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SECONDARY SCHOOL STUDENTS' INTEREST IN PHYSICS, CHEMISTRY AND BIOLOGY CONCEPTS FROM DEVELOPMENTAL VIEW

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Abstract

In secondary school, where students begin to be more interested in physics, chemistry and biology, it is an important issue how their interests are in terms of all three subject areas according to grade levels. The aim of this study was to examine and evaluate the interest of secondary school students in the concepts of physics, chemistry and biology taught in science classes by grade level. The participants included 251 students enrolled in 16 different classrooms in the 5th, 6th, 7th and 8th grades in a boarding secondary school located in the Eastern Black Sea Region of Turkey. The study was carried out as a developmental study in single screening model. For compliance with the research pattern, study data were collected with a questionnaire consisting of four open-ended questions, and the questionnaire was given to the students in order to find out their thoughts on the matter under consideration. In addition, the students were asked to draw a picture depicting the place and importance of science in their life and to explain their drawings briefly in writing. The data obtained from the open-ended questionnaire and drawings were analyzed through content analysis. The collected data were classified in categories and themes, and matrices were generated accordingly. In addition, frequency and percentage analysis was performed. As a result, science was found to be mostly associated with concepts regarding biology discipline by the students. Also, overall interest level was found to be higher with physics and biology topics at all grade levels studied here.

Keywords: *content analysis, science interest, science subjects, secondary school students*

Introduction

One of the most important problems encountered in science teaching is that students have difficulty in understanding science concepts. Learning science is not always an easy task for students (Ayas & Çalık, 2010; Gilbert & Watts, 1983; Nakhleh, 1992; Papageorgiou et al., 2016; Taber, 2003). For students, trying to understand scientific concepts sometimes feel like finding one's way through a dark forest. Many of science concepts are abstract, complex and interconnected which cannot be directly observed or felt by students. Therefore, students sometimes get off the track towards unscientific ways in learning science. Numerous studies in the literature that examine students' conceptual understanding and misconceptions have clearly proved this (Ayas & Çalık, 2010; Papageorgiou et al., 2016; Pikoli, 2020; Tümay, 2016).

Science basically refers to the whole of concepts related to physics, chemistry and biology. Previous studies investigating conceptual understanding, interests, attitudes and skills in all three fields hint at reasons for students' incompetence in science as a whole. The leading reasons can be listed as students' finding some concepts too abstract, complex and difficult to understand, students' inability to associate the content taught at school with real life, the concepts' being unappealing, teachers' deficiency in some cases, students' negative attitudes

https://doi.org/10.33225/pec/21.79.894 ISSN 1822-7864 (Print) ISSN 2538-7111 (Online)

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towards science areas, deficient teaching materials, inefficacious teaching environment, and students' misshapen daily life experiences. The most outstanding one is the fact that learning some science concepts is not appealing and popular enough for students (Holbrook, 2003; Holbrook, 2005; Cooper et al., 2013; Quílez,2019). In other words, students are not interested in learning science.

In reality, interest is one of the important factors affecting and guiding learning processes. (Harackiewicz et al., 2016; Hidi & Renninger, 2006; Renninger & Hidi, 2016). The importance of interest in the context of education was also emphasized by remarkable scientists centuries ago and attempts have been made to explain its relation with learning up to now (Hidi & Renninger, 2006; Hoffmann et al., 1998; Krapp & Prenzel, 2011; Tamir & Gardner, 1989). Besides, interest is a multidimensional concept linked to concepts such as motivation and attitude (Astalini et al., 2019; Bolte et al., 2013; Hidi & Renninger, 2006; Jenkins & Nelson, 2005; Krapp & Prenzel, 2011).

Interest can be short-term (situational) or long-term, yet it qualifies as a driving force for learning in both cases. Although it is often used in conjunction with the term motivation, it is a distinct structure. Despite this, reference is made to individual attention for defining the process of intrinsic motivation (Bolte et al., 2013). In explaining the importance of interest in learning processes, many researchers have also mentioned the concept of relevance since students' finding science education irrelevant to their own life has been indicated as one of the chief obstacles to show interest in learning science. For instance, Stuckey et al. (2013) have studied the importance of relevance in science teaching and learning stating that relevance is one of the key terms related to reforms in science teaching. In presence of this notion, students can learn more easily the subjects and concepts that are interesting and relevant to them while having difficulty learning the subjects they are not interested in (Boullion & Gomez, 2001; Jenkins & Nelson, 2005). In addition to this, it can be said that the interest in participating in a learning activity is shaped around individual interests, needs and values. For this reason, the concept of interest in learning processes is a phenomenon that needs thinking and defining multidimensionally in a wide perspective (Stuckey et al., 2013).

Researchers have looked at what subjects or topics students are most interested in, and they have concluded that students are generally interested in learning subjects related to their real life and they value these concepts more (Holbrook & Rannikmae, 2007; Tsaparlis, 2003; Wu, 2003). As a noticeable result, so far research has shown that learning some science concepts is not valuable enough for students. From students' point of view, topics which have nothing to do with their daily life are labeled irrelevant and they are used only in solution of certain academic problems at school (Ben-Zvi & Gai, 1994; Jenkins & Nelson, 2005; Ng & Nguyen, 2006; Songer & Linn, 1991; Treagust, et al., 2000).

Songer and Linn (1991), in their study examining secondary school students' perspectives on science, have found out that some of the students characterize science as being dynamic, "understandable" namely, "interpretative" and linked to daily life, while some others find science static, that is, reliant on intense memorization and disconnected from daily life. Jones and Miller (2001), in a two-year lasting chemistry course discussing applications and reflections of chemistry in everyday life, have observed a change in the students' interest and attitudes in a positive way by the end of their study. Dede Er et al. (2013) have examined primary school students' level of associating their scientific process skills and knowledge on electricity with daily life and the relationship between them. It has been demonstrated that students fail to fully link knowledge of electricity with daily life. Ürey and Özsevgeç (2015), in their study with pre-service primary school teachers, have revealed a significant positive relationship between the participants' science literacy and attitudes towards science and their ability of correlating these with everyday life. They have also found that students base the explanation of some concepts of biology and chemistry on their simple everyday experiences, while they cannot

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readily discover everyday life equivalences of concepts learnt in the classroom or they cannot use such concepts in true contexts. In another study, Akgün et al. (2015) have examined the extent at which secondary school students can transfer biology concepts learnt at school to their daily life by asking the students to exemplify the learnt subjects from their everyday life. They have been proved to be at a low level of associating the subjects with daily life. What is more, the students have been able to give examples from the course book only. The students have been found to be unaware of the sample cases and situations in their surroundings beyond their course book. In a similar study on eighth grade students, Emrahoğlu and Mengi (2012) have noted quite low levels of full transfer among students in the context of force and motion as topics of science. From the previous research, it can be concluded that classroom learning is meaningful and valuable to the extent that it can be linked to learners' life (Jones & Miller, 2001; Karagölge & Ceyhun, 2002; Nieswandt, 2001; Seçken, et al., 1998).

According to researchers, there has been a worrying picture of science learning at the secondary school level in recent years, particularly concerning physics and chemistry lessons (Stuckey et al., 2013). The teaching of science concepts is initiated at the primary third grade in Turkey. The basic subjects that make up science are taught in secondary school, more specifically within the scope of physics, chemistry and biology (MEB, 2018). For this reason, it can shed light onto developing science teaching curriculum to expose what science concepts are appealing to secondary school students, what science concepts such students are more eager to learn, what science concepts they find connected with their everyday life, and why they need to learn science, and to examine the changes in these answers by grade level. In the studies aimed at determining the interests of the students, it is seen that either physics, chemistry and biology are focused on a single subject area, or the interest of the students are determined with the help of some scales. Also, studies comparing students' interests in all three subject areas together and examining them according to grade levels are not sufficient (Lamb et al., 2012; Hasni & Potvin, 2015). In this context, the main problem of this study is the question of how the secondary school students are interested in physics, chemistry and biology according to their grade levels. And in the study, it is aimed to examine and evaluate the interest of secondary school students in the concepts of physics, chemistry and biology taught in science classes by grade level.

Research Methodology

General Background

The study was carried out with single screening model as it was targeted at describing an existing situation without intervention. It is also a developmental study due to the inclusion of the secondary school 5th, 6th, 7th and 8th grade students as specified by the sectioning approach (Karasar, 2008). The research data were collected in the 2018-1019 academic year and took two weeks.

Sample

This study was implemented with 147 males and 104 female total 251 students enrolled in a boarding secondary school (grades 5 to 8) located in a district of Eastern Black Sea Region. All 16 classes in the school participated in the study. The total number of students according to their grade levels is given in Table 1.

https://doi.org/10.33225/pec/21.79.894 ISSN 1822-7864 (Print) ISSN 2538-7111 (Online)

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Table 1
The Total Number of Students according to Grade Levels

Grade levels	5	6	7	8	Total
Numbers of students	69	57	68	57	251

Instrument and Procedures

Taking into account the research problem, research model, and developmental characteristics of the sample all together, a form consisting of open-ended questions and student drawings were used to collect data in the study. There were four questions in the open-ended form. The questions in the form are: "what concepts or topics come to your mind first when you think of science", "which science subjects are you most curious about and which subjects would you like to learn", "please list the science topics they are most curious about and want to learn the most", "which science topics or concepts do you think are most relevant to your daily life" and "why do you think we should learn science, please explain." The questions were reviewed and revised by two science education researchers and one science teacher. In order to collect more detailed data on the research problem, the students were told to depict "the place and importance of science in our life" by drawing pictures besides filling out the form. Lastly, they were required to explain briefly in writing what they wanted to convey in their drawings.

Data Analysis

The data collected with the open-ended questionnaire and drawings were analyzed by using content analysis. The basic process in this type of analysis is to gather similar data around certain codes and themes and then to interpret them by making available for the reader to understand (Çepni, 2012; Yıldırım & Şimşek, 2008). During the content analysis, all responses to the open-ended questions were examined and lists of codes were created accordingly. Then, the codes were categorized on the ground of similarities in order to allow explaining the resulting codes. The categories formed were classified under certain themes. The coding process was done separately by the researcher and a science teacher, and the percentage of agreement between the coders was found to be 0,93. Likewise, the students' drawings were checked together with their explanations to elicit the codes. Next, the categories and themes were drawn out to explain the codes. Drawings of 4 students were omitted before the analysis because they were not meaningful and accompanied by no applicable explanation. Percentage and frequency analyses were performed on the themes and categories emerging from both sources of data, and the findings were tabulated. The codes were not included in the tables since the lists of codes were too exhaustive to jeopardize comprehensibility of the tables. The tables were kept simple with the themes and categories only. In the coding process for the drawings, the percentage of agreement between coders was found to be 0,96.

Research Results

Results from the Open-Ended Questionnaire

In this study, the students were interrogated to find out the topics and concepts most frequently evoked by science in their mind. For this purpose, they were asked that what concepts or topics come to their mind first when they think of science? The findings obtained from the analysis of their responses are presented in Table 2.

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Table 2
Science Topics that Are Primarily Remembered by Students

Theme	Category	5th grade		6th grade		7th grade		8th grade		All grades Total	All grades Total %
		Frequency	%	Frequency	%	Frequency	%	Frequency	%		
PHYSICS	Electricity	17		10		9		7			
	Force and motion	6		7		2		3			
	Light and sound	2		3		2		-			
	Total	25	**30**	20	**29**	13	**17**	10	**19**	68	24
CHEMISTRY	States of matter and changes of state	4		8		5		3			
	Particulate structure of matter	1		4		8		6			
	Heat and temperature	6	**13**	3	**26**	-	**17**	1	**19**		***18***
	Density	-		3		-		-		52	
	Total	11		18		13		10			
BIOLOGY	Living Things (plants, animals, microscopic creatures)	12		3		4		7			
	Harms of alcohol and smoking	11		-		-		-			
	Body systems (digestive, excretory, respiratory, etc.)	1		13		36		3			
	Food and nutrition	7		-		5		-			
	Our body and organs	4	45	-	**29**	-	**58**	-	**55**		
	Human-environment relationship	3		-		-		-			***47***
	Matter cycles	-		-		-		13			
	Reproduction, growth, development	-		4		-		6		132	
	Total	38		20		45		29			
OTHER	The Earth and the universe	10	**12**	11	**16**	6	**8**	4	**7**	31	***11***
Total frequency of mentioned concepts		84		69		77		53		283	

When Table 2 is examined, it is seen that the frequency of scientific concepts expressed by the secondary school students is 283. These concepts were grouped under categories as of "physics", "chemistry", "biology" and "other". "Other" was inserted to all tables to cover the concepts expressed by the students regarding the Earth and the universe.

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The distribution of the responses by subject and grade level shows that biology concepts were mentioned with the highest frequency (45%) by the 5th grade students. These concepts are mostly related to the world of living things, harms of alcohol and smoking, and food and nutrition. This category was followed by physics (30%), chemistry (13%) and other (10%), respectively. Electricity was recalled by the respondents with the highest frequency among all physics concepts, and the most popular chemistry concepts were heat and temperature.

The 6th grade students referred to concepts about biology (29%) and physics (29%) with equal weight. Chemistry was the third subject in this scope. The highest frequency appeared with states of matter and changes of state, and particulate structure of matter among chemistry concepts. In themes, the total smallest frequency was determined as earth and the universe.

In response to the same question, the findings of the 7th and 8th grade students imply that they listed biology concepts with top priority (58% and 55%, respectively). Body systems and matter cycles were the topics that come to the students' minds with the highest frequency. After biology subjects, the students at both grade levels expressed concepts falling under the subjects of physics and chemistry with equal frequency. It can be seen in Table 2 that the frequency values for both types of topics were low.

The last two columns of Table 2 show the findings obtained from the explanations provided by all participants for this question. When the related columns were examined, it was noticed that almost half (47%) of the associated concepts consisted of topics and concepts from biology discipline. They were followed by concepts and topics related to physics (24%), leaving chemistry (18%) in the third place.

In the open-ended questionnaire, the respondents were asked to list the science topics they are most curious about and want to learn the most. The findings obtained from their explanations are given in Table 3.

Table 3
Science Topics that Secondary School Students Wonder and Want to Learn Most

Category	Theme	5th grade		6th grade		7th grade		8th grade		All grades Total	All grades Total %
		Frequency	%	Frequency	%	Frequency	%	Frequency	%		
PHYSICS	Electricity	18		7		8		18			
	Force and motion	4	**39**	3	**20**	2	**21**	2	**40**	70	30
	Light and sound	4		-		4		-			
	Total	26		10		14		20			
CHEMISTRY	States of matter and changes of state	-		3		2					
	Particulate structure of matter	2		2		9		5			
	Heat and temperature	1	**4**	-	**10**	-	17	4	**18**	28	***12***
	Total	3		5		11		9			

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BIOLOGY	Living things (plants, animals, microscopic creatures)	8		5		5		3				
	Body systems (digestive, excretory, respiratory, etc.)	-		5		18						
	Food and nutrition	6		-		-		2				
	Our body	-	**21**	6	**32**	6	**50**	3	**28**			33
	Human-environment relationship	-		-		4		-				
	Matter cycles	-		-		-		2				
	Reproduction, growth, development	-		-		-		4		77		
	Total	14		16		33		14				
OTHER	The Earth and the universe	24	**36**	19	**38**	*8*	**12**	7	**14**	58		25
Total frequency of mentioned concepts		67		50		66		50		233		

According to Table 3, the frequency of the concepts expressed by the respondents totaled to 233 including all categories. When the distribution of these concepts by topic across grade levels was examined, it was found that the 5th graders were most curious about physics concepts (39%) and the Earth and the universe (36%) as a close thing. Among physics topics, electricity was found to be wondered and sought to be learnt the most. Biology concepts were seen to be the third leading object of curiosity (21%) among others. On the other end, those students mentioned concepts in chemistry area as items that they wonder and want to learn the least (4%).

When it comes to the 6th grade students, it was seen that concepts concerning the Earth and the universe were in the first place with a rate of 38% representing the concepts and topics they are the most curious and enthusiastic about. Those concepts were followed by concepts related to biology (32%) and physics (20%). Contrarily, the least spoken phenomena were about chemistry (10%). The most common concepts were as follows: our body, body systems, living things, electricity, lunar eclipse, solar eclipse, states of matter.

As can be seen in Table 3, biological (50%) issues accounted for half of the concepts that the 7th graders wonder and want to learn the most. The other half was comprised of concepts falling under physics (21%), chemistry (17%) and other (12%), respectively.

From the 8th grade students' perspective, physics concepts were at the top of the list of topics and concepts wondered and desired to be learnt the most (40%). As the second most interesting area, biology (28%) was implied, and it was followed by chemistry (18%) and other (14%).

The last two columns of Table 3 represent the explanations offered to the current research question by all of the study participants. The students mostly pointed out that they wondered and wanted to learn concepts concerning biology (33%) and physics (30%); conversely, they implied topics under chemistry (12%) as the least interesting and wondered concepts. They expressed concepts related to the Earth and the universe at a rate (25%) close to biology and physics.

https://doi.org/10.33225/pec/21.79.894 ISSN 1822-7864 (Print) ISSN 2538-7111 (Online)

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Another question addressed to the participants aimed at listing the concepts they perceive most relevant to their daily life. The results of the analysis of the students' answers are given in Table 4.

Table 4

Science Topics that Secondary School Students Find Most Relevant to Their Everyday Life

Category	Theme	5th grade		6th grade		7th grade		8th grade		All grades Total	All grades Total %
		Frequency	%	Frequency	%	Frequency	%	Frequency	%		
PHYSICS	Electricity	14		13		20		21			
	Force and motion	5		12		3		16			
	Pressure	2				-		2			
	Light and sound	5		4		8		-			
	Simple machines	-	**32**	-	**41**	7	48	-	**51**	132	43
	Total	26		29		38		39			
CHEMISTRY	States of matter and changes of state	3		18		10		8			
	Matter and its structure	-		4		2					
	Heat and temperature	4						2			
	Expansion and contraction	6									
	Water, oxygen, air	4									
	Density	-		3							
	Physical and chemical change	-	**21**	2	**39**		**25**		**17**	77	25
	Dissolution, solution, mixtures	-				8		1			
	Acid-base	-						2			
	Total	17		27		20		13			

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BIOLOGY	Living things (plants, animals, microscopic creatures)	11		1		5					
	Photosynthesis	-		-		-		9			
	Body systems (digestive, excretory, respiratory, etc.)	3		5		9		6			
	Food, nutrition	10		-		2		-			
	Our body, organs	-		-		-		-			
	Diseases	-	**30**	-	**9**	3	27	1	26	72	23
	Food chain	-		-		-		4			
	Organ donation	-		-		3		-			
	Total	24		6		22		20			
OTHER	The Earth and the universe	14	**17**	8	**11**	-	-	5	**6**	27	9
Total frequency of mentioned concepts		81		70		80		77		308	

As can be seen in Table 4, the secondary school students associated science topics with a large number of concepts including electricity, force and motion, states of matter and changes of state, dissolution, solution and mixtures, living things, body systems, diseases, and organ donation. When the distribution of the concepts by grade level was examined, it was seen that the 5th graders often associated physics (32%) and biology concepts (30%) with their own life. However, they mentioned less concepts related to chemistry (21%) in this regard.

According to Table 4, the 6th grade students principally touched upon concepts from physics (41%) and chemistry (39%) as concepts associated with everyday life with a narrow margin between the two target fields. The subject that the 6th grade students thought to be the least related to everyday life was biology (9%).

When the 7th grade students' findings are examined, it can be seen that most (48%) of science subjects considered the most relevant to everyday life are about physics. Topics under biology ranked second (27%) and chemistry (25%) ranked last. Apart from these, this sub-group did not refer to any concepts about the Earth and the universe in this context.

The 8th grade students responded similarly to the 7th graders, resulting in the highest proportion of physics (51%) and biology (26%) concepts considered to be connected with everyday life. Chemistry is in the last place according to both fields.

As can be seen in the last two columns of Table 4, the participants from all of the 5th, 6th, 7th and 8th grades considered concepts and topics about physics associated with everyday life. These topics were "electricity", "force and motion", "pressure", "light and sound", and "simple machines".

https://doi.org/10.33225/pec/21.79.894 ISSN 1822-7864 (Print) ISSN 2538-7111 (Online)

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Lastly, the findings obtained from the analysis of the explanations brought by the secondary school students in reply to the question "Why should we learn science?" are demonstrated in Table 5.

Table 5
Reasons for Needing to Learn Science Explained by Students

Theme	5th grade (frequency)	6th grade (frequency)	7th grade (frequency)	8th grade (frequency)	Total	*%*
Its existence in everyday life	19	24	26	26	95	*53*
Its being necessary	8	14	14	16	52	*29*
Health	9	-	10	-	19	*10*
Being able to recognize oneself and the environment	9	3	-	2	14	*8*

According to Table 5, the students stated that they must learn science because of "its existence in everyday life" with the highest frequency at all grade levels. It can also be seen from the table that the frequency of this theme increased from the 5th grade towards the 8th grade. Following this theme, the participants explained their need for learning science with other reasons such as "its being necessary", "health", and "being able to recognize oneself and the environment" in a descending order of frequency.

Results from the Students' Drawings

This part is devoted to the findings obtained from the analysis of the students' drawings. The students were told to draw "the place and importance of science in our life" and briefly write about such illustrations. Table 6 displays the findings obtained from the analysis of the students' drawings for each and all of the grade levels.

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Table 6
Students' Drawings by Topic and Grade Levels

Category	Theme	5th grade		6th grade		7th grade		8th grade		All grades Total	All grades Total %
		Frequency	%	Frequency	%	Frequency	%	Frequency	%		
PHYSICS	Electricity	*16*		*17*		19		*17*			
	Force (friction force, simple machines, dynamometers, etc.)	8		13		8		10			
	Light and sound	2	**40**	3	58	5	47	2	51	120	49
	Total	26		33		32		29			
CHEMISTRY	Changes of state	2		*9*		10		9			
	Matter and its properties	1		1		3		-			
	Dissolution, mixtures	-	**5**	-	18	8	31	-	16	43	17
	Total	3		10		21		9			
BIOLOGY	Harms of alcohol and smoking	16		4		1		7			
	Balanced and healthy diet	10		2		5		2			
	Living things (plants, animals, photosynthesis, adaptation, etc.)	5		-		2	19	4			27
	Our body, organs, diseases	1	**49**	2	14	5		1	24	67	
	Total	32		8		13		14			
OTHER	The Earth and the universe	4	6	6	10	2	3	5	9	17	7
		65	100	57	100	68	**100**	**57**	**100**	***247***	***100***

It can be seen in Table 6 that almost half (49%) of the 65 concepts symbolized by the 5th grade students were composed of biology-related topics. Physics concepts were in the second place (40%) in the drawings. The most frequently referred topics of biology and physics were "harms of alcohol and smoking", "a balanced and healthy diet", "electricity" and "force". It was found that the 5th grade students embodied chemistry as a subject in their drawings in the smallest amount (5%) with 3 only associated concepts.

In the drawings of the 6th grade students, the first place was occupied by physics topics such as electricity and force, with a percentage as high as 58%. Physics was followed by chemistry with a small percentage (18%) usually depicting changes of state.

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It can be noticed from the table that the majority of both 7th grade and 8th grade grades portrayed physics, specifically electricity in their drawings. As regards chemistry, concepts about chemistry were the second most frequently drawn phenomena with a percentage of 31% by the 7th grade graders. Changes of state, dissolution and mixtures were the main themes of drawings of this sub-group. As for the drawings by the 8th grade students, biology was in the second place and chemistry was in the third place. Only 9 of the 57 science concepts drawn by the 8th graders were falling under chemistry as a subject, and all of them were intended to symbolize changes of state. Some examples of student drawings are given below.

Image 1.
5th grade student's drawing about down syndrome

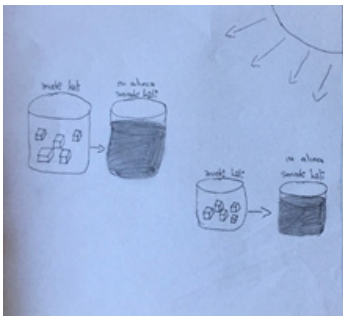

Image 2.
6th grade student's drawing about changes of state

Image 3.
7th grade student's drawing about the use of simple machines in daily life

Image 4.
5th grade student's drawing about electricity in daily life.

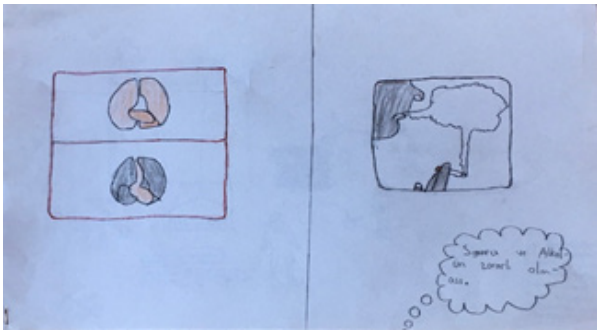

Image 5.
7th grade student's drawing on the harmful effects of smoking and alcohol

When the drawings of all grades were analyzed collectively, it was found that almost half (49%) of them covered physics-related topics and concepts in their drawings. These included electric shock, electrically operated tools, the use of simple machines in everyday life, and effects of friction force in everyday life. After these, biology emerged as the second most popular subject. The students mainly illustrated harms of alcohol and smoking, healthy diet, and diseases. Lastly, the Earth and the universe appeared as the least common topics in drawings of all students except the 5th grade, and these topics were pictured as lunar eclipse and solar eclipse.

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Discussion

This study was carried out to identify and evaluate with a developmental view the interests of secondary school students in the topics and concepts of physics, chemistry, biology they learn in science lessons. To this end, the findings obtained from open-ended questionnaires and drawings rendered by the 5th, 6th, 7th, and 8th grade students were discussed in the light of the related literature.

In the open-ended questionnaire, item one interrogates what concepts or topics come to respondents' mind as they think of science. The findings reveal that the students from all grade levels (5 through 8) heavily addressed biology topics. In particular, more than half of the key concepts offered by the 7th and 8th graders belong to the discipline of biology. Consideration of the students' responses collectively also suggests that science largely bring into mind topics and concepts related to biology. It can be said that students take science as biology in a sense. Previous research proves evidence that students have positive thoughts about the biology lesson (Yapıcı, 2015; Kışoğlu, 2018). In response to this question, the first place is held by topics and concepts from physics field. Interestingly, chemistry was the least common field of science among the three disciplines. It can be inferred that students are relatively less interested in chemistry concepts in general (Holbrook & Rannikmae, 2007; Osborne & Dillon, 2008).

Another item in the questionnaire is intended to explore topics that students are curious about and want to learn the most. The answers varied between biology and physics topics at every grade level. Similar to the results of question one, chemistry topics and concepts come after physics and biology for students at every grade level considered here. When the answers of all the participants are evaluated at once, this result becomes obvious once again. Again, the students' answers seem to be in favor of biology and, subsequently, physics. Chemistry concepts are in the last rank with percentage even smaller than "the Earth and the universe". So, it can be argued that students find chemistry less attractive than physics and biology among fields of science and they are not interested in chemistry. These results look worth noting and thought-provoking in terms of chemistry teaching. However, considering the number of units devoted to subject areas in the secondary science curriculum this result may not be considered a surprise. When the curriculum is examined, the number of units allocated to chemistry at all grade levels is only one. 3 units are devoted to physics and 2 units to biology (MEB, 2018).

The third item in the questionnaire, in a similar vein to the preceding two questions, investigates what topics of science the students consider associated with everyday life. The results in this scope seem interesting. To start with, the respondents linked physics topics with everyday life at all grade levels in an ascending order from the 5th grade towards the 8th grade. Among others, electricity was implied with the highest frequency. The participants in this study come from a boarding school in a rural area. There must be frequent power outages in the surrounding of the school. Since electricity has an effect on their life in the most direct and clear way, it is quite understandable that the students referred to this concept while answering this question. Secondly, biology extended the second most down-to-earth concepts from the students' point of view, except the 6th graders. Those students often associated states of matter and changes of state with their everyday life. This particular topic is regarded the most relevant among chemistry concepts at all class levels in the study. Like electricity, changes in states of matter might have been implied by the respondents since it is a visible and direct phenomenon in the participants' surrounding.

The drawings explaining the place and importance of science in students' life also seem to reinforce this result in a way. Except at the 5th grade, nearly more than half of the drawings involve physics topics. The students mostly painted the topic of electricity, supporting their answers to the open-ended question concerned.

https://doi.org/10.33225/pec/21.79.894 ISSN 1822-7864 (Print) ISSN 2538-7111 (Online)

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As a result of the first three questions and drawings about the students' interests, the results here are in agreement with the existing literature which proves the priority of biology in terms of interest and popularity among students (Osborne et al., 2003; Tamir & Gardner, 1989), whereas the results relating to physics concepts seem incongruent with the literature. There are studies claiming that concepts related to physics as well as chemistry are not popular and interesting to secondary school students (Gardner, 1998; Hoffmann et al, 1998). However, the current study revealed that physics topics were found to be a subject area of interest to students along with biology to a great extent.

Although the results of the study expose a satisfactory scheme in support of physics concepts, it is hardly true for chemistry concepts. What is more, other studies in the field of chemistry education confirm the results reached in this study. Chemistry science and chemistry concepts are not interesting for students, and they are far from everyday life as students see it (Akgün et al., 2016; Ben-Zvi & Gai, 1994; Holbrook, 2005; Jones & Miller, 2001; Ng & Nguyen, 2006; Wu, 2003).

In the current study, both the answers to the open-ended questions and the pictures reveal that physics and biology concepts are more dominant than other science fields in the minds of the secondary school students. When students think of science, they recall biology concepts at the first stage, they want to learn about biology and physics more than the other subjects, and they find physics and biology most close to their own life. This attitude of the students in favor of physics and biology could be justified by looking at their answers to the question "Why should we learn science?" Most of the students pointed out that they need to learn science owing to the fact that it is close to real life, and it is necessary. It can be asserted that it is more meaningful and valuable for students to learn issues that they need and that have a place in their life. It is also known that students show more interest in concepts that have a part in their life (Bolte et al., 2013; Gräber, 2011; Holbrook, 2003; Holbrook & Rannikmae, 2007; Kışoğlu 2005).

As far as this study is concerned, secondary school students are the least interested in chemistry among the three science subjects. This result deserves discussing and analyzing for the benefit of chemistry education. The listing position of interest in chemistry lagging behind physics and biology can be studied from several aspects. The science of chemistry includes abstract concepts such as atom, electrons, ions, molecules, and bonds. More often than not, one resorts to abstract and microscopic concepts and symbolic explanations in order to be able to explain a phenomenon that seems to be related to chemistry. It is challenging for students to understand the unusual language of chemistry (Çalık & Ayas, 2005; Griffiths & Preston, 1992; Johnstone, 1993). Studies on chemistry concepts also show that students have difficulty figuring out chemistry, have negative attitudes towards the chemistry lesson, and cannot use their knowledge of chemistry adequately and effectively for explaining the events they see in their environment (Azizoğlu & Geban, 2004; Ben-Zivi & Gai, 1994; Eilks et al., 2007; Karaer, 2007; Nakhleh, 1992; Osborne & Cosgrove, 1983; Özmen et al., 2002; Schmidt et al., 2009; Solsona et al., 2003).

Another argument may be that, as revealed in this study, chemistry concepts are not manifested in students' life. In other words, students perceive chemistry-related phenomena much less true to their real life than concepts of physics and biology. (Treagust et al., 2000). One reason is probably the fact that chemical phenomena take effect in more indirect ways. For example, pupils can easily observe the germination of a seed and its sprouting on the soil surface. Likewise, electricity plays an indispensable role in students' life as they turn on the light in their room every evening. However, more is needed to realize why the leaf of a tree turns yellow or how iron becomes rusty. But it should be remembered that chemical events do not take up a smaller place in our life even though they cannot be observed directly.

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For another probable explanation for the lower level of students' interest in chemistry, a closer look can be taken at the science curriculum which is currently being implemented in secondary schools. By looking at the number of target outcomes and course hours allocated to each of the three disciplines of science for the 5th, 6th, 7th and 8th grades, it can be easily seen that the number of planned outcomes, units and course hours for the chemistry course remains much smaller than those of physics and biology at all grades (MEB, 2018). In a previous study discussing how to promote students' interest in chemistry education and their motivation; Bolte et al. (2013) have found that interest is not a constant thing, rather, it is changeable under many circumstances including external stimuli, specific situations, time, and activities. It can be extended to say that the duration of students' engagement with a specific subject could be a factor that increases their interest. Hence, students can be expected to have higher interest in subjects or matters in which they stay involved for a longer time.

Conclusions and Implications

This study revealed a holistic description of secondary school students' (the 5th, 6th, 7th and 8th grades) interest in physics, chemistry and biology subjects, and it showed that the students have the highest level of interest in physics and biology among science topics and concepts at all grade levels. On the other hand, the interest and curiosity towards chemistry is quite low for almost all grade levels in this study. Apart from these, the students predominantly considered physics topics pertinent to their everyday life, whereas they listed chemistry concepts as the least pertinent ones. This result is also regarded as a cause of the lower levels of interest in chemistry. The results obtained from this study have some foresights for improvement of the secondary school science curriculum.

Interest in chemistry-related concepts can be increased by reviewing the content and organization of the secondary school science curriculum and to update the expected outcomes and course hours of chemistry to keep up with physics and biology at all grade levels.

Given that students in an ordinary science class have different interests and needs, educational components such as interest and motivation seem to relate to the nature, organization and structuring of the subject or topic of teaching rather than the strategies to be followed. Therefore, it is necessary to take a wider approach to science concepts and especially the teaching of chemistry concepts as they are more critical, and to choose more suitable paths and approaches considering the nature of the subject or topic in question.

Students' interest in participating in any learning and teaching activity can be influenced by many variables, one of which is the provision of rich contextual contents that help students connect with their lives. On this basis, students should be made to become aware of what concepts mean to them in their present and future life and to appreciate concepts accordingly. Therefore, it would be beneficial to integrate a special point of view to highlight this aspect of concepts in the teaching of chemistry topics, which have been seen far from life so far, as a part of the science curriculum.

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Received: *September 30, 2021* Accepted: *November 27, 2021*

Cite as: Kurt, S. (2021). Secondary school students' interest in physics, chemistry and biology concepts from developmental view. *Problems of Education in the 21st Century*, *79*(6), 894-911. https://doi.org/10.33225/pec/21.79.894

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