recommendations for future camps. The data obtained through the parents' responses about the science camp were subjected to content analysis. It is presented in the form of themes, with direct quotations.

Data Analysis

It was determined that the data collected by data collection tools are applicable to normal distribution. Therefore, the t-test was used in statistical analysis of the pre and post -test marks. Paired sample T test was conducted to investigate the effectiveness of the intervention using the five STEM-based modules in the camp on participants' understanding and knowledge of STEM. Moreover, frequency, percentage, mean and standard deviation scores for each program effectiveness evaluation item of the questionnaire were calculated.

The pre and post tests contain similar questions on the STEM content and activities in the five modules (an example of module content is shown in Figure 1 below).

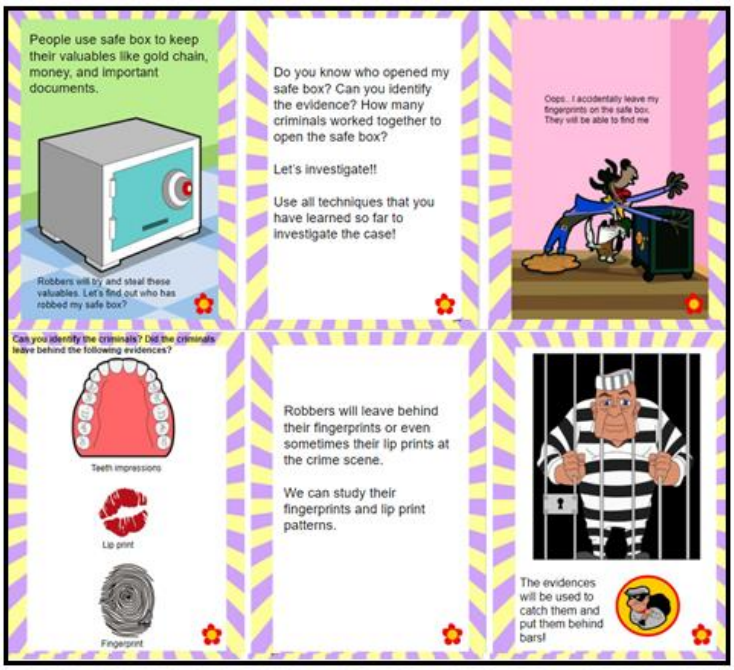

Figure 1.

Module Content : I am a Forensic Scientist

The five modules are 'I am an engineer', 'I am a scientist', 'I am a chemist', 'I am a forensic scientist', and 'I am a natural scientist'. There are twenty five questions with multiple choice answers. The children were only required to circle the correct answers. The mean and standard deviation were calculated for both pre and post test marks. Figure 2 below shows examples of some questions for the pre and post tests.

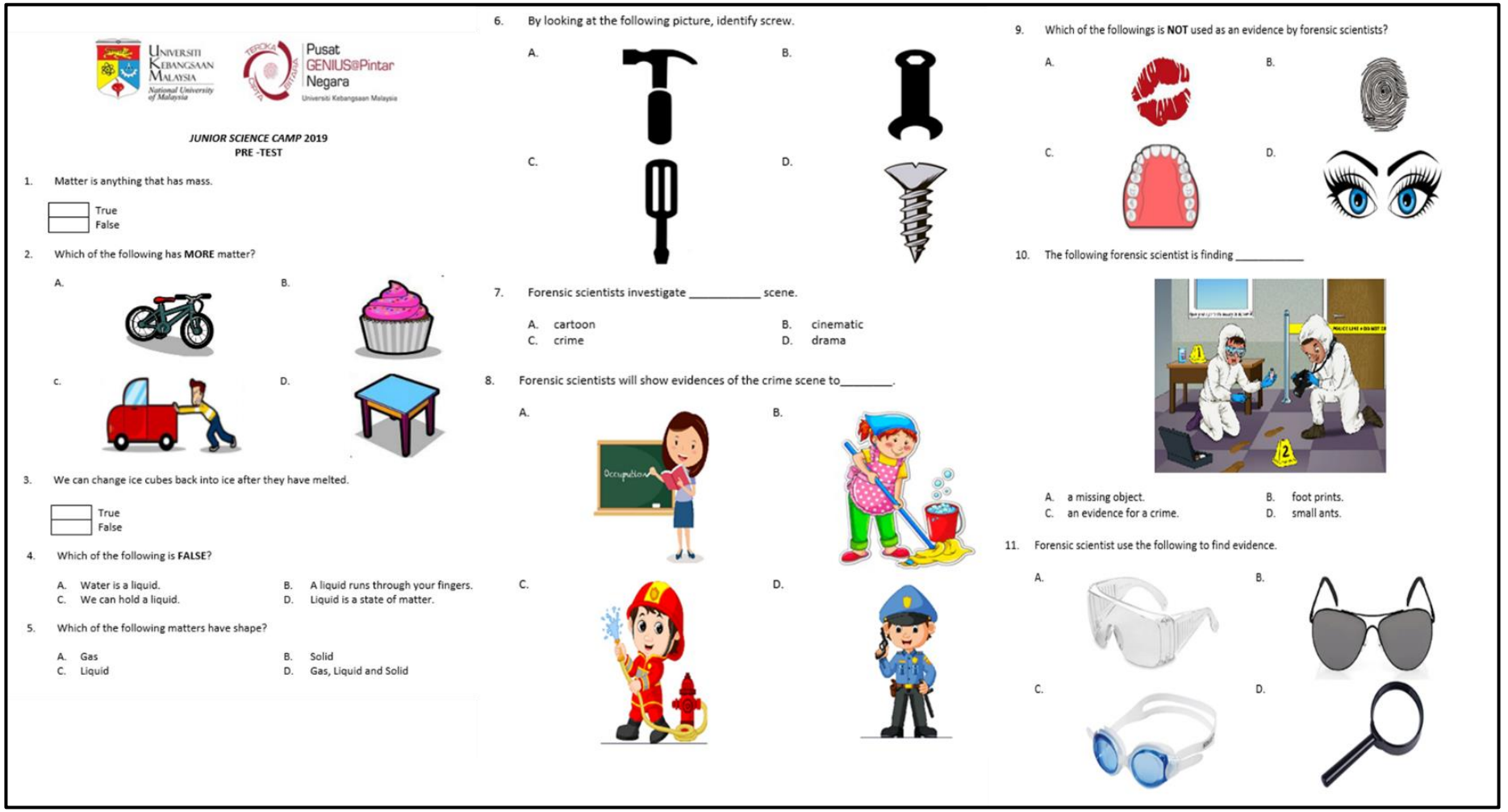

Figure 2.

Questions for the Pre and Post Tests

As for the questionnaire for parents, only the data from one section of the questionnaire were used to triangulate the data from the pre and post-tests. There were 3 sections in the questionnaire; 1) Implementation of the camp, 2) Administration of the camp, and 3) Effectiveness of the camp. Only the data from the third section, Effectiveness of the camp, were included in the data analysis. The mean of the responses was calculated. The reliability score for the evaluation of implementation of the camp, management, and effectiveness of the camp is between 0.780 to 0.909 (as shown in Table 1 below). While the Cronbach's alpha for the overall JSC 2019 Program Evaluation is 0.921 (16 items). This shows that the instrument used has good reliability.

Table 2.

Instrument (Survey for Parents) Reliability

Variables	Cronbach's Alpha	Number of items
Program implementation evaluation	0.780	4
Program management evaluation	0.891	6
Program effectiveness evaluation	0.909	6
Overall (JSC 2019 Program Evaluation)	0.921	16

In the questionnaire on the camp effectiveness, there was an open-ended section on Comments For Camp Improvement. The responses from the open-ended question enriched the data with more depth. The responses provided useful information on the parents' opinions and experiences. The open-ended question complemented the quantataive survey data. Only responses related to effectiveness of the camp in enhancing STEM understanding and knowledge for the young participants were regarded as the qualitative data. The qualitative data from the open-ended section of the questionnaire were analysed qualitatively where first codes were assigned. Then, the codes were categorized to identify the themes.

PERMATA Children Intelligence Scale (PCIS)

An online screening test, PERMATA Children Intelligence Scale (PCIS) was used to recruit the participants for the camp. It was developed by both National Child Development Research Centre (*NCDRC*) Universiti Pendidikan Sultan Idris (UPSI) and Pusat GENIUS@pintar, Universiti Kebangsaan Malaysia (UKM).

There are 5 aspects of cognitive ability tested in PCIS, which include i) abstract reasoning; ii) speed of information processing; iii) visual-spatial; iv) verbal comprehension and v) active memory. A pilot test of the PCIS was carried out with a sample size of 137 gifted and talented children from all over Malaysia (n=137). The reliability of the test is 0.918, which indicates that the test has high consistency in measuring young children's IQ. This shows that PICS is a reliable instrument to identify young gifted children because of its high stability. The validity score of the test based on each aspect is shown in Table 2 below. All the scores are above 0.70, and this proves that the items developed in the test are able to measure the desired variables accurately.

Table 3.

Validity Score of Cognitive Ability Aspects in PCIS

Aspect	Validity Score
Abstract reasoning	0.872
Speed of information processing	0.821
Visual spatial	0.770
Verbal comprehension	0.845
Active memory	0.771

The screening test was available online from 1 September, 2019 until 19 October, 2019 for children aged four to six years old. The children could do the test at any time convenient to them with the assisance of their parents or caregivers. However, parents or caregivers could only read out the instructions and questions and the children themselves must click or type the answers. If the test is taken at the pre-schools, the teachers must get the consent of the parents first. The evaluation and screening for the participants to be offered places at the camp were done after 19 October, 2019. The parents or caregivers of the selected children were contacted through email and phone calls in November, 2019. One hundred and three participants were selected to attend the camp at two venues, Pusat GENIUS@pintar, UKM and National Child Development Research Centre, UPSI.

Research Context

This section describes the research context where the STEM camp, module used for the camp, and research participants are presented.

STEM Camp (Junior Science Camp)

The Junior Science Camp was held at Pusat GENIUS@pintar, Universiti Kebangsaan Malaysia (UKM) and National Child Development Research Centre (*NCDRC*) Universiti Pendidikan Sultan Idris (UPSI) for three days from 9 a.m to 4.30 p.m. The camp was handled by five main instructors and teacher assistants (aged 20-24 years old) who were science graduates with Degree and Masters qualifications. The instructors and teacher assistants were given training for four days by the camp organisers who were science lecturers at the gifted centre on the aspects of traits of gifted children, teaching and learning for the gifted children, and how to carry out the activities in the five camp modules and programme. The training was conducted based on the Teacher's Manual prepared by the camp organizer.

There were five modules: I am an engineer, I am a scientist, I am a chemist, I am a forensic scientist, and I am a natural scientist. The modules were published by Pusat PERMATApintar Negara. The focus of the content of the modules was on doing science where the camp participants were expected to be involved in the hands-on STEM activities and experiments.

Results

The results answer the two research questions; 'Does the science camp (Junior Science Camp) has an effect towards the young children's understanding and knowledge about science?' and 'What are the parents' opinion of the camp?'

The First Section of the Results Answer the First Research Question

Effect of the Camp Towards the Young Children's Understanding and Knowledge About Science

The results show that there was an increase in the participants' scores in the post-test. The mean and standard deviation are higher in the post-test as shown in Table 4 below.

Table 4.

Paired Sample t-Test

Test	No	Min	Standard Dev.	t -value	Correlation	Level of Significance
Pre	103	12.58	4.53	- 3.92	0.42	0.00
Post		14.61	5.17			

Paired sample T test (as shown in Table 4 above) was conducted to see the effectiveness of the intervention using the five STEM-based modules in the camp for participants' understanding and knowledge of STEM. All 103 participants answered the pre-test before the activities started on the first day of the camp and the same questions were given on the last day of the camp after all the modules had been completed by the participants. The full score for the pre and post-test was 25. The average score for the pre-test for all 103 participants was 12. 58 and 14.61 for the post-test. The analysis of t test showed a significant improvement with pre-test ($M = 12.58$, $SD = 4.53$) and post-test ($M = 14.61$, $SD = 5.17$); $t(102) = -3.92$, $p = 0.05$. The pre and post-test scores showed a significant positive correlation ($r = 0.42$). Overall, there was an increase in marks in the post-test, and this proves that the STEM based learning and activities in the module have successfully improved the understanding and mastery of STEM knowledge among the young participants. This shows that this STEM camp has achieved one of its objectives which is to increase children's knowledge related to science through all the modules used.

Table 5.
Program Effectiveness Evaluation

No.	Statement	STS	TS	N	S	SS	Mean	SP
C1	The objective of the program to cultivate interest in the STEM field is achieved.	0 (0.0)	0 (0.0)	1 (1.0)	39 (40.2)	57 (58.8)	4.58	.517
C2	The content of the program is suitable to generate interest towards STEM.	0 (0.0)	0 (0.0)	0 (0.0)	30 (30.9)	67 (69.1)	4.69	.465
C3	My understanding of program content increased compared to prior attending the program.	0 (0.0)	1 (1.0)	5 (5.2)	33 (34.0)	58 (59.8)	4.53	.647
C4	Participants can increase their knowledge in related STEM fields after attending this program.	0 (0.0)	0 (0.0)	3 (3.1)	28 (28.9)	66 (68.0)	4.65	.541
C5	I feel I'm able to use the *Junior Science Camp* module to teach my child about *Science, Technology, Engineering and Mathematics* (STEM).	0 (0.0)	0 (0.0)	5 (5.2)	33 (34.0)	59 (60.8)	4.56	.595
C6	Overall, this program is successful and beneficial.	0 (0.0)	0 (0.0)	1 (1.0)	30 (30.9)	66 (68.0)	4.67	.494
	Overall						**4.61**	**.453**

(Level: Low = 1.00 – 2.33, Average = 2.34 – 3.66, High = 3.67 – 5.00)

Table 5 above shows the frequency, percentage, mean and standard deviation scores for each program effectiveness evaluation item measured by 6 items from the third section (Effectiveness of the camp) of the questionnaire. The results show that all six items have a high score with a mean range between 4.53 to 4.69. Based on these results, item C2 which is *"*Program content is suitable to generate interest towards STEM*"* recorded the highest mean (mean = 4.69, SP = 0.465), while item C3 which is *"*My understanding of program content increased compared to prior attending the program*"* recorded the lowest mean (mean = 4.53, SP = 0.647). Overall, the program effectiveness evaluation score (mean = 4.61, SP = 0.453) is at a high level.

Qualitative Research Results

Parents' Opinions of the Camp

Qualitative analysis of data (responses in the open-ended section of the questionnaire for parents) resulted to themes which emerged during the analysis, Theme 1. Exposure and spark interest in science, Theme 2. Effectiveness of camp module and instructors, Theme 3. Suggestions for improvement of future camp. Parents' opinions that the science camp has been successful in giving exposure and creating the young children's interest in science were evident in the following response.

Theme 1. Exposure snd Spark Interest in Science

Effective in providing exposure as kids have science technology and mathematics in primary 1 to 6.
Thanks to the effort, my son is very interested in science now.
It could make the children interested in science.
Overall, this program is very successful and gives new knowledge to participants and parents. Indirectly it can attract students in the field of STEM

The responses could imply that the parents felt that their children have received good exposure to science and the children became interested to explore more in relation to science. Moreover, responses also include parents' thoughts that the camp has played a role in achieving Malaysian government's goal in producing more students who are interested in science and pursue further studies in science related fields.

Theme 2. Effectiveness of Camp Module and Instructors

The following response from a parent shows that the camp has been effective due to the comprehensive module which contains creative activities and interesting science experiments.

… complex and creative modules that are rarely found in any institution
Well-established module, however, may be activities related to astronomy can be included because there is a planetarium here

Besides the module, positive responses were also given by parents for the instructors and teaching assistants.

A great module, dedicated instructor and teaching assistants who deliver wonderful work throughout the programme
Instructor and teaching assistants are skillful in handling young children. They are patient and my child likes them
My son has fun in this camp. Teachers and facilitators are diligent and wise in serving the needs of the children

Theme 3. Suggestions for Improvement of Future Camp

Responses from parents also indicated their suggestions for similar camps to be conducted for primary school students throughout the country. The following response indicate parents' suggestion for science camp to be made available for primary school children in order to make them interested in science from early age.

Similar camps at schools could foster students' interest in STEM at an early stage

A parent suggested for the modules to be made available to other primary schools in the country, and the camp is opened to anyone regardless of background and intelligence score.

I suggest these modules to be shared with all primary schools across the country. I think learning opportunities like this should be made available so that all students regardless of urban, rural, IQ level should be given the same opportunity

However, a response indicated that the focus should be on the students from rural areas. This could make them more interested in science.

This kind of program should be extended to more students (especially those in the rural areas) to enhance interest in STEM among students.

There were responses that the module, experiments and activities were not thought-provoking enough for the participants. Thus, comments include suggestions for more various and challenging experiments to be included. The responses from parents also include suggestions for improvement of the camp.

Increase the use of more 'scientific terms' that can increase children's curiosity

The evidence from this study suggests that generally the parents were satisfied with the science camp, and parents' responses include suggestions for the participants to be invited to participate in future science camps so the children's interests in science can be further nurtured and enhanced. Responses also include suggestions for longer duration of camp as shown below.

A very interesting camp, can cultivate students' interest in STEM. Maybe lengthen the camp duration to 4 or 5 days.
Include more learning by doing activities and also field trips

Discussion and Conclusion

This study was conducted to investigate the effectiveness of science camp to enhance STEM understanding and knowledge for young children with high ability. The findings show that the program effectiveness evaluation score is at a high level. The findings of this study make several contributions to the current literature on positive effects of science camp to students. The findings reveal that there was an increase in marks in the post-test, and this has proven that the STEM based module and activities have been effective in enhancing the understanding and mastery of STEM knowledge among the young participants. This indicates that the STEM camp has accomplished one of its objectives which is to increase children's knowledge related to science through all the modules used. An important finding was that the camp has been successful to generate interest towards STEM. This is consistent with the findings in Konur's (2019) study where students' interest increased in the post-test due to the activities carried out in the science camp for the secondary school students, and they could better relate chemistry to their daily life. There are suggestions for the inclusion of more hands-on experiments and field trips in future camps. This corroborates previous findings which showed that learning science by doing enhanced students' positive attitude towards science and nature (Birinci Konura, Şeyihoğlu, Sezen, & Tekbiyik, 2011), had positive impact on students' interests toward biology, their career decision and perception concerning biology and daily life (Sezen Vekli, 2013), and promoted positive behaviour toward animals, empathy, and conservation behaviour (Bexell, Jarrett, & Ping, 2013).

An interesting finding from the qualitative data of this study is the positive response about the teaching instructor and assistants. As they were carefully selected by the camp coordinator and were trained well, they were committed and showed enthusiasm in handling the activities and the young participants' behaviours. This finding is in agreement with Colker's (2008, p. 72) 12 characteristics of effective early childhood teachers: "(1) passion about children and teaching, (2) perseverance, (3) risk taking, (4) pragmatism, (5) patience, (6) flexibility. (7) respect, (8) creativity, (9) authenticity, (10) love of learning, (11) high energy, and (12) sense of humor". The teaching instructor and assistants showed patience, flexibility in carrying out the camp activities, respect for the children and were energetic.

Although this study's findings show that the camp has been successful, there are some comments for improvement given by parents. Following suggestions should be considered while designing future science camps or programs: First, include more first-hand activities, experiments, and field trips which will give exposure and chances for students to be engaged in various STEM related experiences such as astronomy, engineering and others, second, lengthen the camp duration, third, offer science camps to underprivileged students from the rural areas, and fourth, plan camps which have continuation and not just a one-off program. Future camps may also consider to include arts, as STEAM (Science, Technology, Engineering, Arts and Mathematics) education allows for children's engagement in arts activities which may enhance their holistic development not just cognitively, but also physically, social and emotionally. This is because while doing arts activities, children get the chance to practice diverse skills.

Limitations of Study

Several limitations of this study need to be acknowledged. Future research might include parent interview to evaluate the effectiveness of the camp and observation of the children's carrying out the activities could be carried out to triangulate the data.

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Research Article

Gifted and talented students in sports in the Slovenian primary school system

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Abstract

The aim of this study was to determine the attitudes of the educational staff and their assessment of their competence in the field of discovering and working with gifted and talented students in sports. Forty classroom teachers and 40 physical education teachers were included in the study. We used a questionnaire designed for the purposes of this study. The results show that teachers are aware of the role and importance of discovering and working with gifted and talented students, but that they need additional professional training to avoid possible mistakes and problems they might encounter in their work. The teachers believe that their school takes the serves the area of discovering gifted and talented students ($\bar{X}$= 3.50 (0.91); p < 0.001), somewhat less the area of educational work with them ($\bar{X}$ = 3.39 (0,77); p <0.001) and for the systemic and operational regulation of the education of gifted and talented students ($\bar{X}$= 3.35 (0.94); p = 0.001). Physical education teachers identified more children who were gifted or talented in sports than class teachers ($t_{(78)}$ = -5,979, p< 0,000). The scientific contribution represents an important contribution in the field of work with talented and talented students, as for the first time in Slovenia the views of the pedagogical staff and their assessment of competence with such a group of students are presented. We conclude with a critical presentation of some gaps and an overview of the existing situation as well as with some guidelines for further pedagogical and scientific research.

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Introduction

For the success, talent, giftedness or ability of the student to achieve exceptional learning outcomes, the school is most important, only then the family (Čotar Konrad & Kukanja Gabrijelčič, 2015; Kukanja Gabrijelčič, 2015a). The process of discovering talented and gifted students and adapting the pedagogical work begins immediately after entering school, where teachers must create suitable conditions for teaching by adapting the contents, methods and forms of work, and must enable admission to additional classes, other forms of individual and group help and other forms of work (Act Amending the Primary School Act, 2011). In Slovenia in 2019 there were major changes in the area of modernizing work with gifted and talented students. The basic legislative and programmatic starting points and other documents that have contributed to the renewal of the starting points are: (i) Concept: Discovery and work with gifted students in a nine-year primary school (1999); (ii) White Paper on education in the Republic of Slovenia (2011); (iii) Some modern talent theories of selected authors such as Gagne, Heller, Pfeiffer, Renzulli, Robinson, Subotnik, Sternberg, Ziegler; (iv) Recommendations of the Economic and Social Council European Union, Expert Group on Employment Social Affairs and Citizenship on unlocking the potential of students and young people with high intellectual capacities in the EU (García-Caro, 2013). The essence of discovering, encouraging and supporting gifted students is that they achieve optimal learning outcomes, are self-actualising according to their natural potential,

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values and goals, while contributing responsibly to social development. Indeed, it is assumed that the entire educational system has a duty to support the intellectual, emotional, social, moral, ethical and motor - i.e. holistic - development of students along the entire educational vertical.

In the Slovenian primary school system, gifted and talented students are enabled to harmonize school duties and sport in two ways:

- With special forms of organization, such as additional sports programs (more diversified sports, usually with five hours a week and additional courses or schools in nature) and
- With legal status rights of the student sportsman (Kovač & Jurak, 2012). For talented and gifted primary school sportsmen and women, special adaptations are provided for in the school legislation, which will be regulated by the Act Amending the Primary School Act (2013).

The inclusion of students in the additional sports program is voluntary and at the request of parents and students. A sports pedagogue and a class teacher participate in the implementation of the program in the first educational period, and two sports pedagogues in the second educational period (Curriculum, 2011). Another way of reconciling school commitments and sport is that the application for the status of a student to be awarded to a promising or top athlete is submitted by the student's parents. The school's rules on the adaptation of school obligations regulate the procedure for obtaining the status of a promising or top athlete and the adaptation of school obligations, such as participation in lessons and other activities and the methods and deadlines for assessing knowledge (Act amending the Law on Primary Education, 2013).

Giftedness and Sports Talent

More modern explanations of talent and holistic approaches on which the updated Slovenian guidelines are based refer to some foreign definitions, such as (i) Renzulli's three-circle model of talent (Renzulli, 1998), which points out the difference between school talent and the t.i. creative-productive talent; (ii) Gagné's model of talent and giftedness (Gagné, 1999), in which he clearly distinguishes between talent, which he understands as natural abilities or potentials, and talents that are developed from natural abilities through learning or through the development process; (iii) the definition of R. Subotnik, who says that talent is a manifestation of an achievement or product at the top of the talent distribution (Subotnik, Olszewski-Kubilius & Worrell, 2011); (iv) the definition of Pfeiffer (2012), who says that talent is tied to certain basic cognitive traits that manifest optimally together with certain personality traits, and so on.

Understanding and demonstrating talent in the general field requires (i) high general intelligence, (ii) creativity and (iii) personal characteristics (Renzulli, 2016), and the demonstration of talent (giftedness) requires not only a cognitive component, but above all: (i) mental and physical dispositions; (ii) the influence of the environment and (iii) the self-activity of the individual (Kukanja Gabrijelčič and Volmut, 2020). We speak of an athletically gifted individual if he or she reaches the top 10% of the distribution in the reference group in the area of motor (ability to move, manipulate and stabilize), psychomotor or sensomotor abilities and is characterized above all by sensitivity (senses), motor skills and abilities (coordination, precision), balance, mobility, speed, strength and endurance), accuracy of observation, hearing, sense of movement, etc. (Vaeyens et al. 2008).

Baker (2003) defines talents in sport on the basis of four groups of indicators: (i) anthropometric predictors, (ii) physiological-motor predictors, (iii) psychological predictors and (iv) sociological predictors. For a child to be talented in sport, he or she must have, in addition to motivation, endurance and environmental support, appropriate basic dispositions or innate abilities and characteristics from all three groups: (i) morphological characteristics (height, body weight, skin fold, circumference - joint diameter, body surface, longitudinal measurement of limbs); (ii) motor skills (coordination, strength, speed, precision, mobility, balance); (iii) functional skills (endurance: aerobic, anaerobic) (Kukanja Gabrijelčič & Volmut, 2020). The structure of psychomotor abilities of children must include a number of sensory, motor and cognitive abilities, namely (1) effective self-control and self-regulation of motor activities; (2) fine differentiation of sensitivity and adaptation of movements to the main control parameters (time, space, effort, speed, rhythm); (3) responsiveness and efficiency of motor activity regulation; (4) good motor memory; (5) strong will to regulate movement; (6) psychomotor performance and reliability (Petkova & Grebennikovaa, 2016). Škof (2010) names the most important motor skills, such as: muscle strength, agility, coordination, balance, mobility and functional ability (endurance). Schmidt and Lee (1999) point out not only the mentioned motor skills and abilities but also the precision of movement, reaction time, manual skills, dexterity and timing. The following points are therefore very important for motor skills: (i) Exceptional responsiveness and strength, which is reflected in the individual's speed; (ii) Performance, characterized as endurance or the ability to resist fatigue; (iii) Coordination of movement, which

manifests itself as agility (Petkova & Grebennikovaa, 2016). We point out that the entire identification and development process depends on the body constitution, biological and behavioral development and their various interactions (Kukanja Gabrijelčič & Volmut, 2020). Škof (2014) therefore emphasizes that resounding sporting successes can only be achieved by people who possess exceptional biological and psychosocial abilities for a particular sport that are hereditary (conditioned). It is also worth mentioning that each individual has his or her own unique dynamics of both biological and psychosocial development. As the differences in developmental dynamics between individuals increase sharply during puberty, they make it very difficult to predict sporting creativity in adulthood with regard to the situation in childhood (Kukanja Gabrijelčič & Volmut, 2020). Individual differences in biological development therefore have a direct and indirect impact on the process of talent recognition (Cumming et al. 2012), physical and functional characteristics are an important social stimulus for those involved in the recognition and development of young sports talents.

Identification Sport Talent

Identifying athletically gifted and talented students is a challenging process involving teachers, parents, a counseling service and, if necessary, external experts (e.g. a sports coach). The most appropriate period for discovering and promoting talent in a child is the early stages (Čotar Konrad & Kukanja Gabrijelčič, 2015). Experts do not entirely agree on the early detection of gifted and talented children, as some believe that early detection leads to greater chances of error in younger children due to the rapid and unpredictable development (Kovač & Jurak, 2012). However, the authors warn that if we start to discover talents and gifts too late, we could miss the best years that allow the athlete to develop in a particular sport.

When discovering and later identifying outstanding achievements in the psychomotor and sensomotor field in Slovenia, (i) sports competitions from individual sectors or areas (participation and good results in regional and national competitions) and (ii) outstanding achievements in the field of physical activity can be demonstrated.

The discovery of talented and gifted students, also in the field of sports, is done in three stages: (1) Discovering, (2) identification and (3) communication with parents and obtaining their opinion (Koncept, 1999).

Discovering

Discovering is based on various criteria, excluding tests or the use of specific assessment tools (Koncept, 1999). The criteria are (Concept, 1999; Štemberger and Filipčič, 2014): (i) the consistent evidence of excellent learning success in the subject of sport; (ii) the professional opinion of the teacher about the student during the educational process (the observation focuses on the quality of movement and performance). Particular attention should be paid to those students who show signs of talent and/or aptitude but do not show excellent learning outcomes, who come from a different cultural or socially disadvantaged background, who have specific learning or behavioral problems; (iii) the sporting performance of the student in regional and national competitions; (iv) Hobbies - a strong interest of the student in more permanent activities in the field of sport, in which the student achieves above-average results; (v) the opinion of the school counseling center, formed on the basis of existing student records, with kindergarten teachers, class and other teachers, interest mentors and other activities.

Students must meet at least one of the above criteria to be accepted into the enrolled group. Records of these students are kept by the school counseling center (Concept, 1999).

Identification

The identification of gifted and talented students (in the field of sport) involves a more detailed treatment of registered students and includes the following criteria: (i) Evaluation of already registered students by teachers using a specific evaluation tool covering the following areas: thinking skills, creativity, motivation and interests, leadership skills, physical abilities, excellence in various fields. Different methodologically sound instruments can be selected for the assessment, covering the above mentioned areas; (ii) aptitude test - individual or group test and (iii) creativity test.

In the first criterion, teachers assess students' motor skills with the help of a sports pedagogical map (Štemberger & Filipčič, 2014) or OLNADO7 assessment scales prepared by a group of experts from the Institute of the Republic of Slovenia for Education. A student who received an above-average grade in an individual area on the OLNADO7 assessment scale for teachers was classified as gifted or talented. The appropriateness of the assessment is assessed by the School Advisory Service together with the teacher who assessed the student (Concept, 1999).

Greater emphasis is placed on the tests of the sport-pedagogical map, as it allows a systematic review of the performance and developmental opportunities of the students. The sports pedagogical card is a national system by means of which we regularly monitor and evaluate the physical and motor development of children and adolescents aged between six and 19 years (Štemberger & Filipčič, 2014). Children and adolescents and their parents can use data

from physical education to observe physical and motor development, and sports educators receive important information on the basis of which they can provide professional advice. The sports pedagogy card therefore plays an important role in identifying talented students in the Slovenian school system, as there are no specific areas where the specific abilities of the entire student population are regularly monitored and assessed (Štemberger & Filipčič, 2014).

We note that the processes of identifying and selecting sports talents are among the important factors of sports excellence.

In practice, two different approaches or methods of identifying and selecting young talent have developed, namely (i) the natural method and (ii) the scientific method (Škof & Bratina, 2016).

In natural or spontaneous selection, the recognition of the sporting potential of children and young people and the involvement of young talents in sport is usually based on the results of competitions in various school and other competitions. In natural selection, the actual level of athletic fitness of the individual is taken into account, which can be considered an advantage. At the same time, however, it is also its biggest problem and shortcoming, as it does not take into account differences between children in the amount and intensity of sporting activity, the degree of biological maturity, differences in the development of the individual and his or her abilities. In natural selection, people with an early biological development, people who are or have been in training for a long time, children from a wealthier family, etc. have an advantage in various sports (Bishop & Brother, 2016).

Another approach to identifying and selecting talent is the scientific method. Many systems have emerged in which the selection process is based on scientifically defined criteria. Such identification and selection of talents, based on tests of various abilities, traits and characteristics, is called planned selection. In order to help coaches, parents and school teachers to identify talents for individual sports, a computer-based system "Talent - an expert system for guiding children and young people in sport" has been developed in Slovenia.

Information to Parents and Obtaining Their Opinion

The final step in identifying gifted and talented students is to get to know the parents and obtain their opinion. The counseling center, together with the class teacher, informs the parents that their child has been recognized as gifted and/or talented and asks for their opinion about the child (Štemberger & Filipčič, 2014). In this way, we obtain written consent for further monitoring of the child's development and for the preparation of an individualized program (Kukanja Gabrijelčič, 2017).

Preparation of an Individualized Programme

The individualized program for gifted students is adapted to the characteristics of each individual (Kukanja Gabrijelčič, 2017), whereby teachers of a particular profession, school counseling services and external experts must participate in the preparation for an individual subject area (e.g. for physical education).

In the following, it is agreed which topics are planned specifically for individualisation, and strategies are presented for adaptation at the content and process level, and for testing and evaluating knowledge.

Purpose of Research

According to the exposed problem starting points, we aimed to describe systemic regulation of the education of gifted and talented students at selected schools in the Republic of Slovenia, find teachers' opinion about working with sports gifted and talented students, describe how class teachers and physical education teachers recognize and discover gifted and talented students; and find how pedagogical work with them takes place at the primary school level in Slovenia.

Method

Research Model

The research is a descriptive research in survey model. With this research, a descriptive survey model was used to determine teachers' opinions about how gifted and talented students are diagnosed in the field of sports in Slovenia, how classroom and physical teachers implement pedagogical approaches. Because survey models are suitable for researches aiming to describe a past or present situation as it exists (Cohen, Manion, & Morrison, 2007).

Research Sample

The sample of respondents (N = 80, from where 40 primary school teachers (39 females) and 40 sports pedagogues (18 females)) was selected randomly and purposefully, as it included only primary school teachers and sports pedagogues of selected primary schools in the Štajerska region. Most of the teachers have been at work for 25 years or more (21 class teachers and 13 sports pedagogues), while the shortest working time (1-5 years) was repčorted for six sports pedagogues, whereaas one class teacher reported 6-10 years for shortest working time.

Data collection

Data was collected from May to December 2018 by the means of annonymous survey send by email. Email consists of link to electronic form with the website www.1ka.si.

Questionaire

The research data was collected by means of an anonymous questionnaire that was prepared for primary school teachers and sports pedagogues working at elementary schools. The questionaire consisted of 22 questions. It contained six demographic questions (gender, age, education, occupation, seniority and class), eight closed questions, two open questions, three combined questions and three Likert scales.

Data Analysis

The questionnaire data were manually entered into Excel and then downloaded and processed with the computer program SPSS (IBM SPSS Statistics 22). The following statistical procedures were used to evaluate the questionnaire: Frequency distribution (f, f%) - averages, scatter measures; inferential statistics (t-test). A t-test for a single sample and a t-test for an independent sample were used to analyze the data. The data obtained are presented in the form of tables. All decisions were meade at $p \leq 0.05$ and Bonferroni correction where multiple tests were used (see Tables for specific p-value being used).

Results

Opinion on the Systemic Regulation of the School Education of Gifted and Talented Students

The respondents answered on a five-point scale of positions, with 1 not at all, 5 being excellently provided for. In these statements, there are differences between the actual average and the hypothetical average that we calculated ourselves (3 - partly taken into account).

Table 1.

Teachers' Opinion on the Systemic Regulation of the Education of Gifted and Talented Students at Their School

Label variables	$\bar{X}$ - sd	p
Systemic and operational regulation of the education of gifted and talented students.	3.35 (0.94)	**0.001**
The area of discovering talented and gifted students.	3.50 (0.91)	**< 0.001**
Educational work with gifted and talented students.	3.39 (0.77)	**< 0.001**
Concern for the empowerment of educational staff.	3.03 (0.95)	0.815
Help for the pedagogical staff at the school and in supporting external institutions. Support for the pedagogical staff at the school and in supporting external institutions.	3.14 (1.04)	0.241

Legend: The mean value (standard deviation) is displayed. All decisions were made after Bonferroni correction of p-value to 0.01.

Teachers believe that their school best serves the area of discovering gifted and talented students ($\bar{X}$= 3.50 (0.91); p < 0.001), somewhat less the area of educational work with them ($\bar{X}$= 3.39 (0.77); p <0.001) and for the systemic and operational regulation of the education of gifted and talented students ($\bar{X}$ = 3.35 (0.94); p = 0.001). We assume that the systemic and operational regulation of the education and training of gifted and talented students is well provided for at their school. The least care is taken in the area of support of the pedagogical staff at the school and in the support of external institutions ($\bar{X}$ = 3.14 (1.04); p = 0.241) and in the area of care of the skills of the pedagogical staff (X = 3.03 (0.95); p = 0815).

Teachers' Opinions on Working with Sports Gifted and Talented Students

We were interested in the teachers' attitude towards gifted/talented students in relation to their length of service. We divided the teachers into two groups. The first group of teachers included teachers with a length of service of 1 to 15 years; the second group included teachers with a length of service of 16 years and more.

Table 2.
Teachers' Attitudes Towards Working with Gifted and Talented Students in Terms of Seniority

Label variables	»1–15 years«	»16 years and more«	P
Work is a burden to me.	2.38 (1.20)	2.14 (0.86)	0.400
Work is a pleasure for me.	4.38 (0.64)	4.09 (0.76)	0.115
My work represents an extended area of pedagogical work.	3.25 (1,18)	3.21 (1,18)	0.902
My work represents a greater complexity of pedagogical work.	3.33 (1.12)	3.82 (0.93)	0.048
My work represents a greater responsibility for the pedagogical work.	3.50 (1.02)	4.04 (0.91)	0.023
My work represents less knowledge in the field of learning differentiation, individualisation.	2.38 (0.92)	2.68 (1.01)	0.211
The work is more interesting and diverse.	4.21 (0.72)	4.05 (0.74)	0.394
My work presents me with new professional and personal challenges.	4.42 (0.50)	4.23 (0.66)	0.225

Legend: The mean value is given by age (standard deviation). All decisions were made after Bonferroni correction of p-value to 0.0062.

Using the Likert scale of attitudes (1 - not applicable at all, 5 - fully applicable) we found no differences between teachers with shorter lenght of service and teachers with longer lenght of services.

Discovering Athletically Gifted and Talented Students at School

Below we present the views of classroom teachers and physical education teachers on discovering gifted and talented students in sports at their school.

Table 3.
Differences between Class Teachers and Physical Education Teachers in Their Attitudes Towards Discovering Gifted and Talented Students in Sports

Label variables	Clasroom teachers	Physical education teachers	P
The process of discovering gifted and talented students in sports at school is extremely demanding.	2.78 (1.05)	2.50 (0.75)	0.182
I work with other educational staff to discover gifted and talented students in sports.	4.03 (0.89)	3.88 (0.96)	0.473
I encounter various problems when registering (nominating) students who are gifted or talented in sports.	3.03 (1.02)	3.00 (1.06)	0.915
My assessment in the process of registering a student as gifted or talented in sport proved to be correct in the further identification process.	3.83 (0.78)	4.00 (0.59)	0.264
I encourage both students who are already successful in sports and those who show potential in sports.	4.75 (0.43)	4.65 (0.62)	0.409
When identifying younger students who are gifted or talented in sports, it is appropriate to take measurements of motor skills.	4.05 (0.84)	4.18 (0.93)	0.531
The results of motor skills measurements are a good indicator of talent in sports.	3.63 (0.83)	3.98 (1.05)	0.103
I have a student in the class who is identified or is in the process of being identified as gifted or talented in sports.	2.35 (1.14)	3.88 (1.13)	**< 0.001**
I have attended a training to discover and work with gifted and talented students in the field of sports.	1.58 (0.90)	2.03 (1.23)	0.066

Using the Likert's scale of views (1 - I do not agree at all, 5 - I fully agree) we find that there are no major differences between the groups of primary school teachers and physical education teachers, only in the statement "I have a student

in the class who is identified as gifted or talented in sports or who showed statistically significant differences in the recognition process (t-test = - 5,979; df = 78; p < 0,001). Physical education teachers identified more children who were gifted or talented in sports than class teachers.

Adapting Physical Education for Gifted and Talented Students

Table 4.

Differences between Classroom Teachers and Physical Education Teachers According to the Frequency with Which Physical Education Lessons are Adapted to Gifted and Talented Students in Sports

Label variables	Clasroom teachers	Physical education teachers	P
How often do you tailor physical education to gifted and talented students?	2.98 (0.76)	3.20 (0.82)	0.210

Comments. The mean (standard deviation) is displayed.

The T-test for independent samples, taking into account the assumption of homogeneity of variance (F = 1.148; p = 0.287) between physical education teachers and classroom teachers, showed no differences in the frequency of tailoring physical education lessons to gifted and talented students (t = - 1.265 g = 78; p = 0.210).

In the context of this question we were also interested in which part of physical education the respondents differentiate learning most often, when they differentiate and individualize physical education most often and how often they adapt different forms of learning. The results show that the respondents in the central part of physical education most often differentiate learning (f = 71; 88.8%), while in the introductory part (introductory game, special heating) 5% (f = 4) of the respondents differentiate learning, but in the final part (f = 2) only 2.5% (f = 2) of the respondents differentiate learning. Three respondents (3.8%) replied that they do not adapt physical education. We also found that teachers most often differentiate and individualize physical education by consolidating or repeating the acquired subject (f = 57; 71.3%). Only 21.3% (f = 17) of the respondents differentiate and individualize physical education when dealing with new learning material, while only 5% (f = 4) of the respondents adapt physical education when testing and evaluating knowledge.

Discussion and Conclusion

Discovering and accompanying talents for sport and involving them in the coaching process of the sport that best suits their abilities at an early stage is one of the most challenging procedures modern sports science deals with. The desire for early sporting success can lead to a tendency towards rapid specialization. Ambitious encouragement of the child to coach only the chosen sport and thus to give up other leisure activities may hinder the child's concentration on the chosen sport. This, in turn, can increase the risk of recurrent injury and limit further motor, physical, emotional-social and cognitive development.

With a critical review of some Slovenian professional starting points we found this out:

- there are large terminological gaps in the definition of terms referring to talented and gifted students in the field of sport;
- we do not (yet) have a unified conceptual/curricular model in the Slovenian educational area in the field of definition, identification and work with talented students in the field of sport.

From the analyzed quantitative research data we have found that the systemic and operational regulation of the education of gifted and talented students in selected schools is good and that teachers are less well supervised in supporting and developing their competences and skills. Teachers involved in our research report that they are not well enough trained in the subject matter, pedagogical-psychological and didactical-methodological aspects of discovering and working with gifted students, including sports.

We can observe that schools are aware of the importance of discovering these students. On the other hand, the least attention is paid to developing the teacher's skills and abilities in the field of talents and gifts, which may consequently affect the teacher's discovery and work with talented and gifted students. A teacher's competence in working with talented and gifted students is a key factor in ensuring quality work with these children, as it requires maximum adaptation in the pedagogical process. It should be mentioned that higher education programs in Slovenia do not offer a specific subject or training (e.g. specialized studies) on talent, but the contents of this area are embedded

in various study subjects. It is therefore important that teachers attend a variety of training courses to discover and work with gifted students in order to deepen or acquire important knowledge for their higher professional competence.

We must point out that we strengthen the professionalism of the teacher and his or her sense of competence in working with the gifted through high quality training and continuous professional development. Kukanja Gabrijelčič (2015a) even points to a detailed analysis of the current state of a teacher's professional competence and notes that teachers who report a greater number of problems in working with gifted students also feel significantly less competent to work with them. It would be good to provide teachers with several years of additional training for working with gifted and talented students in order to avoid possible problems and thus feel more competent in working with them. Which would probably also influence the fact that they would not have a problem or that they would work with gifted and talented students at all. In this case, however, the following problem arises, which Kukanja Gabrijelčič (2015a) points out on the basis of the analysis of programs for professional development of teachers, namely: the programs offered are not suitable from the point of view of content and didactic-methodological approach; thematic conferences organized by the Institute of the Republic of Slovenia for Education offer rich and interesting content in the field of talents, but the organizer of the thematic conference is a school and not the Institute of the Republic of Slovenia for Education. It is also the burning prize for a particular thematic conference. great interest among educational workers for its implementation. Considering this, we believe that it would be necessary to offer teachers compulsory and multi-year and free or cheap educational opportunities in the field of giftedness, which would have a positive effect on the teacher and at the same time on the optimal development of the students.

We note that teachers do not draw up an individualized learning program for identified gifted and talented students, although the starting points of the program prescribe otherwise, and that teachers with a longer professional life feel more demanding and responsible in their work with gifted and talented students than teachers with a shorter professional life. . We assume that teachers with a longer working life do not have as much knowledge of sports talent and talent as teachers with a shorter working life. We conclude that younger teachers have had content on talent during full-time studies, while older teachers have not acquired much knowledge in this area. Authors and lecturers at the Faculty of Physical Education are increasingly writing about this topic and thus probably also about more awareness and sensitivity of young teachers. The authors Kukanja Gabrijelčič and Čotar Konrad (2015) point out that all teachers must be aware of their basic responsibility in teaching (sports) talent and talented students.

For teachers, working with athletically gifted and talented students means joy, different challenges, interest and diversity. However, despite the fact that the teacher's work is more demanding and extensive, we can conclude from the results obtained that this is not an additional burden for them. On the other hand, teachers agree that they pay too little attention to these students, for example due to lack of time and space, lack of sports equipment and accessories, class size, poorer professional skills, etc.

We also note that the most common problems in discovering and working with athletically gifted students are mainly due to lack of experience, sexual bias, various errors of assessment, one-dimensional assessment of students' talents, overestimation of diligence, more behaviorally oriented students and personal defensiveness towards students. The results of the survey indicate a larger gap, as there is the least agreement of all assertions in determining teacher involvement for continuing education.

On the basis of the results, we make proposals for further pedagogical and scientific research in the field of sports gifted and talented students: i) teachers must provide continuous professional education and training in the field of discovery of and work with sports gifted and talented students in order to facilitate and make work with them more successful; ii) it is necessary to systematize the system of discovery of talented and talented students in the field of sports. As a suggestion we cite e.g. tests that would be updated compared to the sports pedagogy card test and would also be suitable for testing a particular sport; iii) gifted and talented students in sport need to be provided with a more stimulating learning environment and more opportunities to develop talent / giftedness.

Early diversification can also lead to the success of sporting talent and bring important benefits for further participation in sport and the cognitive and personal development of the individual. In order to be able to assess the characterisation of the microstructure of the activities of outstanding sports talents, retrospective reports of young sportsmen and sportswomen must be defined primarily from the perspective of a systematic observation of sports activities. In future studies, it will be necessary to operationalize conceptually the common criteria for determining (discovering and identifying) sports talents (Kukanja Gabrijelčič & Volmut, 2020).

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Research Article

Problems, transformations, application examples and detections for gifted students in the Polish education system in the Covid-19 process

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Abstract

Poland, as a member state of the European Union, made various adjustments to the education system during the coronavirus pandemic. In this process, as in many countries, distance learning came to the fore. In Poland, the positive and negative aspects of the distance learning process, the relationships between students, teachers and teaching activities have become the subject of various studies. In the first stage, these studies were carried out through official institutions in order to obtain feedback about the process. The purpose of this research is to reveal the problems, changes and application samples in the Polish education system, and to examine the impact of remote learning on gifted students. This paper was designed with a case study, which is one of the qualitative research methods. The data obtained was analyzed using content analysis. The impacts of the Covid-19 pandemic on the education system are addressed by thematic groups. It has been observed that the changes implemented as a response to the pandemic have had various effects on teachers, students, parents, technological opportunities, motivation and teaching activities. It has been determined that the pandemic has seriously affected the identification and education of gifted students. Additionally, it was observed that students gained the ability to recognize and work with a new learning-teaching process through distance learning.

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Introduction

The pandemic has forced the entire educational process to be reinvented. This process brought different points of view. The Covid-19 outbreak that occurred in Wuhan, the capital of China's Hubei region in December, rapidly began to spread to other parts of the world – the World Health Organization (WHO) ultimately declared a pandemic on 11 March. With the advent of the Covid-19 virus, humanity faced a crisis. Normality was disrupted, and no known arrangement functioned properly. This new virus can be transmitted in mere minutes through droplets or even by touching metal surfaces or other materials which have been contaminated by an infected individual. Even though the elderly and very young children are the most vulnerable, no one is immune to this new infectious disease once it hits the body, so everyone is susceptible to its devastating effects (Bender, 2020; Meng, Hua, & Bian, 2020). Countries almost cut themselves off from one another. At this point, systems that existed in many areas, from trade to tourism, from health to education started to be questioned. With the closure of schools all over the world, education became one of the most pressing issues.

In addition to the adaptation of the students to the world during Covid-19, the pandemic brought with itself different perspectives in the world of education. It changed the perspective on - and approach to - education. Most importantly, the Covid-19 outbreak revealed that all the people of the world were interconnected. It showed that no behavior or action we have carried out so far is individual, and that these actions can affect the whole world (Smahel et al. 2020). In this context, the concept of the individual lost its importance and the concepts of humanity and unity

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came to the fore (Pyżalski, 2020). Therefore, it is thought that the definition of success will change greatly in the coming years, and a period will be formed in which people who understand mutual relations, strengthen differences and work in a global collaborative manner can be considered successful (Doucet et al. 2020).

By reconstructing the definitions we know, Covid-19 enabled people to re-define the role of the educator by assigning them new tasks. The understanding of teachers as a source of information and the understanding, and the idea that every individual who is knowledgeable is an educator now seems to lose its validity in 21st century education systems. Almost all of the students, who are 'Generation Z', are now able to use their phones, tablets and computers to access information and even gain or learn a technical skill. Nowadays they can access classes, trainings and conferences in just a few clicks (Pyżalski, 2020). Therefore, our concepts such as classroom, school and teacher should be reshaped and restructured completely according to the needs of these students. This highlights the role of the educator in helping the development of young people as members who contribute to society. For educators, flexibility and adaptability seem to be crucial at this point (Cortesi et al. 2020).

The Covid-19 outbreak led educational institutions to plan distance learning activities for students, to create content in this direction, and forced institutions to use existing technological tools. Educators around the world have experienced new things, did things differently and with more flexibility. This has provided potential benefits in accessibility to education for students all over the world. Although the doors of online education, which may be a new model in education, have been opened, the positive and negative aspects of this model have also started to be evaluated. Considering all these, a period has started to redefine many concepts related to education, such as school, teacher, student, and activity. It has become apparent that flexible educators with creativity, collective consciousness and vision will play an important role in the education system and world of the future.

Another fact that the Covid-19 outbreak shows us is that we need to acquire life skills that are different from our current life skills for the future, and that our perspective on life is changing. Accordingly, the need to teach young people about the life skills required for the future is born or will arise. In an ever-changing global environment, young people need flexibility and adaptability. Looking ahead, some of the most important skills employers will look for will be empathy and emotional intelligence, as well as creativity, communication and teamwork (Czechowska & Majkowska, 2020).

Poland's educational war with Covid-19 started on 25 March. As in all of Europe, due to the spread and severity of the virus in Poland, schools were temporarily closed and a new learning system was introduced. As ordered by the Ministry of National Education, the core curriculum was implemented remotely. This practice continued with a structure in which students, teachers and parents participated. The government empowered school principals to organize distance learning. It was emphasized that teachers should monitor and check the student's level of knowledge and progress in learning. With the online education process, following the learning processes has gained a special importance.

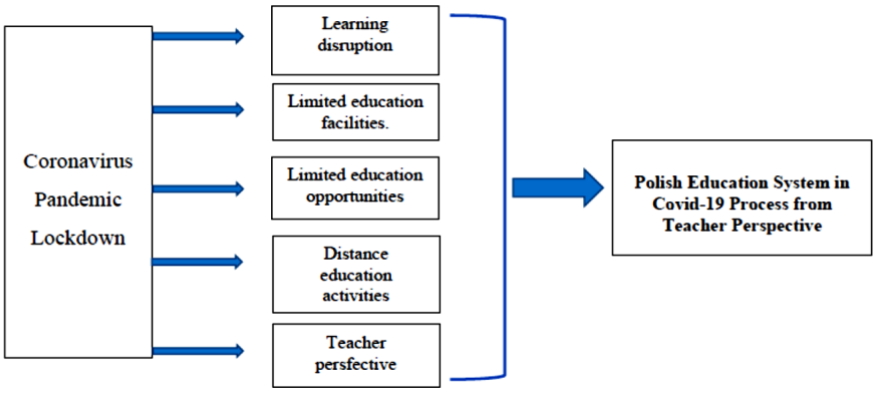

Figure 1.
Conceptual Framework of the Study

In this study the aim was to examine the changes in teaching activities in Poland during the pandemic from the teachers' perspective. For this purpose, the following sub-goals have been determined.

- What were the priority measures of the official authorities for the Covid-19 process in Poland?
- What are the technological difficulties teachers face in online education?

- What is the realization level of the remote learning program?
- What is the impact of the pandemic on the education of gifted students?

Method

Research Model

This study was designed with a case study, which is one of the qualitative research methods. The data of the research were obtained by document analysis. Qualitative research enables detailed comments and observations as studies on texts provide multiple and meaningful information (Denzin and Lincoln, 2005; Guba and Lincoln, 1994). Patton (2000) expresses that the situation can be revealed more clearly without any hypothesis and prejudice in such studies.

Data Collection

The main data of the research includes the steps taken by the Polish Ministry of Education in the educational activities due to Covid-19 in the 2019-2020 academic year and the studies carried out on this subject. Descriptive and classifying analysis was carried out on the regulations and the studies carried out during the pandemic. This made it possible to show the common aspects of the written content and to provide a generalization from the qualitative to the quantitative for the structure and classification of these contents.

The data used in the study was obtained from several sources. The report (Raport Ministra Edukacji Narodowej) published by the Polish Ministry of Education in June 2020 provides important data. The determination of the situation and the measures that can be taken are explained in the study through this report. This report was accessed from the ministry's website on 23.07.2020.

Another source of data is "Biernat, M. (2020). Badanie edukacji zdalnej w czasie pandemii, Badanie zostało zrealizowane przez Centrum Cyfrowe, Centrum Cyfrowe /Creative Commons Uznanie Autorstwa 4.0./ Opracowanie własne" with 1000 teachers in 2020. The data obtained from this study made it possible to examine the pandemic process in Poland from a broad perspective.

In addition, official documents published for gifted students were used. During the pandemic, the selection of gifted students and the applications made during the selection phase were determined.

The data obtained in this context are classified in terms of their subjects, and the common aspects of the changes in the education system are determined. In each item; thoughts after application and change are given.

Results

As highlighted by other countries, social isolation and the new circumstances have also been affected by other changes, including the impact of Covid-19 in the field of education and inexperience or lack of preparation of teachers and parents to support students or their children in remote or online learning – also influenced by the inadequacy of the methods used for online learning to the individual needs of students (UNESCO, 2020). Of course, different reactions have been developed to this unexpected process. The pandemic process started a process in which the entire educational process was recreated. This process brought different points of view. Poland quickly began taking measures to adapt to this unexpected process. Polish National Education Minister Dariusz Piontkowski published a report on the pandemic process (Rmen, 2020). It was decided that school principals and educational institutions should organize the education process using remote learning methods and techniques. It is stated that teachers should apply the curriculum, conduct the classes with students and evaluate student work. He also added that it is possible to create a flexible education system adapted to the needs of approximately 5 million students. It was emphasized that they had a special period behind the entire educational community, requiring a completely new approach to working differently than normal conditions. This report also includes various action plans. The necessity of ensuring the functioning of the units of the education system has been reported during the Covid-19 outbreak. The process of preparing for and implementing remote education has been presented regarding the prevention of Covid-19 – the counter-measures taken, the struggle of adapting to the new normal, and the gradual re-opening of selected types of schools and institutions.

In another part of the Ministry's statement, projects such as the development of digital competencies, digitization of educational projects and schools for teachers (for example "Active blackboard" program, Polish Education Network or IT Championship Center project) are included (Rmen, 2020).

An important part of the report includes information on the introduction of "epodreczniki.pl", the training offer from TVP and Polish Radio, and the support of television and radio channels to provide computer equipment and internet access for schools, teachers and students. The report provides an overview of activities in the field of online

education in selected European Union countries, as a separate section. Thus, it is possible to compare applications. One of the important parts of the report is the section of "Digitization of the education process – results and plans for other actions" (Rmen, 2020). The results are summarized about other activities that aim to improve the digital competences of students, teachers and management staff and to put more emphasis on the digitization of the entire educational process. The most important activities in this field are determined as follows:

- Improving digital and IT competencies of teachers and students
- Developing the Integrated Education Platform 'www.epodreczniki.pl'
- Expanding public, widely available and proven e-resources and an educational tools database
- Supporting leading institutions in equipping schools with the tools necessary to implement the new educational process (Rmen, 2020).

There are broad ranges of online education tools/platforms that facilitate online education particularly in times of outbreaks like the Coronavirus pandemic (Onyema, 2020). During the coronavirus epidemic, the experience of Polish teachers with online education has been the subject of different studies. In a study conducted by Digital Center in collaboration with Citizenship Education Center and School Foundation, Polish teachers' evaluations about the process were discussed. This study is the first major analysis in Poland during the coronavirus outbreak. The study includes 1000 teachers in Poland. The aim of the research is to identify the problems faced by teachers during online education. According to this research, 47% of the teachers who participated in the research stated that losing teaching time was the main problem. The lack of equipment and students' internet connection is the biggest problem for 32% of teachers. Nineteen percent of the participants stated that they had a problem in creating a work area, and 12% of them stated that they complained about their internet connections, while 10% of them were hindered by a lack of equipment. Although only 19% of teachers see a difference in learning as one of the main problems, 60% of teachers think that these differences are only problematic (Biernat, 2020; Mexhuani, 2015).

For most of the teachers surveyed, the e-learning activity was a challenge they were not prepared for. 85.4% of the teachers who participated in the survey stated that they had no previous experience with remote education. However, 48% of them stated that they had no difficulty using digital tools. On the other hand, problems related to the regulation of working in home office mode were also mentioned (Biernat, 2020). Previous studies confirm the impact of all of these factors on the quality of online learning, learning stimulation, motivation and improvement of teachers' attitudes toward technology, and integration of technology into learning processes (Huang et al. 2020).

The teachers who were surveyed pointed out that one of the biggest problems is organizational chaos. In this way, their thinking shows that distance learning was introduced overnight without specific solutions and teaching guidance (Biernat, 2020).

It is seen as an important problem that the way of working and organization did not follow standard principles. Some schools introduced a platform for distance learning and provided specific guidelines, while others used different practices.

Although students belong to a generation that is familiar with digital platforms, many have had problems motivating themselves to use the required programs, since students' interests were limited to web page activities, playing games and browsing social networking sites. During distance learning, students also faced various challenges. Some students lacked the necessary equipment. 36% of the teachers stated that this lack of equipment was a problem. There are several sources of these shortcomings:

- Parents working home must use electronic devices for work.
- In families with many children, the computer is shared among several students.
- Some poor or disadvantaged families do not own a computer (Biernat, 2020). Lurvnik (2020) and Yokozeki (2020) have reached similar findings.

These restrictions are resolved through external assistance or self-organization of parents. Only 10% of teachers cited the lack of equipment in their own homes as the main problem in the implementation of distance learning. Some teachers ordered their equipment at their own expense, while others complained about the quality of the internet connection. It was found that equipment deficiencies affect students more than teachers (Biernat, 2020; Perez, 2020; Wu, 2020) have reached a similar conclusion. The biggest problem arises from the connectivity problems experienced by students during the lesson.

According to some teachers, it is difficult to meet the expectations of students and parents simultaneously. Parents show that they have a problem determining how much time their child spends in front of the computer to play or

learn online. There are allegations about parents' assessment of how much time their children spend studying. For example, some claim that their child worked all day in front of the computer and received a bad grade," while the truth was that the child did not complete any set tasks. Similarly, in studies conducted with computers, it was observed that there was a tendency towards procrastination (Arënliu et al. 2020).

It is stated that using electronic programs and resources is not a problem for Polish teachers. They already had experience with these programs. 71% of the respondents stated that they were successful in this regard. According to them, they experienced problems using the programs and resources not due to their lack of competence, but because of the overload of portals (Pyżalski, 2020).

Whether students will have to revise the curriculum is one of the important issues. The teachers answered the question as to whether the students should revise their materials after the distance education period and before returning to school as follows:

- 23% of teachers do not think that the students should revise the curriculum that has been covered
- 30% of teachers think that the materials should be revised, but only partially
- 17% of teachers believe that there will be a significant amount of material to be revised
- 30% of the teachers reported that they were undecided about this issue. (Biernat, 2020).

What do parents think about distance education in the age of coronavirus? Parents' views on remote learning are not clear. A large group believes that the teacher has more cons than the pros. In the current situation, there is a certain impression that there are parents who take on the burden of educating children. Online lessons for parents is only a problem waiting for parents after class. It has been stated that parents need to spend long hours in order to do the tasks, exercises and other additional things directed by the children.

However, there are also parental opinions that see other sides of the situation and emphasize that distance learning is a significant challenge, but also a chance to develop (Blakemore, 2019). These views point out that online teaching is an important step in digitizing Polish education. However, it has been stated that the teacher's duties involve more creativity through distance education tools (Biernat, 2020).

Despite the problems, teachers see many benefits and opportunities in distance education. They agree that online learning is beneficial (Plebańska, 2019). It is thought that the implementation of the distance education system among professionals will be beneficial in the future, for example for students who do not attend classes or in the implementation of individual learning. Teachers also believe that this formula is a good solution, for example, where students cannot always attend the lesson (Biernat, 2020; Plebańska, 2019). Many teachers also welcome online meetings and mutual learning with other teachers (Biernat, 2020). It was emphasized that it is important to further develop e-learning tools and skills in this field.

The pandemic seriously affected the education of gifted students, like all educational institutions. This effect can be examined in two groups as positive and negative. It can be easily said that the negativities are more in terms of the effects of the pandemic. For example, it made it impossible to run the programs intended for gifted students.

The presented considerations on working with a gifted student show that the key role of the school in supporting the development of students' abilities in many cases fails. As noted by Zbyszko Melosik (2008), "Polish education - at the primary and secondary level - is the education of" lost talents "overwhelmed by the inevitable" mediating". Therefore, it seems necessary to develop a systemic program of work with a gifted student, taking many elements into account. The proper preparation of teachers to work and care for gifted students is of particular importance. In many European countries (including France, Austria, Slovakia, Denmark and Scandinavian countries), the issue of giftedness and forms of support for a gifted student has been included as a compulsory module in the teacher education program (Gwiazdowska-Stańczak & Sękowski 2018). Meanwhile, in Poland, these modules are taken on an optional basis, and decisions to conduct classes on the subject of skills as part of a separate module lie with the institutions organizing teacher education. The research results presented in the paper also indicate the need to motivate teachers to become more involved in working with a gifted student and help improve them in this area. It seems that it would be worthwhile to develop an offer of training, workshops, courses or postgraduate studies covering issues related to the methods of identifying gifted children and youth, developing competences needed in didactic and educational activities aimed at gifted students (Biernat, 2020).

For gifted students, the time of remote education was an opportunity to learn a new work technique. They learned about independence, structuring and planning work, carrying out tasks and finding time to rest. Through systematic contact with the teacher, a new "work rhythm" was created, which helped to structure the day and week. Students

were introduced to independence and responsibility for the individual stages of the projects and the final result. It was also an opportunity to deepen digital competences, including the efficient use of various communication channels, and cooperation with the use of ICT tools.

For gifted students, crisis remote education involves reorganizing their time, giving up many attractive and important activities and consultations, and leaving groups that implement extended education programs, e.g. preparing for competitions. In the face of certain characteristics specific to many gifted students, such as: increased mental excitability, sensitivity, perfectionism, asynchronous development, anxiety, one must take into account that what for some was a playful benefit of remote education, e.g. the possibility of carrying out lessons in pajamas just after getting up, for others it became the beginning of depression. Many gifted students in relation to the discussed situation may have problems with emotional stability, deepen their low self-esteem, increased difficulties in adapting to the high level of teachers' requirements, while having problems mastering digital skills. Another problem for students is the postponing of important exams, such as the eight-year exam or the matura exam, as well as moving away from the possibility of carrying out various forms of competition (Łukasiewicz-Wieleba, 2020, Rmen, 2002). Uncertainty related to arranging further educational plans and building a portfolio of extracurricular achievements, prolonged stress and entering into activities that compete with the field of abilities (here: media, new technologies) may lead to a reduction in motivation, the belief that there is no sense in one's own activity, disregard for achievements and resignation from effort (Bochniarz and Grabowiec, 2019).

In education, this concept of educational loss is acknowledged and recognized – that is, a noticeable decrease in the level of students' knowledge and skills. This happens especially after the summer holidays, when students spend this time completely detached from learning. The difficulties with remote education for gifted students include losses in educational progress. It can be assumed that they are more pronounced in the case of those students who associated specific development plans with a specific period (Gajderowicz, 2020). It affects students who were preparing for competitions and Olympics in schools and had to give it up or postpone it for the future. This also applies to the suspension of sports clubs, community centers and dance schools, and the cancellation of competitions and tournaments (Łukasiewicz-Wieleba, 2020).

Research has shown that there are teachers who say they don't have gifted students, or that they haven't worked with them at all. For some, remote education has no advantages, only disadvantages, because it will not replace the traditional method of learning, but can only be supplemental. And in the case of gifted students it does not work, because in the virtual world there is insufficient access to specialist literature (Bochniarz and Grabowiec, 2019).

An important element of the education of gifted students are extracurricular activities, carried out, inter alia, through a number of additional classes, often aimed at participation in competitions. However, it is difficult to hold teachers accountable for not doing extra-curricular activities with their students via the Internet. First of all, schools gave up such classes, recognizing that the most important thing is to maintain the continuity of the curriculum implementation. For the first time, a significant number of teachers faced the necessity to use remote education. They didn't have developed materials in their resources, they had neither experience nor ideas how to do it well. They used their own resources to buy the necessary equipment and pay for internet connections. In addition, even the preparation of materials for students for asynchronous education (the criticized instructions for independent work) could be very time-consuming, both due to the need to select the content and to clearly describe the recommendations for students. Instructions are given orally differently than when they are in writing (Łukasiewicz-Wieleba, 2020).

Teachers who decided to use the conference form of remote work also had to have time to test the possibilities and decide on their accuracy in relation to the diverse educational needs of students. In addition, the work performed by students was checked - sent in different formats and quality, at different times of the day and night. In such a multitude of technological and methodological innovations, it is difficult to find time to work with gifted students. Hence, many teachers, overwhelmed by the new responsibilities related to distance education, gave up their systematic care for gifted students (Łukasiewicz-Wieleba, 2020). Even if earlier, in the traditional way, they conducted additional classes, prepared students for competitions, provided psychological and pedagogical care, in the new conditions there was not enough time and opportunities for this. Some teachers decided that their subject could not be taught remotely. Even in sports schools, physical education lessons were limited to making presentations by students or discussing theoretical aspects of sport.

Conclusion

The increasing use of technology in education has modified teachers' methods from the traditional approach that often place them as dispensers of knowledge to a more flexible approach where they act more as facilitators, mentors and motivators to inspire students to participate and learn (Barr & Miller, 2013; Onyema & Deborah, 2019; Kumar, 2020). The primary steps of official authorities in Poland were to improve the digital and IT competencies of teachers and students during the pandemic, to develop the Integrated Education Platform, to prepare public and widely available scientific e-resources, to expand the educational tools and database, and to support leading institutions in equipping schools with the necessary equipment to implement the educational process. The Ministry of National Education has carried out various projects to prepare online education environments and make them available to teachers. Online education platforms, TV and radio channels, as well as the use of the internet stands out here. It is stated that using electronic programs and resources is not a problem for Polish teachers. According to them, they experienced problems using the programs and resources not due to their lack of competence, but because of the overload of portals.

Many teachers stated that losing teaching time was the biggest problem with distance learning. A lack of equipment and internet connection are among the main issues for students and teachers. Many findings indicate that access to the internet and technological tools is the biggest problem they encountered during online learning. (Houlden & Veletsianos, 2020; Morris, 2020; Perez, 2020; Wu, 2020; Zhong, 2020).

For most teachers, e-learning activity is a challenge they were not prepared for. Almost half of the teachers stated that although they had no previous experience with distance learning, almost half of them did not have difficulty using digital tools. Educators face difficulties in using technological tools. Especially many studies show that these problems are more prominent during the pandemic process (Geuna, 2020; Lau, Yang, & Dasgupta, 2020; Leung, & Sharma 2020; Ramadan, 2020).

It has been determined that educators who have recently adapted to distance education are failing to achieve the aims of the program (Barnes & Buring, 2012; Farrington, 2020; Obana, 2020; Olivier, 2020; Patrinos & Shmis, 2020). A similar situation is observed in the Polish example. 23% of the teachers stated that the students would not need to revise the curriculum after returning to school; 30% stated that parts of it should be revised, and 17% believed that a significant portion of the curriciulum needed to be revised.

Despite many difficulties, teachers think that distance education is beneficial. It is thought that the implementation of the distance learning system among professionals will be useful in the future, for example for students who do not attend classes, or in the implementation of individual learning. It was emphasized that it is important to further develop e-learning tools and skills in this field.

The pandemic made it impossible for gifted students to participate in activities that would reveal their true potential. Supportive training in line with the individual needs of the students could only be provided to a limited extent. This situation caused students to stay away from activities that could improve their abilities.
Competitions for gifted individuals could not be held due to the pandemic. Therefore, the number of applications submitted to such educational institutions was lower than in previous years.

Limitations of Study

The research is limited to addressing the changes that started with the Covid-19 process in the 2019-2020 academic year in terms of teachers. However, additional data was taken from the Ministry of Education, school reports, and remote learning study reports carried out during that time.

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Research Article

Effects of learning style based differentiated activities on gifted students' creativity

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Abstract

This study aims to investigate how effective are differentiation and enrichment of an instructional design in revealing and improving creative thinking skills of gifted and talented learners. Pre-test and post-test experiment-control group quasi-experimental design was used in this study. The subjects of the study consisted of 72 students aged 10 to 11 years, who were identified as gifted and talented and who are currently attending the same Science and Arts Center (SAC) in the province of Istanbul. When the findings were interpreted, it is possible to conclude that the instructional design that was differentiated and enriched by means of the Kolb's learning styles the Bloom's taxonomy had positive effects on revealing and improving creative thinking skills of gifted and talented learners. Based on the findings obtained within this study, we could recommend that teachers, who would like to support and develop their students' creative thinking skills, should first start with identifying the potentials, interests and learning styles of their students; then provide them with a learning environment where the students can demonstrate their creativity, defend their ideas freely, and produce unique solutions to the problems that they face; and finally employ the approaches, methods, or techniques that improve creative thinking and whose effectiveness is scientifically proven in the literature.

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Introduction

In the 2013 Strategic and Operational Plan published by the Supreme Council for Science and Technology (SCST), the concept of "giftedness" proposed as a corresponding term to the concept of "superior intelligence" refers to the individuals exhibiting higher levels of performance, compared to their peers, in the fields of intelligence, creativity, art or some other special academic fields (MEB, 2013). When the literature related to the characteristics of the gifted and talented individuals, which is portrayed in that description, is reviewed, it is seen that rapid learning, effective use of numbers, potential of creativity, spatial abilities, problem solving skills, strong memories, advanced moral judgment and sensitivity are among the most common features (Ataman, 1998; Maker and Nielson, 1996; Sak, 2010; Tortop, 2018).

In order to diagnose and develop the aforementioned characteristics of the gifted and talented individuals, it is essential to employ differentiated instruction models such as accelerating, enriching, and grouping, as well as prepare well-designed learning environments (Sak, 2010). The activities should be differentiated and enriched in order to enable gifted and talented learners to progress in their own pace and in accordance with their own abilities and learning experiences.

Differentiation is defined as differentiating the content, process and product dimensions of curriculum by taking the individual differences of the learners (Tortop, 2018). In differentiation, learners are provided with different options of absorbing the information, making sense of it, and expressing what they have learned. In other words, differentiation offers different ways of learning for students while they are working on the content to be learned and interpreting, processing, or producing the information they obtained. In this way, the learners are ensured to learn

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subjects and concepts more effectively by experiencing a variety of ways. On the other hand, enrichment is defined as improving the content related to the themes in the curriculum in line with the needs of the learners as well as maximizing the learning outcomes existing within the curriculum. Enrichment is also characterized as the study of a gifted and talented individual on a subject area in the program, much more intensively and extensively compared to his/her peers. In other words, with the help of enrichment the scope of the curriculum is broadened, and thereby more advanced themes are included. In this way, the students who are high achievers are provided with higher-order skills such as creativity, critical thinking and scientific thinking.

In gifted and talented education (GATE), differentiated instruction usually takes place in the following three dimensions: readiness, learning styles, and interest (attention). Learning styles could be described as the most effective dimensions to facilitate an individual's learning. When the relevant literature is examined, there appear a wide of range of classifications in relation to learning styles. One of the most important classifications is the Kolb's Learning Styles Model, which is also known as Experiential Learning Theory. The experiential learning theory sets out four distinct learning styles as components of an individual's learning. On the basis of those components, Kolb (1984) divides individuals into *Converging, Diverging*, *Assimilating*, and *Accommodating* learners.

Individuals with *Converging* learning styles prefer to deal with technical issues. They are successful in problem solving and they do systematic planning while solving the problems. As for learning methods, they prefer techniques such as experimentation, reflective observation, research, and problem solving. Individuals as *Diverging* learners review many aspects of concrete situations and organize relationships in a meaningful way. In the learning process, their thoughts and emotions are of paramount importance. They prefer methods and techniques in which they could use their imagination. Individuals with *Assimilating* learning styles focus on abstract concepts and ideas in their learning process. Their most prominent feature is creating conceptual models. They prefer research, observation and discussion as usual strategies or techniques in the learning process. Individuals as *Accommodating* learners are open-minded in learning situations and able to adapt to everchanging situations easily. Executing the decisions that they make and taking part in new experiences are among their major tendencies. During learning processes, they usually prefer creative writing and reading, brainstorming, and station technique.

Purpose and Importance of Research

In the education of gifted and talented students, teaching environments should be created that will enable students to question different situations and use high level thinking skills, support their independent work, and provide opportunities for them to use skills in different disciplines. In order for this to happen, teachers should configure their learning life by taking into account the characteristics and learning needs of each student in their classroom (Mann, Mann, Strutz, Duncan & Yoon, 2010). Especially identifying individuals' learning styles and providing appropriate educational opportunities according to those styles are important to ensure permanent and effective learning. As depicted in the relevant literature, many studies (Biggs, 2001; Bilgin & Durmuş, 2003; Ekici, 2013; Ghaedi & Jam, 2014; Graf, Kinshuk & Liu, 2009; Güven, 2004; Kaya & Akçin, 2002; Kılıç & Karadeniz, 2004; Ozerem & Akkoyunlu, 2015; Paris & Winograd, 1990; Sutliff & Baldwin, 2001; Vural, 2013) also confirm that a curriculum and learning-teaching processes designed on the basis of learners' learning styles would make it easier for learners to perceive real life events better, make use of learning-teaching processes more efficiently, learn how to use the information they acquire in appropriate conditions, and gain a higher level of motivation. There are different learning styles in the relevant literature. In this study, Kolb learning styles based on experiential learning were used, as it allows students to determine the learning styles as well as the places that need learning and individual development (Yoon, 2000; Kolb, 2000; Whitcomb, 1999).

This study aims to investigate how effective is *differentiated* and *enriched* instruction in revealing and improving creative thinking skills of gifted and talented learners. The instruction implemented within this study was differentiated with the help of the tasks and activities provided to the participants in accordance with the Kolb's learning styles and was enriched through the adjustment of the learning outcomes in the curriculum to the levels of analysis, synthesis, and evaluation in accordance with the Bloom's Taxonomy. When the relevant literature is examined, there are studies on the importance of differentiation and enrichment for the education gifted and talented learners, although there are not enough studies to be applied on the differentiation and enrichment of the course outcomes.

The design, which is prepared for the aforementioned purpose, aims to reveal gifted and talented individuals' creative thinking capacities existing as an innate capability and foster their creative thinking with the help of differentiated and enriched educational activities. With this study, it is thought that differentiation and enrichment concepts for teachers of gifted and talented students will be given to how to use them in the lessons.

Problem of Study

What is the effect of differentiated activities based on learning style on the creativity of gifted students?

Method

Research Design

In this study, pre-test and post-test experiment-control group quasi-experimental design was used. The fact that groups are formed through the similar experimental objects, not randomly, while forming experimental group and control group in a quasi- experimental model makes this model different from experimental model (Karasar, 2009). In this study, the features to be tested were determined in accordance with the purpose of the study, the learning environment was arranged in accordance with the subjects and the lesson, and the application was carried out by considering the students' readiness levels.

Participants

The subjects of the study consisted of 72 students (36 experimental group, 36 control group) aged 10 to 11 years, who were identified as gifted and talented and who are currently attending the same Science and Arts Center (BİLSEM) in the province of Istanbul. The method of appropriate sampling was used in the study.

As for the learning styles of the gifted and talented students who participated in this study, the average values of the points they obtained from the Kolb's learning styles inventory were calculated and the students' learning styles were identified. The results of the analysis are presented in Table 1.

Table 1.

Participants' Learning Styles by Gender

Styles	Gender	f	%
Converger	Female	9	25.00
	Male	7	19.44
Assimilator	Female	7	19.44
	Male	5	13.88
Diverger	Female	2	5.55
	Male	2	5.55
Accomodator	Female	2	5.55
	Male	2	5.55

As seen in Table 3, 25% of the female students and 19.44% of the male students reflected *converging* learning styles. While 19.44% of the female students and 13.88% of the male students tended to have *assimilating* learning styles, only 5.55% of both female and male students tended reflected *diverging* and *accommodating* learning styles.

In order to determine the level of creativity of the specially gifted students in the experimental and control group involved in the research, the creativity scale (how creative are you? the t test was used to determine if there was a significant difference between the scores. The results obtained are presented in Table 4.

Table 2.

T-test Results Regarding the Scores Obtained from the Creativity Test

	N	X	SS	Sd	t	p
Experimental Group	36	54.62	1.26	1.64	-1.68	0.38
Control Group	36	53..27	2.17			

It was determined that there was no significant difference between the scores obtained from the creativity scale of the students in the experimental and control groups ($t=-1.68$; $p>0.05$). In other words, the study concluded that there was no difference between the creativity levels of the students in the experimental and control groups and that they could participate in the practice in both groups.

Data Collection Tools

The data collection instruments that were used in the study were as follows: the Kolb Learning Styles Inventory (1985); the Creativity Test by Whetton and Cameron (2002); Torrance creative thinking Test Form A (Torrance, 1966) which was adapted by Aslan (2001) to Turkish culture.

The Kolb Learning Styles Inventory

The translation of the Kolb Learning Styles Inventory into Turkish was performed by Akkoyunlu and Peter (1993) (transmitted by Genç & Kocaarslan, 2013). The inventory includes 12 items each of which have four options. Each item receives a score of one to four points. The minimum score that can be obtained from the inventory is 12 and the maximum score is 48. It was determined that Gencel (2007) adapted to Turkish and the learning style dimensions of the inventory, whose validity and reliability study was performed, varied between Cronbach Alpha reliability coefficients between 0.71 and 0.80. Total score is obtained from inventory individuals among four that best define their learning styles. The next step is to obtain combined points. The combined scores value ranges from -36 to +36. With the combined scores, scores for the four basic learning styles are created in the learning circle of the student. The combined points represent the learning style of the individual on the x-y axis.

The Creativity Test (How creative are you?)

In order to determine the difference between the pre-implementation creativity levels of experimental and control groups, the scale named "How creative are you?" that was taken from Whetton and Cameron (2002) was used. Linguistic equivalence in the translation, validity, and reliability of the items within the scale was ensured by Aksoy (2004). The 40 items included in the scale aims to designate the learners' attitudes towards, interests in, and desires for creativity as well as to identify their creative personalities. On the other hann the 40 question was not in grading scale type. The reliability analysis of the scale indicated the Cronbach Alpha value as 0.78.

Torrance Creative Thinking Test

In this study, Figural Form A of the Torrance creative thinking test developed by Torrance (1966) and Turkish language equivalence by Aslan (2001) was used to determine the creativity skills of the students in the experimental and control group. Figural Form A consists of three activities: picture creation, picture completion and parallel lines. Torrance Test scores are calculated on the sub dimensions of creativity: fluency, authenticity, detailing and elaboration (abstraction of titles, resistance to closure, control States of creative power). When calculating scoring, these four sub-dimensions are calculated separately and as total points. 3 experts were involved in the scoring process. With regard to the inter-rater reliability of the TTCT, the results of five rater- reliability studies conducted with 2nd, 5th, and 8th graders as well as college level students and a random group of students ranged between .90 and .99 for five subscales except the college level student group which had a coefficient of .78 for the resistance to premature closure subscale (Torrance, 2008).

Data Analysis Process

During the analysis of the collected data, one-sample t-test was used and the Levene's test, mean values ($\bar{X}$), standard deviations (sd), frequency distributions (f), and percentages (%) were calculated.

Procedure

The implementation process took place in a total of 16 weeks between November 2017 and March 2018. Three inventories were employed to determine the characteristics of the participant students before the implementation. To determine the participants' learning styles, the Kolb's Learning Styles Inventory was applied and the participants having 4 different learning styles were identified. After the students ' styles were determined, TTCT was implimented.

During the implementation process, students are divided into groups according to their learning styles and the students were assigned tasks in line with their learning styles. In this way, the differentiation is ensured by achieving the same learning outcomes in different ways. In the implementation, along with the high-level learning outcomes, the low-level learning outcomes were adjusted to the higher levels in accordance with the Bloom's Taxonomy; and thus, the enrichment process was ensured.

During the implementation process, tasks assigned to students are based on the KOLB competency circle created by Maltbia (2009) based on the characteristics of learning paths and learning styles. In the following Figure 1, qualification circle features are presented.

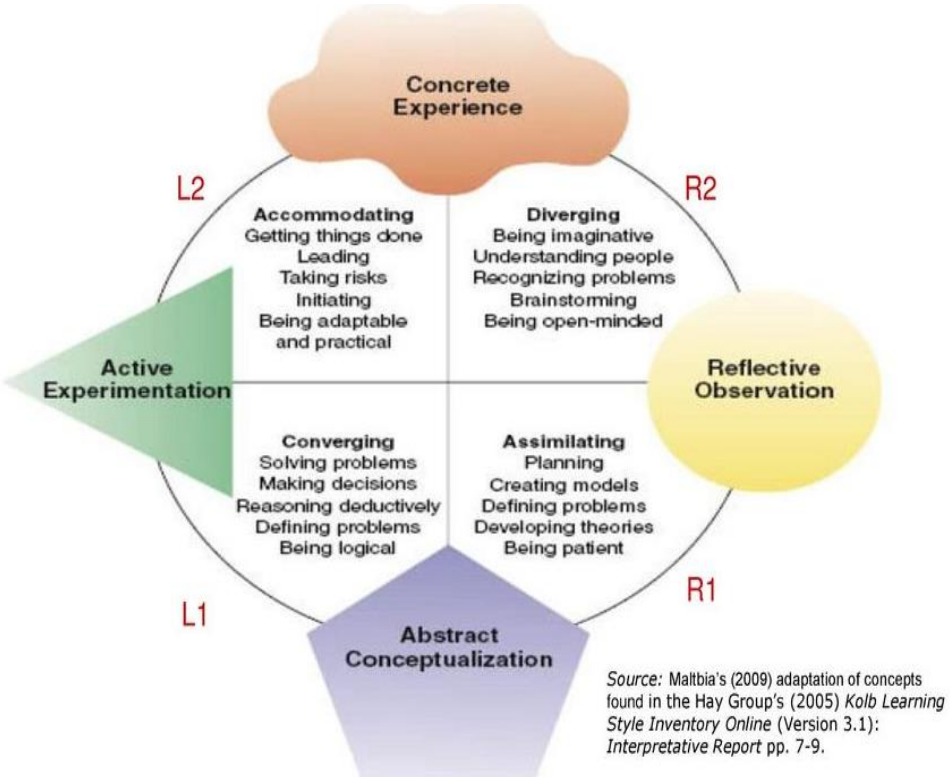

Figure 1.
KOLB Circle Features

During the implementation process, the participants completed the tasks in accordance with their own learning styles. In Table 1, the tasks given to the participants were determined on the basis of their learning styles and different approaches, methods and techniques were employed during the implementation process so as to improve creative thinking skills of the participants. The opinions of the groups presented in the table and 2 experts working in Yıldız Technical University, Department of Educational Sciences and 3 teachers working in Science and Art Center were taken.

Figure 2.
Scenes from Activities

Table 3.

Tasks Given to Participants by Learning Style

Groups	Activities	Details
Common Tasks	Application of the Kolb's Learning Styles Inventory	Participants' learning styles were identified.
	Application of the Creativity Test	It was employed as a pretest –posttest
	Torrance Creative Thinking Test	It was employed as a pretest –posttest
	Semi-Structured Interviews	To identify students' views
	Implementation of the Creative Thinking Activities by J. Renzulli	The creative thinking activities prepared by J. Renzulli were implemented on the basis of the participants' learning styles.
Converging	Authentic Designs for the Science and Technology Learning Outcomes	Machines and robots were designed as a solution to environmental pollution.
	Designs for Mathematics Learning Outcomes	Within the scope of the unit "Currencies" they designed their money by taking references from the models of the coins and banknotes around the world.
	Technology and Enrichment	Creative products were constructed through the programs of Canva, Storybird, Storyboard, Tagul from Web 2.0 tools.
	Engineering Theme and Creativity	An authentic machine was designed as intended for a specific problem in accordance with learning styles. The school of the future was designed.
Diverging	Implementation of the Station Technique	Outcomes were produced in accordance with the method related to the theme so as to reveal their level of creative thinking as a group.
	Game Design	Based on the materials given, original games were designed in groups and the games were played by other groups.
	Implementation of the Drama Technique	Activities were carried out to reveal their level of finding creative solutions that can be proposed to a problem situation as a group.
	Authentic Designs for the Visual Arts Learning Outcomes	Authentic products in relation to Visual Arts learning outcomes were designred.
Assimilating	Implementation of the Six Thinking Hat Technique	In order to reveal various thinking skills, different ideas about the theme were put forward.
	Implementation of the RAFT Technique	Through RAFT, which is a differentiated instruction technique, the participants performed the tasks that are appropriate to their own styles.
	Creative Reading for Turkish Language Learning	They performed tasks that are suitable for their learning styles with the help of the Reading Circles method.
	Social Studies Learning Outcomes and Creative Problem Solving	Solutions were generated in relation to specific social problems by means of the creative problem-solving technique.
Accommodating	Implementation of the Station Technique	Outcomes were produced in accordance with the method related to the theme so as to reveal their level of creative thinking as a group.
	Creative Reading Activity	Stories were written in in compliance with grammatical rules. They constructed their own alphabet with the help of the Cryptology Technique.
	Boxs Game Design	Based on the materials given, original box games were designed in groups and the games were played by other groups.
	Original Designs	As for the world of living creatures, new species were designed taking references from the features of the already existing species.

Results

Effect of Gifted Students' Creativity

The creativity of the gifted students study six dimensions of fluency, originality, eloboration, abstractness of titles, resistance to prematüre closure, creative strengths in order to determine their level of pre-test and Torrance creativity test was used as a contest to determine whether there is a significant difference between the scores of the effects obtained from a T test was applied. The scores obtained by the students in the experimental group are presented in Table 4 and the scores obtained by the control group Students are presented in Table 5.

Table 4.

t-Test Results Of Experimental of Torrance Creativity Test Score

Dimensions	Test	N	$\bar{X}$	S	t	p
Fluency	Pre-test	36	13.86	2.97	- 11.31	0.00*
	Post-test	36	20.63	2.66		
Originality	Pre-test	36	14.83	3.70	-6.31	0.00*
	Post-test	36	20.78	5.08		
Elaboration	Pre-test	36	14.31	2.64	-6.36	0.00*
	Post-test	36	20.72	1..56		
Abstractness of Titles	Pre-test	36	12.13	2.24	-16.74	0.01*
	Post-test	36	18.72	1.57		
Resistance to premature closure	Pre-test	36	12.52	2.46	-17.71	0.01*
	Post-test	36	19.94	1.49		
Creative strengths	Pre-test	36	9.80	1.57	-20.67	0.00*
	Post-test	36	15.48	2.64		

As shown in Table 4, the Torrence Test of the students in the experimental group was determined by the fluency (t= -11.31, p<.05), originality (t= -6.31, p <. <.05), abstraction of titles (t= -16.75, p <.05), resistance to premature closure (t= -17.71, p<.05), creative strenghts (t= -20.67, p < 05) sub-dimensions' pre-test post-test scores were found to be statistically significant. In other words, it was concluded that the application had a positive effect on the creativity levels of the students.

Table 5.

t-Test Results of Control Group of Torrance Creativity Test Score

Dimensions	Test	N	$\bar{X}$	S	t	p
Fluency	Pre-test	36	12.75	2.74	-3.22	0.38
	Post-test	36	13.24	4.68		
Originality	Pre-test	36	12.74	3.74	-2.04	0.21
	Post-test	36	13.38	3.98		
Elaboration	Pre-test	36	13.36	2.14	-3.63	0.38
	Post-test	36	15.53	3.57		
Abstractness of Titles	Pre-test	36	10.97	2.55	-3.43	0.32
	Post-test	36	11.52	2.14		
Resistance to premature closure	Pre-test	36	11.94	2.19	-3.38	0.20
	Post-test	36	12.36	2.08		
Creative strengths	Pre-test	36	10.19	1.97	-3.24	0.19
	Post-test	36	11.74	2.30		

As shown in Table 5, the Torrence Test of the students in the control group was determined by the fluency (t= -3.22, p> .05), originality (t= -2.04, p> .05), elaboration (t= -3.63, p> .05), abstraction of the titles (t= -3.43, p> .05), resistance to early closure (t= -3.38, p> .05), creative strenghts (t= -3.24, p> .05) the difference was not statistically significant.

Discussion and Conclusions

When the findings emerging in the current study were interpreted, we could conclude that the instructional design that was differentiated and enriched according to the Kolb's learning styles had positive effects on revealing and developing creative thinking skills of gifted and talented learners. The finding that the creative thinking can be improved when the learning and teaching processes are arranged in accordance with the learning styles of the students

is also consistent with the findings of the studies conducted by Chapman (1997) and Scott, Lenitz and Mumdorf (2004).

Tomlinson (2000) argues that the educational environment should be differentiated for gifted and talented learners. His statements about the reasons for this proposition are as follows: 1) The readiness level, interests and learning styles of the learners might differ even within the same class. In particular, gifted and talented children are in need of different levels of content and acceleration. 2) Gifted and talented learners might need to be challenged to show higher performance on the subjects that they have acquired. 3) Gifted and talented learners need to associate what they have learned in the school with their daily life. In other words, they need an enriched, challenging and well-designed learning environment for the themes included in the curriculum. After all, they need differentiated and enriched instructional designs that provide authentic research opportunities, as a starting point, for the problems regarding everyday life; ensure the use of scientific knowledge in solving those problems; and support higher-order thinking, interdisciplinary associations and creative productivity (Cooper, Baum & Neu, 2004; Güven, 2004; Meador, 2003; Maker & Nielson, 1996; Sak, 2010; Tomlinson 2000). The results of those attempts could be implied as indicators of the occurrence of significant changes observed in their learning processes going through differentiated and enriched instruction; use of skills for scientific processes; attitudes towards the classes; getting pleasure out of the classes, and so on.

One of the aims of education is to educate individuals who are constantly thinking, transferring their ideas into the real life, and producing new solutions to the problems they encounter. Raising individuals in line with this goal is mostly possible with their being aware of their own cognitive processes. Therefore, it is important for individuals to get to know their own learning styles. Individuals who are aware of their own learning can be successful in both academic and social life (Güven, 2004). In this study, the students were enabled to realize their own learning styles and to perform the tasks that are appropriate to their learning styles. For example, since the students having the "*Converging*" style of learning, as one of the Kolb's learning styles, are more willing and successful in working on technical issues, they were given tasks such as machine design, game design, spacecraft design, or design of the future school; and by this way, it is aimed to develop their creative thinking skills. In this process, the students participating in the research performed their tasks according to their learning styles and developed their creative thinking skills.

The positive impact of designing a learning environment suitable for learning characteristics on students' thinking skills have been put forward by several previous studies. For instance, the study conducted by Aktamış and Ergin (2006) emphasized that the students having creative potentials need a supportive environment that endorse both the product and the process; all children come to the world with the potential for creativity; and their school life is supposed to allow them to make discoveries through creative thinking, to look into the events and situations from different perspectives, and to produce new solutions to the problems they face in their daily lives.

Creativity levels need to be developed in order for students to grow up as individuals who can solve problems about themselves and their immediate surroundings as well as to look into the events from different perspectives. To do this, as given in the activities implemented within the scope of this study, it would be more effective, to find solutions to a real-life problem or improve their imagination in accordance with their learning styles. In addition, teachers can develop creative thinking skills in such a classroom setting where the teacher is a democratic and respectful guide; the students learn by doing and through lived experiences; different thinking skills are used and in-class interaction is engaged; and there is a positive atmosphere for discussion and inquiry. That classroom setting is also supposed to be environmentally friendly. According to Özerbaş (2011), a teacher who wants to improve the creativity of his/her students should firstly prepare a comfortable learning environment in which the students enjoy and learn as well as express their feelings and thoughts freely. In addition, he claimed that a curriculum which is designed within the vision of progressive education; which is based on interests and developmental characteristics of students; which attaches importance to the research and problem-solving skills of the students; and which gives priority to the student decisions would definitely make a positive impact on the creativity of the students. Başer and Ersoy (2009) argue that teachers should include activities that will motivate students within the classroom and that will enable students to make authentic experiments. They should also prepare learning-teaching environments that will enable students to find different solutions to the problems encountered in real life.

Based on the findings of the current research, it could be recommended that teachers, who would like to support and develop their students' creative thinking skills, should first start with identifying the potentials, interests and learning styles of their students; provide them with a learning environment where the students can demonstrate their creativity, defend their ideas freely, and produce unique solutions to the problems that they face; and employ the

approaches, methods and techniques which develop creative thinking and whose effectiveness is scientifically proven in the literature.

Limitations of Study

In this study, the necessity of applying and evaluating the Torrance Creativity Test correctly is seen as the limitation of the study. In this context, the limitation was reduced by the researcher taking Torrance Test Practitioner Training.

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Research Article

Learning style and motivation: gifted young students in meaningful learning

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Abstract

This study aims to look at how the learning styles of young gifted students in Islamic education which is meaningful learning, then also see how the learning motivation, and how the influence of learning styles of learning motivation of the young gifted students. This research is a mixed study using a sequential explanatory approach. The sample of this study is the children of the young gifted students at Elementary education level, which focuses on Islamic learning. This research was conducted in two different places, namely in urban areas and in rural school areas. Researchers used a purposive sampling technique to get a number of samples, based on the technique were used, obtained by 108 students participating, with 57 students from urban school areas and 51 students from rural school areas based on the grades given by the teacher. Two types of instruments have been used in this study, namely questionnaires relating to learning styles and student motivation, as well as in-depth interview guides. The questionnaire uses a Likert scale of 5 with a Cronbach alpha value of 0.81 for the learning style questionnaire and 0.79 for the student learning motivation questionnaire. Data analysis in the form of descriptive statistics such as mean, frequency, percentage, standard deviation, min and max, and inferential statistics such as simple regression and independent sample t-test was used to answer the question of the study. The results show that the learning styles of the young gifted students in Islamic learning are very varied and good, both urban and rural school areas. Motivational results also show very good results where students feel motivated by meaningful learning both in urban school areas and rural school areas. Furthermore, further analysis shows the significant influence of student learning styles on student motivation. Independent sample t-test also shows that there are differences in the mean of students' learning styles and motivation among students who study in urban areas and students who study in rural areas, which have higher motivation and learning styles in urban students compared to students who study in rural areas. Lastly, researchers hope that further research will examine the Indonesian young gifted students, especially research, such as learning styles with student learning outcomes, or motivation towards learning outcomes, which focus on Islamic learning with the implementation of meaningful learning.

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Introduction

Learning is a process of the development of human life. Through learning, humans experience a process of change so that their knowledge, behavior, understanding, and skills change (Tanti et al. 2018). A quality learning process can be created if students and educators play an active role in it (Azhary, Supahar, Kuswanto, Ikhlas & Devi, 2020). Students and educators, interact in an activity called learning that takes place in the learning process (Asrial, Syahrial,

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Maison, Kurniawan & Piyana, 2020). Efforts to realize an effective and efficient learning process, the instructor should be able to realize teaching behavior appropriately, in order to be able to realize the learning behavior of students through effective learning interactions in a conducive learning process.

In the learning process, a person needs a way that is considered suitable or comfortable with what he lived during the learning process. Comfort in learning is a learning style that is considered suitable by the learner (Holliday & Said, 2008; Gurpinar, Alimoglu, Mamakli, & Aktekin, 2010). Learning style is a combination of how students absorb lessons, then organize and process information (Abante, Almendral, Manansala, & Mañibo, 2014). Learning style is not only an aspect when dealing with information, seeing, listening, writing, and saying, but also aspects of secondary processing, analysis, global, or left-brain or right-brain, other aspects are when responding to something about the learning environment be it absorbed abstractly or concretely. All people of all ages can really learn anything if allowed to do it in a unique style that is in accordance with their own personal strengths (Uğur, Akkoyunlu & Kurbanoğlu, 2011). These students are better able to display consistent performance if the working conditions match the preferences of their individual style, this is the same as student learning styles. If students learn using their learning styles, students will more easily process the material provided by the teacher to her/him.

In effective learning, not only with learning methods and approaches, but learning styles also affect the success of learning (Riener & Willingham, 2010; Gilakjani, 2012). Based on the results of research, the most appropriate teaching methods all fail, because each teaching method is very dependent on student learning styles and ability to understand the material (Komarraju, Karau, Schmeck & Avdic, 2011). Thus, it can be concluded that improving the quality of learning is very dependent on the learning styles of students, by using an effective and enjoyable learning style, students can improve learning outcomes, motivation and learning enthusiasm even though the material taught by educators is quite complicated for them.

Every child has a different level of intelligence (Asrial, Syahrial, Kurniawan & Anandari, 2020). Each child has a different learning, character, different habits, with a different way of learning, there are those who prefer learning while playing, telling stories, or listening. Many students are very focused and very enthusiastic about activities outside the classroom, but in class they do not pay attention to the lesson, there are also students who are active outside the classroom, but also active in the class, there are students who are not enthusiastic about both. There are also students who do have a level of intelligence from birth, and there is also a gradual intelligence level. In terms of the environment can also affect students in learning (Wang & Holcombe, 2010; Reyes-García et al. 2010). So, with this educator must be smart in choosing which learning style is appropriate for the students who can generate motivation and learning outcomes. Because there are still many educators who have not been able to use appropriate learning styles in the learning process. Educators must have a variety of teaching tricks, namely learning styles that include visual, audio and kinesthetic or practice, to help students learn (Roach, 2014). In the use of learning styles in the learning process, educators can also be assisted by learning media. Learning media that can be used in visual learning styles such as educational videos or films, graphics and pictures, audio learning styles using learning media in the form of listening or radio, and kinesthetic learning styles that can use learning media that optimizes motion functions.

With a learning style that is assisted by diverse educational media, educators can enhance effective learning styles in the classroom and educators will have a steadier and more trustworthy handle to provide enjoyable lessons (Buckley, & Doyle, 2017; Darmaji et al. 2019). Learning styles can also affect students' personal learning, it can be said that students are scientifically motivated which makes the learning process of students more effective (Tai, 2013; Ghaedi, & Jam, 2014). Scientific attitudes such as self-motivation towards the teaching-learning process will give a critical attitude to the way of learning and encourage to search a path that guarantees more success. With the emergence of motivation, students will be able to learn by themselves (Reeve, 2012). Motivation will change students' perceptions that the lessons taught are not difficult, and do not haunt students in working on problems.

Students who have high learning, motivation are very likely to get better learning outcomes because he will try hard with all the effort to learn the subject (Chang et al. 2014; Dogan, 2015). Therefore, learning motivation is very important in achieving student learning success. Everyone who does various learning activities, of course, does it because there is something underlying it. Motivation is what will affect the learning process and learning outcomes that will be achieved both directly and indirectly (Eisenkopf, 2010; Ushioda, 2012). Generally, motivation will encourage behavior and influence and change behavior. Students who carry out their learning activities cheerfully, happy without feeling depressed will facilitate the effective teaching and learning process because it is naturally motivated. Basically, motivation is aroused desire or action to do something so that it can get the desired results

(Kim, & Pekrun, 2014). So motivated students will easily accept the lesson. For a student, the role of motivation is very important. With the motivation provided by educators through the intermediary of learning styles, it will support a very enjoyable learning process and eliminate the perception that learning in the classroom is creepy.

Furthermore, some research on learning styles in Indonesia tends to be for students in general both elementary school, high school, and the bachelor's degree (Surjono, 2015; Leasa & Corebima, 2017; Rahman & Ahmar, 2017). In the research conducted by researchers, researchers focused on the young gifted students in elementary school. Interestingly, every school that is targeted for research applies meaningful learning-based learning. Meaningful learning is an approach that allows students to work on diverse activities to develop their skills, attitudes, and understandings with an emphasis on learning while working (Keskitalo, Pyykkö & Ruokamo, 2011). Meanwhile, the teacher uses various resources and learning aids, including the use of the environment, so that learning is more interesting, enjoyable, and active (Baid, & Lambert, 2010). Furthermore, researchers are also more focused on student learning styles and their effects on student motivation to learn Islamic education. This research focuses on answering several questions, such as:

- What is the learning style of the young gifted students of elementary school in Islamic education learning?
- What is the motivation for learning the young gifted students of elementary school in Islamic education learning?
- How does the influence of the young gifted students' learning style toward their motivation in learning Islamic education?
- Is there any differences gifted students learning styles and motivations in who enrolled urban or rural cities?

Method

Research Design

This research is mixed research that combines quantitative and qualitative sequential explanatory approaches (Creswell, & Clark, 2017). The sequential explanatory approach in its use, prioritizing quantitative data followed by qualitative data (Bakla, 2018). Quantitative data in this study describe how the description of the results of learning styles and learning motivation of young gifted students, then see how the influence of learning styles of learning motivation. Furthermore, the researchers confirm the research by taking qualitative data, in which qualitative data aims to strengthen quantitative data.

Research Sample

Research that has been conducted in Elementary Education, Bengkulu Province with two different regencies or cities, namely Seluma Regency and Bengkulu City. There are 6 Elementary Education sites which are the research sites where 3 schools from Bengkulu City and another 3 schools from Seluma Regency. The participants of this study are sixth graders, who have above average ability or young gift in each of these schools. In the Indonesian setting, there is usually 1 class per grade for the young gifted children. Furthermore, in selecting participants, the researcher used a sampling technique, purposive sampling, in which the researcher determined his own criteria (Lichtman, 2012). These criteria are schools that have a place for the young gifted children, and then the children who are taken in the sixth grade at each school. For details on the distribution of the number of participants for each of the young gifted children from the Elementary Education in Bengkulu City and Seluma Regency, where 108 students participated, with 57 students from urban areas, and 51 students from rural areas, as indicated by the following table 1.

Table 1.
Distribution of the Participants

Regency / City	School	Sample (n)
Bengkulu City	SDN 52	20
	SDN 5	18
	SDN 20	19
Seluma Regency	SDN 23	19
	SDN 164	17
	SDN 60	15
Total (N)		108

Instrument and Procedure

In this study, there are two types of instruments, namely, questionnaire and interview. The questionnaire is used to get quantitative data (Muijs, 2010; McMillan, & Schumacher, 2010), while the interview is used to get qualitative data (Atkins, & Wallace, 2012). There are two questionnaires used, namely a questionnaire related to student learning styles, and a questionnaire related to student learning motivation. Questionnaires related to learning styles were developed by researchers based on three categories of learning styles such as audio, visual, and kinesthetic. This questionnaire has valid 30 items, with 10 items for the audio learning styles, 10 items for visuals, and 10 items for kinesthetic. This questionnaire has a Cronbach alpha of 0.81. While the questionnaire related to learning motivation was independently developed by researchers. The questionnaire consisted of 25 items valid, which focused on looking at the motivation to learn from the young gifted students. The questionnaire has a Cronbach alpha of 0.79. For each of the questionnaire, categories are shown in table 2. While the interview questions used, developed by the researchers themselves, adjust to the questionnaires that have been used.

Table 2.

Categories of Questionnaire Learning Styles and Motivation in Islamic Learning

Learning Styles				Motivation	
Category	**Auditory**	**Visual**	**Kinesthetic**	**Category**	**Interval**
Very low	10.00 – 18.00	10.00 – 18.00	10.00 – 18.00	Very poor	25.00 – 45.00
Low	18.01 – 26.00	18.01 – 26.00	18.01 – 26.00	Poor	45.01 – 65.00
Fair	26.01 – 34.00	26.01 – 34.00	26.01 – 34.00	Fair	65.01 – 85.00
High	34.01 – 42.00	34.01 – 42.00	34.01 – 42.00	Good	85.01 – 105.00
Very High	42.01 – 50.00	42.01 – 50.00	42.01 – 50.00	Very Good	105.01 – 120.00

Data Analysis

SPSS 25 has been used in this study. The SPSS is used to analyze quantitative data both descriptive and inferential statistics. Descriptive statistical data used are frequented, percentage, min, max, and mode, which types of data can explain the quantitative results of participants (Muijs, 2010; Darmaji et al. 2019). Furthermore, inferential statistics displayed are regression tests and independent sample t-tests. Regression is used to see the influence of variables (Seber & Lee, 2012), which is the influence of the learning style of each young gifted on learning motivation. Meanwhile, the independent sample t-test was used to see the difference between the two different means (Muijs, 2010), where the researcher wanted to see the results of the difference between students who went to school in urban areas, Bengkulu City, and students who attended rural schools, Seluma Regency. Afterward, the flow of this research begins by selecting the study sample. Then, researchers spread questionnaires related to student motivation and learning styles. Lastly, researchers conducted interviews with several students. More clearly about the research procedure, can be seen in Figure 1 below.

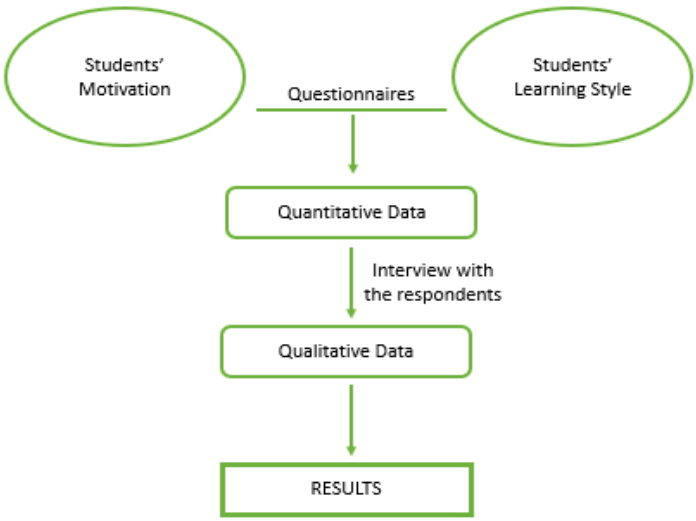

Figure 1.

Data Collection Procedure

Results and Discussion

The novelty of this study has been shown in exploration of the young gifted students' motivation and learning styles, as well as how these learning styles affect their motivations in learning. In addition, researchers also made a comparison between students in rural schools and students in urban schools. Some of the studies found were discussed in this section, quantitative results are explained through several forms such as descriptive statistics such as frequency, percentage, standard deviation, min, mode, mean and max; and inferential statistics like regression and independent sample t-test.

Learning Styles of the Gifted Young Students

In this section, researchers show the descriptive results of the learning styles of the young gifted children in learning Islamic Education both in urban schools and rural schools. These results can be shown in table 3 and table 4.

Table 3.

Learning Styles of the Young Gifted Students in Islamic Learning in Urban Schools

Learning Styles	Category (f, %)					N	Mean	SD	Min	Max
	Very Low	Low	Fair	High	Very High					
Auditory	0 (0)	0 (0)	3 (5.26)	24 (42.11)	30 (52.63)	57	44.64	2.91	28	50
Visual	0 (0)	0 (0)	5 (8.77)	25 (43.86)	27 (47.37)	57	42.91	2.67	27	50
Kinesthetics	0 (0)	0 (0)	4 (7.02)	20 (35.09)	33 (57.89)	57	47.12	3.02	30	50

Based on table 3 shows that the young gifted students' learning styles in learning Islamic about urban schools' area as much as 57 respondents. Students' learning styles for auditory type dominated by very high category, as many 30 (52.63%) students. In learning styles of visual type dominated very high category as 27 (47.37%) students. And for the kinesthetics type dominated very high category as 33 (57.89%) students.

Table 4.

Learning Styles of the Young Gifted Students in Islamic Learning for Rural Schools

Learning Styles	Category (f, %)					N	Mean	SD	Min	Max
	Very Low	Low	Fair	High	Very High					
Auditory	0 (0)	0 (0)	8 (15.69)	25 (49.02)	18 (35.29)	51	39.01	2.91	26	50
Visual	0 (0)	0 (0)	9 (17.65)	23 (45.10)	19 (37.25)	51	40.12	2.98	27	50
Kinesthetics	0 (0)	0 (0)	4 (7.84)	26 (50.98)	21 (41.18)	51	41.17	2.87	28	50

Based on table 4 shows that the young gifted students' learning styles in learning Islamic about rural schools' area as much as 51 respondents. Students' learning styles for auditory type dominated by high category, as many 25 (49.02%) students. In learning styles of visual type dominated by high category as 23 (45.10) students. And for the kinesthetics type dominated by high category as much as 26 (50.98%) students.

Motivation of Talented Young Students in Learning Islamic Education

In this section, researchers show the descriptive results of the motivation of the young gifted children in learning Islamic Education both in urban schools and rural schools. These results can be shown in table 5 and table 6.

Table 5.

Motivation Result of the Young Gifted Students in Urban Schools

Motivation		Frequency	%	SD	Mean	Min	Max
Category	Range						
Very poor	25.00 – 45.00	0	0.00				
Poor	45.01 – 65.00	0	0.00				
Fair	65.01 – 85.00	3	5.26	6.43	100.89	79	120
Good	85.01 – 105.00	33	57.89				
Very Good	105.01 – 120.00	21	36.84				
Total		57	100				

Based on table 5 shows that the motivation of the young gifted students in urban schools as much as 57 respondents, dominated by good categories as many as 33 respondents or 57.89%. So, the motivation of the young gifted students in learning Islamic education in urban school areas is categorized good. Then table 5 also shows the

motivation of the young gifted student which fair category as much as 5.26%, and for the very good category is 36.84%. Meanwhile, for the very poor and poor category is none. Of the 57 students have a mean value of 100.89, a maximum value of 120, and a minimum value of 79.

Table 6.
Motivation Result of the Young Gifted Students in Rural Schools

Motivation		Frequency	%	SD	Mean	Min	Max
Category	Range						
Very poor	25.00 – 45.00	0	0.00				
Poor	45.01 – 65.00	0	0.00				
Fair	65.01 – 85.00	5	9.80	6.79	93.27	71	120
Good	85.01 – 105.00	34	66.67				
Very Good	105.01 – 120.00	12	23.53				
Total		51	100				

Based on table 6 shows that the motivation of the young gifted students in rural schools as much as 51 respondents, dominated by good categories as many as 34 respondents or 66.67%. So, the motivation of the young gifted students in learning Islamic education in rural school areas is categorized good. Then table 5 also shows the motivation of the young gifted student which fair category as much as 9.8%, and for the very good category is 23.53%. Meanwhile, for the very poor and poor category is none. Of the 51 students have a mean value of 93.27, a maximum value of 120, and a minimum value of 71.

The Regression between Young Gifted Students' Learning Styles toward Their Motivation
For the results of the impact of young gifted students' learning styles with students' motivation can be seen in table 7 below.

Table 7.
The Results of Regression

Variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	8.291	2.434		6.670	.000
Learning styles	1.341	.126	.135	2.142	.005

From table 7, it gets the results of a simple regression test between learning styles on learning motivation, which obtained equation is Y = 8.291 + 1.341, which means that students 'learning styles effects students' motivation ($p < 0.05$). Furthermore, how much influence the learning styles have on student motivation is shown in table 8 below.

Table 8.
The magnitude of the influence of learning styles on student motivation

Model	R	R square	Adjust R Square	Std. Error of the Estimate
1	.561	.532	.515	1.876

Table 8 shows the influence of students' learning styles on their motivation. The results of simple regression analysis presented that the rate of coefficient of determination were (R^2) 0.532, which means that the contribution of students' learning styles toward to motivation is 53.2%, while the remaining 46.8% is influenced by other variables.

Differences in Young Gifted Students' Learning Styles and Motivation Based on Urban and Rural Schools
To seek out whether there is a difference between young gifted students' learning styles and motivation in learning Islamic education based on urban and rural schools' area, an independent sample t-test was used. Table 9 shows the difference between young gifted students' learning styles in elementary school based on urban and rural schools' area. Meanwhile, table 10 shows the difference between young gifted students' motivation in learning Islamic for elementary school based on urban and rural schools' area.

Table 9.
Independent Sample T-test for Young Gifted Students' Learning Styles in Learning Islamic Education

Learning styles	School Area	Mean	Std. Deviation	T	df	Sig.	95% confidence interval	
							Lower	Upper
	Urban	4.056	.1825	1.685	106	0.015	1.445	.3200
	Rural	3.632	.2025	1.685	102.026		1.823	.4625

Based on table 9, the result shows if that there are differences between young gifted students' learning styles in learning Islamic based on elementary school area ($t_{(106)}$ = 1.685, p<0.05), where students who are schooling in urban schools' area (M=4.056, SD = 0.1825) has higher learning styles than students who are schooling in rural schools' area (M=3.632, SD = 0.2025).

Table 10.
Independent Sample T-test for Young Gifted Students' Motivation in Learning Islamic Education

Motivation	School Area	Mean	Std. Deviation	T	df	Sig.	95% confidence interval	
							Lower	Upper
	Urban	4.109	.1620	1.433	106	0.009	1.366	.2920
	Rural	3.628	.1728	1.433	103.521		1.912	.5535

Based on table 10, the result shows if that there are differences between young gifted students' motivation in learning Islamic based on elementary school area ($t_{(106)}$ = 1.433, p<0.05), where students who are schooling in urban schools' area (M=4.109, SD = 0.1620) has higher motivation than students who are schooling in rural schools' area (M=3.628, SD = 0.1728).

Discussion and Conclusion

Based on the results of the study found that the learning styles that exist in the young gifted students in Islamic learning both urban and rural are very diverse, and obtained high scores both auditory, visual and kinesthetic. This indicates that learning styles in young gifted children have a variety of learning (Andheska, Suparno, Dawud & Suyitno, 2020), and does not depend on one learning style (Kuo, Maker, Su & Hu, 2010; Mooij, 2013). Of course, this is very good for young children who are gifted, where they can be easily guided by teachers with a variety of diverse methods and approaches to learning. Furthermore, the results also show that there is a significant influence on students' learning styles on their motivation in Islamic learning. This indicates that the more varied learning styles of young gifted students, the higher the motivation.

Furthermore, the researchers gave interview findings toward several students, including one from students from rural areas, how their learning motivation was based on meaningful learning by the teacher, as shown by the following manuscript.

> *"In the process of teaching and learning in Islamic studies in general, my motivation for learning is quite good, the motivation arising from within me is inseparable from my sincerity in learning and reducing play and every task I always do, both being told to look at books or newspaper. So, the information that I have is more complete... "*

Then there are also the results of other interviews with students who come from urban schools.

> *"... When we study with Islamic education teachers, we always pay attention to the teacher explaining the lesson ahead, although sometimes we don't pay attention, we are more dominant to pay attention. We are very happy to learn with these Islamic teachers, we are very motivated because the teachers like to tell stories and joke, so we are orderly when following the learning process... ".*

From the explanation above, it can be concluded that most of the young gifted students in Islamic learning are good enough to follow the learning process, they show it with high learning motivation. This high learning motivation appears when they follow the teaching and learning process seriously.

Lastly, there were also interviews with children who came from rural schools.

> *"We attend Islamic lessons with the teacher, we are not noisy, we always pay attention to the teacher in explanation of the lesson in front, and we record what the teacher wrote on the blackboard when the teacher explains the Islamic*

subject matter, the material is related to events in life, both in society and events in the course of government. With an explanation like this, we are very diligent and focused on following the teacher's explanation. "

Looking at the information that has been stated above, it can be concluded that in the teaching and learning process in several rural schools, most students pay attention or focus on the teacher who is delivering the subject matter. An activity of teaching and learning process is inseparable from the planning that has been done by the teacher in learning because thus it will provide clear direction in every schedule conducted by the teacher (Fernandez, 2010; Fujii, 2019). With the application of meaningful learning based on good learning, it will produce a good teaching and learning process as well (Darling-Hammond & Snyder, 2015; Romance, & Vitale, 2013).

In the application of meaningful learning in the implementation of teaching and learning in Islamic education in elementary schools in urban and rural schools, most students have the motivation to learn well. This can be seen when they follow the learning process, where students are focused and earnest in following the learning process, and when given the opportunity to ask questions, some students ask questions. In the application of meaningful learning in Islamic subjects in the implementation of the teaching and learning process, it is very necessary that the attention of students (Gadelshina, Vemury & Attar 2018; Mendoza, & Mendoza, 2018), so that what is explained by the teacher in front can be understood properly (Vachliotis, Salta, & Tzougraki, 2014), this is evident when they follow the learning process in the classroom looks orderly, seriously so there is no commotion in the classroom.

Furthermore, it is known that there are several benefits in applying meaningful learning, especially for the young gifted students such as information that is learned meaningfully longer can be remembered; new information built by students will facilitate the next learning process for continuous learning material; and, information that is forgotten after the new knowledge structure is built will facilitate the process of learning things that are similar even though they have been forgotten (Lee, 2011; Tirri, Kuusisto & Aksela, 2013; Tolppanen & Aksela, 2013; Özgür, & Yılmaz, 2017).

Lastly, it can be concluded that the research that has been done, the young gifted students both in rural and urban elementary schools have varied learning styles, although there are differences between urban and rural schools. This can be caused by the environment in urban areas which is more comprehensive than the environment in rural areas (Astalini, Kurniawan, Darmaji & Anggraini, 2020). In addition, the results of motivation from both urban and rural areas also found differences. Nevertheless, the motivation of the young gifted students is very high in learning, this is certainly very useful for them in participating in learning, and makes it easier for teachers to prepare for learning.

Recommendations

The results show that student learning motivation is very good in Islamic learning after the implementation of meaningful learning. Given the importance of the role of motivation for students in learning, the teacher is expected to be able to arouse and maintain and increase student motivation. In order for students to achieve optimal learning outcomes, students must have high learning motivation. In addition, it was found that the learning styles of young gifted children vary greatly in not one type of learning style. Of course, this is very important for teachers to be able to combine methods and approaches to learning that are right for their students. Furthermore, the researchers hope for further research related to meaningful learning, namely how the influence of meaningful learning increases student learning achievement, whether there is a relationship or not. In addition, researchers felt the need for further research on the relationship between learning styles and student motivation towards learning outcomes and their performance, especially the young gifted children.

Limitations of Study

The limitation in this study is to only look at the influence between learning styles and motivation of gifted students in two situations (urban and rural).

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Research Article

The effects of birth order and family size on academic achievement, divergent thinking, and problem finding among gifted students

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Abstract

The current study explored the influence of birth order and family size on academic achievement, divergent thinking (DT), and problem finding (PF) with a sample of 156 gifted male and female Arab students (M= 12.21 years, SD= 1.75). Regarding academic achievement, it was found that first-borns possessed higher grade point averages (GPAs) than did other-born children. Family size was also related to academic achievement-participants from smaller-sized families had significantly higher GPAs compared with gifted students from middle- and large-sized families. As for the influence of birth order and family size on both DT and PF, a multivariate analysis of variance showed significant differences for birth order and the interaction between birth order and family size in the originality dimension of PF. Non-significant differences were found concerning family size. The follow-up analyses of variance showed that later-born gifted students scored higher than first-, second-, third-, and fourth-born children in PF originality. Later-born gifted students who scored higher on originality were from smaller families. No significant influences for birth order and family size were found concerning fluency for both DT and PF as well as DT originality. Limitations and future directions are discussed.

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Introduction

Unlike earlier theories of giftedness which mainly focused on the person, the modern conceptions of giftedness consider several external factors that influence the gifted child. These factors, including expertise (Feldhusen, 2005), noncognitive abilities (Gardner, 1983; Renzulli, 2005), chance (Gagné, 2004; Tannenbaum, 1997), and environment (Miedijensky, 2018; Olszewski et al. 1987; Olszewski-Kubilius et al. 2014) are essential to understand how gifts can be transformed into a talent in one domain or more (Albert, 1980a, Runco & Albert, 2005). As Feldhusen (2005, p. 64) put it, "Gifts come from people. Nature gives no gifts; but it does transmit some genetic potentials. Genetic potentials unfold in interaction[s] with stimulating experiences structured by parents, family, home, schools, teachers, and curricula."

This assertion is consistent with well-known theories and conceptions of giftedness such as Gagné's Differentiated Model of Giftedness and Talent (DMGT; Gagné, 2004), and Renzulli's Three-Rings Model theory of giftedness—in which he distinguishes between *schoolhouse* giftedness and *creative-productive* giftedness (Renzulli, 2005). In his DMGT model, Gagné (2004) well explained how gifts (natural abilities) in one or more domains such as intellectual, creative, socio-affective, and psychomotor, might (or might not be) transformed into talents in specific fields such as language, math, arts, sports, science, and chess. A successful transformation from gifts to talents, according to Gagné, depends on four catalysts: (a) chance, (b) intrapersonal skills, (c) developmental process, and (d)

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environment. Environment, especially family environment, plays a major role in shaping the personality and cognitive abilities of gifted children (Albert, 1980a, 1980b; Olszewski-Kubilius, 2018; Runco & Albert, 2005).

The family, with which gifted children spend most of their time (Colangelo & Dietmann, 1983), plays a crucial role in the transformation from what is known as intellectual giftedness (the potential) to creative giftedness (the realization of giftedness; Albert, 1980; Renzulli, 2005). Parents of gifted children not only influence their children's cognitive abilities through genes, but also through: (a) values (e.g., knowledge, hard work, persistence, etc.), (b) support (financial, psychological, and emotional), (c) parenting style (permissive or authoritative), and (d) beliefs about criteria of success in life. Parents who believe in academic achievement as the only indicator of future success will focus/emphasize the importance of education, and only education, because they believe it is the only way to get a better job and thus improve one's socioeconomic status (Olszewski-Kubilius, 2018). In contrast, parents who see education and academic achievement as important, but not necessary for future success, will encourage behaviors related to creativity and creative thinking such as curiosity, risk-taking, openness to experience, and unconventionality. The former type of parents will put all their efforts in one basket (academic achievement), while the latter type of parents will diversify their children's experiences and guide them to "fall in love" with a topic or a domain (Torrance, 1995) since academic achievement is not the only means of success.

As noted, parents have a powerful influence on gifted children's talent development. However, the factors mentioned above do not affect all siblings equally. Other factors such as birth order and family size determine the time and opportunity each child receives within a family. Thus, it is not surprising that a great deal of research has examined the effect of birth order on different variables including coping strategies (Breik & Zaza, 2019), personality (Barton, 2005), sibling relationships (Ben-Artzey Schieber, 2019), and perfectionism (Sondergeld et al. 2007). However, the effect of birth order and family size on intelligence and achievement has received the lion's share of researchers' attention (e.g., Albert, 1980a; Breland, 1972; Cox, 1977; Rodgers et al. 2000; Sulloway, 1966; VanTassel-Baska, 1983). Overall, these works suggest that first-borns surpass their siblings in intelligence quotient (IQ) and academic achievement; however, little is known about the effect of birth order on creativity among *gifted* samples.

The next section summarizes the main findings of research on the effect of birth order on IQ and academic achievement among gifted children. The section after that sheds light on the effect of birth order on divergent thinking (DT) and problem finding (PF).

The Effect of Birth Order and Family Size on IQ and Academic Achievement

There is ample evidence that gifted students are first-borns, regardless of whether IQ or academic achievement (i.e., grade point average [GPA]) is used to define "giftedness." For example, Cox (1977) found that 50% of his sample were first-borns; while Albert (1980b) found that, among his sample of high-IQ gifted boys, 18 were only-children or first-borns (69.2%). Moreover, in a study of 465 gifted students, VanTassel-Baska (1983), who studied the profiles of several talented students, found that first-borns scored higher on the Scholastic Aptitude Test. In addition, Margot and Rinn (2016) reported that, among 96 gifted adolescents, 40% were first-borns or only-children. These findings are consistent with other seminal works conducted with non-gifted samples regarding the effect of birth order on academic achievement and IQ (e.g., Adams & Phillips, 1972; Altus, 1965; Belmont & Marolla, 1973; Damian & Roberts, 2015; Farley, 1978; Paulhus et al. 1999; Roe, 1953; Sampson, 1962; Sulloway, 2001).

As for family size, Olszewski et al. (1987) reported that most gifted students were from small-sized families (i.e., two to three siblings). This makes sense because raising a gifted child requires a lot of time, effort, and resources (Moore, 1982). Some researchers have argued that "family size and family spacing are much more important than birth order in creating an environment which fosters intellectual development" (Parker, 1998, p. 30). However, studies that were conducted with non-gifted samples yielded contradictory findings, such as that family size was unrelated to achievement or IQ (e.g., Abdel-Khalek & Lynn, 2008; Cicirelli, 1967; Rodgers et al. 2000).

Nevertheless, as this study examined a gifted sample, we predicted that academically gifted students would be more represented in smaller (vs. larger) families. Therefore, our hypotheses regarding the influence of birth order and family size on academic achievement were as follows:

$H1_a$: First-born gifted students will have higher academic achievement scores (i.e., GPAs) than middle-born and last-borns.

$H1_b$: Gifted students from smaller families will have higher academic achievement scores (GPAs) than gifted children from larger families.

The Effect of Birth Order and Family Size on DT and PF

In his famous book, Born to Rebel: Birth Order, Family Dynamics, and Creative Lives, Sulloway (1996) showed that first-borns are ambitious, conscientious, achievement oriented, more conforming, and conventional; while later-borns are more open to experience, risk-takers, and radically innovative. These assertions were tested in creativity literature (e.g., Datta, 1968; Eisenman, 1987; Farley, 1978; Sampson, 1962) before and after Sulloway published his works on the influence of birth order on creativity.

Reviewing literature on the influence of birth order and family size on DT revealed that only three studies were conducted with gifted samples (Runco & Bahleda, 1986; Seay, 1985; Szobiova, 2012); other studies were conducted with non-gifted samples and conflicting results were observed.

For instance, while some studies reported that first-born or only-children scored higher than other ordinal positions (Comeau, 1979; Eisenman, 1987; Eisenman & Schussel; 1970; Guo et al. 2018; Lichtenwalner & Maxwell, 1968; Runco & Bahleda, 1987; Yang et al. 2017), other studies indicated that second- or third-born children (i.e., those in the middle birth position) scored higher than only-, first-, and last-borns did (Gaynor & Runco, 1992; Seay, 1985; Szobiova, 2008). Adding more complexity, some studies reported that later-borns scored higher than only-, first-, and middle-borns (Farley, 1978; Staffieri, 1970). Finally, two investigations reported that birth order and DT were unrelated (Szobiova, 2012; Wilks & Thompson, 1979).

Concerning family size, a few investigations considered family sizes influence on participants' DT skills with conflicting findings. For example, Runco and Bahleda (1987) concluded that children with more siblings had higher scores on verbal fluency and verbal originality than children with one sibling, while Cicirelli (1967) reported that creativity scores were slightly diminished when family size increased beyond four children. Further, Gaynor and Runco (1992) indicated that the number of siblings was not related to children's creative abilities.

Our literature search revealed that no single study looked at the influence of birth order and family size on PF. However, since a recent meta-analysis study showed that PF and DT were positively correlated (Abdulla et al. 2020), especially the correlation between PF and fluency ($r = .31$) and originality ($r = .29$), we hypothesized that birth order and family size would have a similar influence on PF as DT. Consequently, we hypothesized the following:

H_{2a}: Later-born gifted students will possess higher DT and PF levels than children from other birth order positions.

H_{2b}: Gifted students from smaller families will have higher DT and PF scores than those from larger families.

Methods

Participants

Participants were 156 students from the Giftedness Academy in the State of Kuwait—an intermediate, secondary private school for gifted and creative students. The acceptance of students to the Giftedness Academy is based on their performance on the following criteria: (a) traits and behavioral characteristics of gifted and creative students, as assessed by the Hope Teacher Rating Scale (Gentry et al. 2015); (b) academic aptitude tests (≥ 95 percentile), which were developed and normed for Kuwaiti culture; (c) a (≥ 95 percentile) on Raven's Advanced Progressive Matrices (Raven et al. 1998); (d) fifth-grade academic achievement (i.e., ≥ 90th percentile) in the following subjects: mathematics, science, and language; and (e) an interview with a panel of experts in gifted education and teachers of mathematics, science, and language.

Participants' ages ranged from 11 to 15 years ($M = 12.21$ years, $SD = 1.73$); 50% of participants were boys and 50% were girls. Participants' family sizes ranged between 3 to 9 members ($M = 6.01$; $SD = 1.24$), and 80% of participants came from families that comprised 5–7 members. This is consistent with the United Nations Report (2017) of household size in the State of Kuwait ($M = 5.8$ members). Based on this statistic, participants who were from a family comprising of 3 to 6 members were considered as a small family, while participants from 7 and above members were considered large family. As for birth order, 64 (41%) were first-borns, 39 (35%) were second-borns, 25 (16%) were third-borns, 18 (11.5%) were fourth-borns, and 10 (6.4%) were fifth-borns. Six participants were only-children. Finally, students' mean GPA was 96.93% ($SD = 2.20$).

Data Collection Tools

Uses Test

To measure DT, we employed the Alternative Uses Test (AUT; Wallach & Kogan, 1965). Three tasks were administered: (a) uses for a wheel, (b) uses for a spoon, and (c) uses for a toothbrush. Following Wallach and

Kogan's (1965) method for administering DT tests, the AUT was a game-like test (i.e., time was not restricted). The verbatim directions for the Alternative Uses Test were as follows:

> *"People typically use everyday items for specific purposes. Often there are alternative uses for the same object. For example, a newspaper could be used as a hat or a blanket, and many other things. For the following items, list as many alternative uses as you can. The more uses you think of, the better. Do not worry about spelling."*

Responses to the AUT were scored for fluency and originality. Participants produced 1,236 ideas in the wheel task, 1,059 ideas in the spoon task, and 1,304 ideas in the toothbrush task. Fluency was defined as the total number of different responses produced by a participant for a particular task, and originality was defined as the number of unusual responses produced by a participant for a particular task. Originality was scored based on a 3% cutoff criterion.

Problem Generation (PG) Test

The second study instrument was the PG test (Okuda, Runco, & Berger, 1991; www.creativitytestingservices.com), which was used to assess PF ability. The PG test consists of three open-ended tasks that ask participants to list as many problems as they can for problems that are related to: (a) home and school, (b) life situations, and (c) health and well-being. An example of a PG tasks is as follows:

> *"List problems with your present living situation (home, neighborhood, society, whatever). The more you list, the better. They do not have to be real problems--they can be things you have not actually experienced. Use your imagination!"*

The PG test was scored for fluency and originality. For home and school problems, life situation, and health and well-being, 1,490, 1,553, and 1,602 ideas were generated, respectively. The same method for scoring fluency and originality was used in the PG test. Reliability coefficients for fluency and originality for the Uses and PG tests were estimated using Cronbach's alpha. Results showed that Cronbach's alphas ranged from .63 to .85 for the fluency and originality dimensions on both tests.

Demographic Information

Participants were asked to complete a demographic questionnaire about their age, sex, family size, and birth order. Information about participants' GPA was obtained from school officials.

Results

Birth Order, Family Size, and Academic Achievement

Descriptive statistics showed that 64 (41%) of gifted students were first-borns, followed by second- (n = 39, 25%), third- (n = 25, 16%), fourth- (n = 18, 11.5%), and fifth-borns (n = 10, 6.5%), which is consistent with previous findings suggesting that first-born children are more represented in gifted samples (Albert, 1980b; Cox, 1977; Margot and Rinn, 2016; Sondergeld et al. 2007; VanTassel-Baska, 1983). Table 1 shows mean and standard deviations for study variables.

A one-way analysis of variance (ANOVA) was performed to determine if there was a significant difference between: (a) birth order and GPA on one hand and (b) family size and GPA on the other hand. An ANOVA yielded a significant difference between participants on academic achievement based on birth order, $F_{(4,151)} = 3.41$, $p = .011$. First-born participants had a higher GPA (M = 97.44; SD = 1.66), while fifth-born participants' GPA was the lowest (M = 95.02; SD = 3.71). Post-hoc analyses showed that this difference was significant (p = <.01).

A second ANOVA was performed to examine the effect of family size on academic achievement as measured by GPA. The results showed a significant difference between participants' academic achievement and family size, $F_{(6, 149)} = 2.90$, $p = .011$. Gifted students from smaller families had higher GPAs compared with those from larger families.

Table 1.
Descriptive Statistics of Study Variables

		Dependent variable					
		n	Fluency DT *M* (*SD*)	Originality DT *M* (*SD*)	Fluency PG *M* (*SD*)	Originality PG *M* (*SD*)	GPA *M* (*SD*)
Birth order	1.00	64	8.45 (2.23)	3.06 (1.63)	10.06 (2.62)	5.03 (2.68)	97.44 (1.66)
	2.00	39	8.69 (3.14)	3.44 (3.08)	9.28 (2.58)	4.95 (3.03)	96.48 (2.25)
	3.00	25	8.08 (2.96)	2.72 (1.51)	9.40 (3.04)	4.00 (1.76)	96.92 (2.64)
	4.00	18	8.17 (1.98)	3.28 (1.67)	9.44 (2.48)	4.67 (2.35)	97.16 (1.32)
	5.00	10	8.00 (2.16)	2.20 (1.14)	9.10 (2.38)	5.40 (4.03)	95.02 (3.71)
	Total	156	8.39 (2.56)	3.07 (2.06)	9.63 (2.65)	4.83 (2.71)	96.93 (2.20)
Family size	3.00	6	7.67 (1.75)	2.83 (0.98)	9.33 (1.51)	4.33 (1.03)	97.33 (1.51)
	4.00	8	8.50 (2.20)	3.63 (1.77)	9.13 (2.17)	4.50 (1.31)	96.34 (1.29)
	5.00	36	8.33 (2.14)	2.78 (1.57)	9.08 (1.95)	3.97 (1.61)	97.08 (1.87)
	6.00	55	8.15 (2.82)	3.24 (2.62)	10.18 (3.08)	5.05 (3.16)	97.15 (1.74)
	7.00	34	8.82 (3.04)	3.32 (2.01)	9.41 (3.04)	5.56 (3.09)	97.29 (2.44)
	8.00	14	8.79 (1.97)	2.64 (1.28)	9.79 (2.04)	4.79 (2.72)	94.79 (3.53)
	9.00	3	8.00 (1.73)	1.67 (1.15)	9.67 (1.53)	4.67 (3.79)	97.80 (1.39)
	Total	156	8.39 (2.56)	3.07 (2.06)	9.63 (2.65)	4.83 (2.71)	96.93 (2.20)

Note: DT = divergent thinking; PG = problem generation; GPA = grade point average; M = mean, SD = standard deviation

Finally, a linear regression analysis was conducted to examine whether participants' birth order predicted their GPA. A significant regression equation was found, b=.335, $t_{(155)}$=2.47, p=.016). However, family size did not significantly predict participants' GPA, b=.180, $t_{(155)}$=1.27, p=.205. Furthermore, multiple regression analysis where both, birth order and family size were included as independent variables, yielded no significant effect on GPA.

Birth Order, Family Size, PF, and DT

A multivariate analysis of variance was conducted to determine the effect of birth order and family size on DT *and* PF abilities. Family size was coded as follows: (0) for 3-6 members who were considered a small family, and (1) 7-9 members who were considered a large family. Significant differences were found for birth order, Wilks' Lambda = .823, $F_{(4,151)}$ = 1.80, p = .029 and the interaction between birth order and family size, Wilks' Lambda = .827, $F_{(4,151)}$ = 1.75, p = .035. No significant differences were found for family size (Table 2).

Table 2.

Analysis of Variance of Dependent Variables by Birth Order and Family Size

Source	Dependent variable	*df*	MS	F	p	Eta
Birth order	Fluency DT	4	4.76	.72	.583	.019
	Originality DT	4	2.25	.52	.722	.014
	Fluency PG	4	7.29	1.05	.385	.028
	Originality PG	4	20.12	2.95	.022	.075
Family size	Fluency DT	1	.12	.02	.895	.000
	Originality DT	1	1.93	.45	.505	.003
	Fluency PG	1	6.38	.92	.340	.006
	Originality PG	1	2.31	.34	.562	.002
Birth order * Family size	Fluency DT	4	4.89	.73	.570	.020
	Originality DT	4	2.22	.51	.730	.014
	Fluency PG	4	7.60	1.10	.364	.029
	Originality PG	4	21.86	3.20	.015	.081
Error	Fluency DT	146	6.66			
	Originality DT	146	4.33			
	Fluency PG	146	6.97			
	Originality PG	146	6.83			
Total	Fluency DT	156				
	Originality DT	156				
	Fluency PG	156				
	Originality PG	156				

Note: DT = divergent thinking; PG = problem generation

A follow-up ANOVA was conducted to test the effect of birth order and the interaction between birth order and family size on DT and PF. A significant effect of birth order on PF originality was found, $F_{(4,151)} = 2.95$, $p = .022$. Fluency scores in DT and PF as well as originality scores in DT were non-significant. Regarding the interaction between birth order and family size, a significant interaction effect between them was observed in PF originality scores, $F_{(4, 151)} = 3.20$, $p = .015$.

Post-hoc analyses indicated significant differences between later-borns (i.e., fifth) and first- (MD = 5.313, $p = .016$), second-(MD = 5.537, $p = .012$), third-(MD = 6.381, $p = .005$), and fourth-borns (MD = 6.358, $p = .005$), in favor of the later-borns. As for the interaction between birth order and family size, the differences were in favor of the fifth-borns from smaller (vs. larger) families (MD = 4.216, $p = .023$). In other words, those who scored higher in PF originality were from smaller families.

Discussion

This was the first investigation to examine the effect of birth order and family size on academic achievement, DT, and PF in the Arab culture as represented by Kuwaiti sample. Based on previous literature, it was predicted that most gifted children in our sample would be first-borns. The results confirmed such a prediction—nearly half the participants in this study were first-borns. First-born participants had higher GPAs than did other-born students, and students were more likely to have higher GPAs when they were from smaller-sized (vs. larger-sized) families.

The findings are consistent with seminal works that were conducted with both gifted and non-gifted samples, which showed that first-born children are higher achievers than other-born children. For instance, Adams and Phillips (1972) studied differences between first-born and later-born elementary school students and concluded that first-borns scored significantly higher than did later-borns on four different measures of intellectual and academic performance. Moreover, Paulhus et al. (1999) studied the effect of birth order on personality and achievement. They found that first-borns were more achieving compared with later-born students.

Several explanations for first-born children being higher academic achievers than later-borns are offered in the literature, which include (a) higher parental expectations of first-borns compared with middle- and later-borns, (b) first-born children have more opportunity to interact with adults than do later-born children, and (c) parents tend to be stricter with first-born children regarding their academic achievement (Adams & Phillips, 1972; Altus, 1965; Olszewski et al. 1987). It seems that these factors are cross-cultural; meaning, that gifted parents, regardless of what culture they belong to, place higher expectations on first-born children.

The second prediction-that gifted children from small families will have higher academic achievement scores compared with gifted students from larger families—was also supported. This makes sense because the amount of time and resources parents spend on their gifted children will be quite different when they have two or three children compared with families of seven or eight members. This finding was also supported by an investigation that concluded that the average family size observed in gifted children is no more than three (Olszewski-Kubilius et al. 1987).

Hypothesis 2a was only supported for originality in PF. DT and birth order were not related, which is consistent with some previous studies (e.g., Szobiova, 2012; Wilks & Thompson, 1979) yet contradictory to others (e.g., Comeau, 1979; Gaynor & Runco, 1992; Runco & Bahleda, 1987; Yang et al. 2017). Future research might clarify why gifted students who possess high levels of PF originality (i.e., those who could find and discover novel problems) are more likely to be later-born as opposed to earlier-born children.

Limitations of Study

We conclude our study with two limitations. First is that our sample is considered a relatively small sample to represent Arab culture. However, it is not our intention to represent the whole Arab culture since this will require collecting data from more than twenty countries. By Arab culture, we mean the context of Arab culture, not the whole culture. Thus, we recommend that authors from other Arab countries replicate our study and examine potential differences between Kuwait and other Arab countries. The second limitation worth mentioning is that we were restricted by the information provided to us by the Giftedness Academy. Future research might extend our work to include information such as socioeconomic, parental education, and other demographic variables that might help gain a better understanding of the effect of birth order and family size on academic achievement, DT, and PF.

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