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Time Management Problem in Science Course in Secondary School 5th - 8th Grades in Turkey: Units Emphasized Less and the Reasons

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Abstract This study is carried out to reveal which units teachers who encounter problems about falling behind the science course curriculum in secondary school in the 5th grade through the 8th grade prefer to focus on less and the reasons for their preferences. Survey model was used in the research study. Total 302 science teachers from 28 different cities in Turkey participated in the study carried out in 2015-2016 academic year. The research data were gathered via questionnaire form developed by the researcher. The results of the study revealed that nearly two-thirds of the science teachers spent less time teaching the units related to the "Earth and Universe" subject area to catch up on the curriculum in case of holidays, meetings, and exams held apart from the planned schedule. The units including ecology subjects within the subject area of Living Things and Life follow it. When the units are examined considering the grades, "Natural Processes" unit, the last unit of the 8th grade, ranked first. The reasons why science teachers put less emphasis on these units is the place/order of the units in curriculum, timetable of the centralized exam held in the country and timetable of the last written exams in schools, distribution of questions in the centralized exam, the number of gains from the unit and content, and the students' pace in understanding the subject.

Keywords Science Course, Science Teacher, Science Units, Earth and Universe

1. Introduction

Rapid developments in science and technology increase both social and economic competition between the countries. This competition has generated the need for raising individuals who follow, understand, and produce scientific knowledge and technology required by our age, Thus, primarily developed countries and all other countries are in a struggle to increase the quality of education they give constantly but especially science and technology education. At this point, especially The National Science Education Standards created by the American National Academy of Sciences had an effect on science education in many countries including European countries and it caused the curricula in different countries to be redesigned and redeveloped [1].

Within this scope, science course in Turkey underwent a change. Development and approval of curricula in Turkey are performed by the Ministry of National Education's Head Council of Education and Morality. Turkey has closely followed the studies carried out about science education abroad and included implementations of science curriculum designed and developed at elementary and secondary school levels. For that purpose, a study was started to enrich science curricula at elementary level and develop new science education materials in 1968. With these studies, the content of science curricula designed with a view close to the modern understanding of science education was determined and beginning in 1970-1971 education year the implementations were carried out gradually in the second level of elementary education.[2]. This program was replaced by the new science education curriculum in 1992 with transition to eight year compulsory education. However, although this curriculum was developed in 1992, it was designed based on behavioral learning theory. The first curriculum developed with the reform movement entered into force in 2001-2002 education year. Important changes were made with this curriculum and subjects were related to the real-life and based on constructivist learning theory. In the later years, considering the updates performed, the new curriculum was implemented beginning in 2005-2006 education year in the 4th and 5th grades and in 2006-2007 education year it was implemented in the 6th, 7th, and 8th grades under the name of Science and Technology course [3,4,5,6]. Although these curricula published in 2000 and 2005 were based on constructivist learning theory, lack of

unity between the units in the 4th grade throughout the 8th grade was eliminated by adopting the principle of spirality in the curriculum published in 2005. With this way, the 6th, 7th, and 8th grade Science and Technology course curricula were brought into conformity with the 4th and 5th grade curricula. Moreover, focusing more on the aspects of science subjects related to the daily life, the name of Science course changed and became Science and Technology course and it was predicted that it would be taught 4 hours a week [4,5]. Finally, the name of the course called Science and Technology changed and became Sciences with the curricula updated in 2013 and the number of weekly course hours remained the same. Science course was started to be taught in the 3rd grade with this curriculum [7]. In addition to this, with the curriculum updated in 2013, it was found that the number of learning outcomes decreased by 65% and some units' names changed. "Constructivist learning approach" was emphasised in science education curricula in 2005 during the learning-teaching process but considering the 2013 curriculum it was emphasized that "learning-teaching strategy based on inquiry-based learning must be actively used [8].

2. The Structure of Science Course Curriculum

The vision statement of Science Course curriculum in the 3rd grade through the 8th grade updated in 2013 was defined as it was in 2004 curriculum: "*To raise all of the students as scientifically literate individuals."* The strategy adopted in the new curriculum is expressed like that:

> "According to the Science Course Curriculum, while designing and implementing courses, learning environments where students are active and teachers are guides and leaders were considered. In-class and out-of-class settings are designed with regard to inquiry-based learning strategy so that students can learn the knowledge in science domain meaningfully and permanently. Within this context, informal learning settings are also used. The inquiry process is approached not only as "exploration and to experiment but also as a process of creating "explanation and argument" [7].

The new curriculum consists of 4 learning domains which include *Knowledge, Skills, Affective, and Science-Technology-Society-Environment.* Science Course consists of "Knowledge" learning domain, "Living Things and Life" subject area containing biology, "Physical Events" learning domain containing physics, "Matter and Change" learning domain containing chemistry, and "The Earth and Universe" learning domain containing space. "Skills" learning domain consists of two major topics including scientific process skills and life experiences (analytical thinking, decision making, creativity, entrepreneurship, and team work). "Affective" learning domain includes attitude, motivation, value and responsibility topics. Science Course "Science-Technology-Society-Environment" learning domain contains the topics including socio-scientific issues, nature of science, science and technology, the relationship between science and technology, social contribution of science, sustainable development and career awareness [7]. In fact, this up-dated curriculum was constructed on 4 major topics including "Living Things and Life", "Physical Events", "Matter and Change" and "The Earth and Universe". Within the context of this course given in the 3rd grade through the 8th grade, there are 7 units on average included in these content areas. It is estimated that total 330 learning outcomes, 32 outcomes in the 3rd grade, 46 outcomes in the 4th grade, 44 outcomes in the 5th grade, 52 outcomes in the 6th grade, and 78 outcomes in the 7th and 8th grades, will be attained (Appendix.1).

As seen, important changes have been made with the science education curriculum in Turkey for the last 15 years. Since the beginning of 2000, these reformist steps taken in science curriculum have accelerated performing scientific studies with them. Within this context, congresses and symposiums on national scale intended for the Science course curriculum were organized, MA thesis studies were carried out, and many articles were published. The subject area explored intensely is to examine new science course curricula within the light of teacher views and to reveal strengths and weaknesses of curricula [9,10,11,12,13,14,15, 16,17,18,19,20,21,22,23,24,25,26]. In addition to this, the studies comparing the science teaching curricula in different countries like Australia, Finland, Canada, New Zealand, Ireland, and the USA and science teaching curricula developed in Turkey are among the frequently studied topics [27,28,29,30,31]. Moreover, there are studies which compared different science teaching curricula implemented in Turkey [32,33,34,35]. In addition to these, among the topics studied are the feasibility level of science teaching curriculum [36,37,38,39,40,41,42,43,44], teacher competencies during the implementation process of the curriculum [1,45,46], contextual sufficiency of science course books [47,48,49], actualisation level of outcomes in science curriculum [50,51,52,53], evaluation of assessment and evaluation process in the curriculum [54,55], curriculum's level of attaining cognitive purposes [56], curriculum's contribution to comprehension of nature of science and development of science process skills [57] and the condition of being able to do the activities in course books [58]. The opinions of science teachers who are curriculum practitioners are utilized nearly in all of these studies and there are also studies which benefited from pre-service teachers and elementary school students' views taking the course with regard to evaluation of curriculum [59,60,61,62,63].

Ministry of National Education prepare a work calendar for showing the public holidays, religious holidays, and the centralized exams administered throughout the country to

attain the learning outcomes within the context of science curriculum updated in 2013 and consider this calendar for their planning. However, because problems arise due to the students (difficulty / easiness of understanding subjects and etc.), process (parent-teacher meetings, group meetings, teacher' being on leave/ sick leave, school closings because of heavy snow, and mock exams), time problem and new situations occur which are responsible for going beyond the planning. Within this framework, research findings which reveal that teachers complain about lack of time during the implementation of the curriculum have been encountered in literature [12,15,16,17,18,19,20,23,34,40,4953,58].

However, there are not any studies which demonstrate what paths science teachers as curriculum practitioners follow when they suffer from lack of time and try to catch up on curriculum. It is considered that this research study will fill this gap in literature.

Within this context, the purpose of the study is to determine which units science teachers teaching science in the 5th grade through the 8th grade emphasize less to catch up on curriculum when they lack time. The study sought answers to these two research questions:

1. Which units do science teachers teaching science in the 5th grade through the 8th grade prefer to emphasize less to catch up on curriculum when they lack time?
2. What are the reasons why teachers who lack time to catch up on curriculum choose these units?

3. Method

3.1. Research Model

Descriptive research design was used in the research study. Descriptive studies are conducted to clarify a situation, to do evaluations in line with standards and to demonstrate associations or relationships between things. The main purpose in such studies is to describe and explain the phenomenon examined in detail [64]. This method was preferred in this research study to determine which units science teachers emphasize less to catch up on curriculum due to the problems arising such as students (difficulty / easiness of understanding subjects and etc.), process (parent-teacher meetings, group meetings, teacher' being on leave/ sick leave, school closings because of heavy snow, and mock exams).

3.2. Study Group

The study was carried out in 2015-2016 academic year and total 302 science teachers, 120 females and 182 males, working in 28 different cities in Turkey and selected via snowball sampling participated in the study. While 229 teachers had 10 years or fewer years of teaching experience, 73 of them had more than 10 years of teaching experience. While 266 of the teachers received bachelor's degree, 36 of them received Master's degree. In addition to this out of the 302 teachers participating in the study, 58 of them work in village schools, 133 of them work in secondary schools in the towns and 111 teachers have been appointed to secondary schools in the city centers.

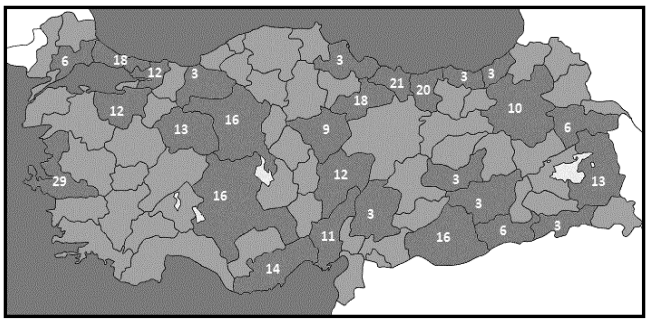

Figure 1. Distribution of Teachers Considering Cities

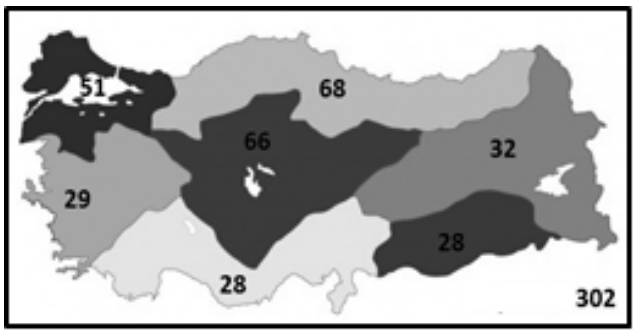

Figure 2. Distribution of Teachers Considering Regions

3.3. Data Collection Tools

The questionnaire developed by the researcher was used in the study in order to determine which units science teachers teaching science in the 5th grade through the 8th grade prefer to focus on less to catch up on curriculum when they lack time. In the first part of the questionnaire, there are four questions determining the demographic characteristics of teachers. The second part of the questionnaire consists of the list of units in the 5th, 6th, 7th, and 8th grade science curricula in order to identify which unit teachers emphasized less. Moreover, an open-ended question was asked to make teachers explain why they chose these units. The opinions of two different experts from the field, a science and technology teacher and a language expert, were taken for the questionnaire and the content validity of the questionnaire was attempted to be provided.

3.4. Data Analysis

Frequencies and percentages, one of the descriptive statistical methods, were used for the required statistical analysis of the quantitative data gathered for the sub-problems for which answers were sought within the general purpose framework of the study. Data related to the quantitative findings were tabulated and interpreted. Content

analysis was used to analyses the data obtained from the open-ended question. The main purpose of content analysis is to determine key concepts and relations in order to explain the data collected. For that purpose, the data gathered are firstly conceptualized and then considering the concepts determined, the data are organized logically and the themes which explain the data are identified. [81]. The data were analyzed by the two researchers. The analysis was carried out in four stages. In the first stage which is also called as coding data, the researchers independently examined the responses given to the open-ended questions in the questionnaire form and they generated codes from the written responses and sorted them into meaningful categories. In the second stage, the codes were gathered to identify what they had in common and the themes were generated. In the third stage, the data were sorted considering the emergent categories and themes and in the final stage, they were displayed in tables and interpreted. Teachers' statements related to their views were given below the table without making any changes. After the procedures performed by the two researchers independently, the researchers' analyses were compared and the points with which they agreed or disagreed were determined. The (internal) reliability of the research was calculated by using the following formula: (Reliability: Agreement /Agreement + Disagreement) [82]. The coding was compared and it was found that there was compatibility at the rate of 92%.

4. Results

Table 1 presents the subject areas and units which science teachers spent less time on teaching due to time constraints.

Table 1. Frequencies and Percentages Distribution of Science Teachers' Views Related to the Units within the subject area of Living Things and Life

Subject area	Grade	Unit	Total	
			f	%
Living Things and Life (Biology topics)	7	5. The Relationship between Human Beings and Environment	153	51
	5	5. Let's Visit and Learn The World of Living Things	99	33
	6	5. Reproduction, Growth, and Development of Plants and Animals	96	32
	8	6. The Relationship between Living Things and Energy	81	27
	5	1. Let's Solve The Mystery of Our Body	48	16
	7	1. Systems in our Body	36	12
	6	1. Systems in our Body	33	11
	8	1. Cell Division and Heredity	15	5

When Table 1 is examined, it is found that 51% of the teachers spent less time on teaching the 5th unit of the 7th grade called "The Relationship between Human Beings and Environment. "Let's Visit and Learn the World of Living Things" the 5th unit of the 5th grade at the rate of 33%, "Reproduction, Growth, and Development of Plants and Animals" the 5th unit of the 6th grade at the rate of 32%, and "The Relationship between Living Things and Energy" the 6th unit of the 8th grade at the rate of 27% follow it consecutively. As understood from the table, time spared for the units related to ecology was less than the time spared for the units consisting of anatomy and heredity about catching up on the curriculum due to time constraint.

Table 2. Teachers' views about their reasons for putting less emphasis on the units within the content of Living Things and Life

	Themes	Code	Explanation	f
Living Things and Life subject area	S.M.	Simple/ Understandable	Easy and understandable subjects and concepts	267
	S.C.	Student Readiness	Due to the relation of the subjects to the real-life, students come to the class having preliminary/prior knowledge	189
	S.M.	Verbal subjects	Verbal subjects which do not require mathematical operations	156
	S.M.	Concrete	Easily comprehended due to concrete subjects and concepts	87
	S.M.	Activity	Few experiments and activities/ experiment and activities are not required	66
	S.C.	Student Interest	Subjects arouse student interest	42
	S.M.	Content/ Gains	Short unit content / Few gains to acquire	39
	C.C.	Principle of Spirality	Subject being told partially in previous years	30
	S.M.	Material	A lot of materials and visuals about the subject	18
	E.S.	Centralized exam	No questions asked in the centralized exam held nation wide	9

Themes: S.M.: subject matter, S.C.: students characteristics, C.C.: curriculum characteristics, E.S.: evaluation system

When Table 2 is examined, 267 teachers who remained under time pressure stated that because the units containing ecology within the subject area of Living Things and Life were simple and understandable, they put less emphasis on them. Moreover, 189 teachers determined that students' level of readiness were at high level with these units and 156 teachers stated that because they were verbal subjects which do not need mathematical operations, they put less emphasis on these subjects. Within this context, while one teacher stated, " *Because they include verbal concepts, subjects which can be understood by reading, students understand these subjects in a short time (F_{21})",* another teacher said, " *I teach the units which have fewer cognitive skills to gain or subjects which can be easily associated with real-life quickly*. *Because biology related subjects are mostly concrete subjects supported by visuals, it is much easier for students to comprehend (F_{140})".* Still another teacher said, *"Because they usually include biology subjects, students interact with these subjects more in daily life (M_{261})".* Another teacher stated, *"Because there are much easier and more verbal subjects in the units I choose and I think that students understand them immediately, I prefer to teach them quickly (F_{28})".* In addition to this, while one teacher remarked, *"In the previous education year, this unit was taught in detail (M_3)"*, another teacher said, "*These are the subject we encounter in our daily life. Because they are easier, children learn them fast, so I teach them quickly when compared to others (F_{65})".*

Table 3. Frequencies and Percentages Distribution of Science Teachers' Views Related to the Units within the subject areas of Physical Events

Subject Area	Grade	Unit	Total	
			f	%
Physical Events (Physics Subjects)	8	4. Sound	93	31
	6	4. Light and Sound	66	22
	5	4. Diffusion of Light and Sound	54	18
	5	2. Measuring Magnitude of Force	30	10
	7	4. Reflection in Mirrors and Absorption of Light	30	10
	7	2. Force and Energy	24	8
	6	2. Force and Movement	18	6
	8	7. Electricity in our Life	18	6
	6	7. Transmission of Electricity	12	4
	7	6. Electrical Energy	9	3
	8	2. Force and Movement	6	2
	5	6. Electricity: Indispensable in our Life	3	1

When Table 3 is examined, it is determined that 31% of the teachers put less emphasis on the 4th unit of the 8th grade called "Sound". "Light and Sound" the 4th unit of the 6th grade at the rate of 22 % and "Diffusion of Light and Sound" 4th unit of Grade 5 at the rate of 18% follow it consecutively. As understood from the Table, it is revealed that when teachers' time problems about falling behind the curriculum were considered, they put less emphasis on the units related to light and sound rather than the units including mechanics and electricity subjects of physics.

Table 4. Teachers' views about their reasons for putting less emphasis on the units within the content of Physical Events

	Themes	Code	Explanation	f
Physical Events subject area	S.M.	Simple/Understandable	Easy and understandable subjects and concepts	105
	S.M.	Content/ Gains	Short unit content / Few gains to acquire	99
	S.C.	Student readiness	Due to the relation of the subjects to the real-life, students come to the class having preliminary/prior knowledge	48
	C.C.	Principle of Spirality	Subject being told partially in previous years	42
	S.M.	Verbal Subjects	Verbal subjects which do not require mathematical operations	36
	T.C.	Teacher	Because s/he has full knowledge of subject, s/he explains it much easily	24
	S.M.	Activity	Activities and experiments are quite clear	21
	S.C.	Student Interest	Subjects draw student interest	12
	E.S.	Centralized Exam	Teaching the subjects quickly to solve questions before the centralized exam	12
	E.S.	End of Year	Because it is end of year, subjects do not draw student interest	12
	S.M.	Concrete	Because subject and concepts are concrete, they are easy to comprehend	6
	S.M.	Material	A lot of ready materials about the subjects and concepts	3

Themes: S.M.: subject matter, S.C.: students characteristics, C.C.: curriculum characteristics, E.S.: evaluation system, T.C.: teacher characteristics

When Table 4 was examined, 105 teachers being under time pressure stated that because the units containing especially light and sound within the subject area of Physical Events were simple and understandable, they put less emphasis on them. Moreover, 99 teachers stated that because unit content was short and the number of gains students acquired was few, they put less emphasis on these units. Because students' level of readiness was high with these units (48 teachers) and these subjects were addressed partially in the previous years (42 teachers), they stated that they laid less emphasis on these units. Within this context, one teacher said, *"Because there are few number of concepts*

to teach in Light and Sound, I explain the subject shortly and then I do exercises to consolidate the subject (F_{12})". Another teacher said, *"Because of the few main concepts given and easier to understand (F_{192})"*. Still another teacher stated, "*Simple subjects without having a lot of details* (*M_{93})" and* another teacher remarked, "*Learning outcomes for light and sound unit are easy and they are grasped much more quickly with experiments (M_{16})"*. In addition to this, one teacher said, *"because it was taught partially in the curriculum in the previous years, students had prior knowledge (M_{67})"* and another teacher suggested, "*The gains achieved are few and they are easily associated with the real-life. Moreover, because subjects are verbal-weighted, students understand them much more easily (F_{96})"*.

Table 5. Frequencies and Percentages Distribution of Science Teachers' Views Related to the Units within the subject area of Matter and Change

Subject area	Grade	Unit	Total	
			f	%
Matter and Change (Chemistry subjects)	5	3. Change of Matter	36	12
	6	6. Matter and Heat	30	10
	6	3. Granular Structure of Matter	27	9
	7	3. Structure of Matter and its Features	18	6
	8	5. States of Matter and Heat	9	3
	8	3. Structure of Matter and its Features	6	2

When Table 5 was examined, it was determined that 12% teachers put less emphasis on the unit of "Matter and Change", the 3rd unit of Grade 5. "Matter and Heat" the 6th unit of Grade 6 at the rate of 10% and "The Granular Structure of Matter" the 3rd unit of Grade 6 at the rate of 9% follow it.

When Table 6 was examined, 42 teachers being under time pressure said that because subjects within the subject area of Matter and Change were related to the real life, students' level of readiness was high so they laid less emphasis on it. Moreover, because these subjects are mentioned in the previous years (33 teachers) and the subjects and concepts were simple and understandable (21 subjects), they stated that they put less emphasis on them. Within this content, one teacher said, *"Due to students' having knowledge about the subject from real life (F_{48})"* another teacher said, *"Because there are concepts students are familiar with from real life and they have some basic knowledge from primary school, I prefer to teach these units much faster (M_{126})"*. Moreover, while one teacher remarked, *"Because it is easy to understand (M_{276})",* another teacher stated, *"It is sometimes needed to tell some sections learned in the previous year briefly in the unit of the granular structure of matter (M_{159})"*. In addition to this, a teacher said, "*Because they are the subjects which students encounter frequently in daily life, they have already had prior knowledge about the subject (M_{136})"* and another teacher opined, *"Because there are few key concepts given and they are easy to understand ((F_{128})"*.

Table 6. Teachers' views about their reasons for putting less emphasis on the units within the content of Matter and Change

	Themes	Code	Explanation	f
Matter and Change subject area	S.C.	Student Readiness	Due to the relation of the subjects to the real-life, students come to the class having preliminary/prior knowledge	42
	C.C.	Principle of Spirality	Subject being told partially in previous years	33
	S.M.	Simple/ Understandable	Easy and understandable subjects and concepts	21
	S.C.	Student Interest	Subjects draw student interest	12
	S.M.	Content/ Gains	Short unit content / Few gains to acquire	12
	S.M.	Concrete	Because subject and concepts are concrete, they are easy to comprehend	9
	S.M.	Activity	There are many experiments and activities and they are understandable	9

Themes: S.M.: subject matter, S.C.: students characteristics, C.C.: curriculum characteristics

Table 7. Frequencies and Percentages Distribution of Science Teachers' Views Related to the Units within the subject area of The Earth and Universe

Subject area	Grade	Unit	Total	
			f	%
The Earth and Universe (Astronomy subjects)	8	8. Natural Processes	210	70
	7	7. Solar System and Beyond	180	60
	6	8. Our World, The Moon, and the Sun: The Source of Life	171	57
	5	7. The Mystery of Earth's Crust	165	55

When Table 7 was examined, 70% of the teachers determined that the unit which they put least emphasis on was "Natural Processes", the last unit of Grade 8. The following units follow it consecutively: 60% of "Solar System and Beyond", the last unit of Grade 7, %57 of "Our World, The Moon, The sun, The Source of Life" the last unit of Grade 6 and 55% of "The Mystery of Earth's Crust" the last unit of Grade 5.

Table 8. Teachers' views about their reasons for putting less emphasis on the units within the content of The Earth and Universe

	Themes	Code	Explanation	f
The Earth and Universe subject area	E.S.	End of Education Year	Because it was the last unit, students were reluctant to attend the lesson / They did not attend the lesson	108
			Time pressure	102
			End of exams/ could be taught only after the exams	93
			No questions asked from them in the centralized nationwide exam	42
	S.M.	Simple/Understandable	Simple and understandable subjects and concepts	96
	S.C.	Student Readiness	Due to the relation of the subjects to the real-life, students come to the class having preliminary/prior knowledge	78
	S.M.	Verbal Subjects	Verbal subjects which do not require mathematical operations	78
	S.M.	Content /Gains	Short unit content / Few gains to acquire	39
	C.C.	Principle of Spirality	Subject being told partially in previous years	27
	S.M.	Material	A lot of ready materials about the subjects and concepts	27
	S.C.	Student Interest	Subjects draw student interest	24
	S.M.	Activity	Few experiments and activities /Experiments and activities are not required	18

Themes: S.M.: subject matter, S.C.: students characteristics, C.C.: curriculum characteristics, E.S.: evaluation system

Most of the science teachers stated that because the units within the context of the Earth and Universe at all levels occurred at the end of education year, they had to put much less emphasis on these units. Within this framework, the reasons given by the teachers for putting much less emphasis on these units can be explained as follows: 108 teachers stated that students did not attend the lesson during the time interval (May and June) when these subjects were taught or they lacked interest in the course. 102 teachers said that because they were the subjects of last week, there was time pressure on them. 93 of them stated that they were the subjects which could be studied after the exams administered in the school and 42 of them remarked that they were the subjects which were not included in the centralized nationwide exam. Within this context, one teacher stated, *"Because the exams are finished, the weather is getting hotter, students lack interest, and there are very few students in the class, I teach these units quickly (F_{94})"*. Another teacher stated, " *Because of the reasons like end of exams, increasing student absenteeism and time pressure, these units are finished much faster (M_5)"*. While still another teacher stated, *"There is not enough time for the last units so I have to explain them quickly (F_{13})"*, another teacher said, *" Because they are taught after the last exams and there are no questions from these units in the centralized exam, I just tell them quickly (F_{40})"*. In addition to this, the following teachers stated that they laid less emphasis on these subjects because the subjects and concepts were simple and understandable (96 teachers), students came to the classroom having prior knowledge as they were related to the daily life (78 teachers) and they were verbal subjects which did not require mathematical operations. Within this content, one teacher expressed her opinion like that: *"Because they are the subjects from the real-life, they are understood much more easily and because they do not require mathematical operations, they take a short time (F_{34})"*. Another one stated, *"Because students' levels of readiness regarding real-life situations are good, I tell them quickly (M_{39})"*.

5. Discussion and Conclusions

The results of the study revealed that nearly two-thirds of the science teachers participating in the study spent less time and put less emphasis on the units containing space and astronomy to catch up on the curricula in case of holidays, meetings, and exams existing apart from the intended ones. Teachers participating in the research study expressed that the most important reason why they spared less time on units containing space and astronomy was that these units in science curricula occurred in the months of May and June when education year was about to finish. In fact, teachers stated that the subjects were easy, understandable and students had prior knowledge about these subjects. However, teachers stated that because education term ended in the middle of June and the third exam or the last exam of science course was administered through the end of May, students' motivation decreased, they lacked interest in the subjects, and problems occurred about having students acquire learning outcomes of the units. There are studies in literature which reveal that many problems were encountered, especially not being able to have some learning outcomes acquired during the science course teaching process [21,50,5358,61]. Moreover, teachers said that not including questions from these units in the centralized exam which was run every year in the 2nd term through the end of April and only the 8th graders could sit had negative effects on student motivation.

The studies done revealed that students could not adequately comprehend the subjects and concepts related to space and astronomy [65] and they generated alternative concepts by being on the horns of dilemma because they

created ideas of mix of scientific knowledge with their ideas about these concepts [66,67,68,69]. Moreover, it was determined that students had different misconceptions about the Earth, night-day, season, planet, star, the Sun, the Moon, space and gravity [70,71,72,73,74,75,76] and these misconceptions continued till the higher education and they were not corrected [65,77]. Within this framework, the results of the research study reveal that there might be further problems for having students gain enough knowledge and skills about space and astronomy subjects and astronomy. Considering the fact that with the foundation of Turkish Space Agency, the generations which will make contributions to space explorations and research get the first and basic information about space and astronomy within the scope of these units and it is estimated that problems will arise regarding qualified man labour force in the next ten years' time. Nearly one-third of the teachers participating in the research study put less emphasis on the subjects involving units containing ecology, living things, the relationship between environment and energy due to time constraints. Teachers stated that the main reason why they spared less time on these units was that students came to the class having prior knowledge because the units were verbal-weighted, the subjects and concepts in the units were simple and understandable and the subjects were related to the real-life situations. There are findings present in the studies carried out that students can obtain information from different learning sources related to these subjects [83]. Moreover, it can be stated that considering the spiral structure of science curriculum, the similar content of some subjects in some grade levels [84] promoted the learning process of these subjects. Moreover, nearly one-fifth of the teachers spent less time on the subjects involving units containing light and sound. Teachers determined that the most important reason why they laid less emphasis on these units was that students came to the class having prior knowledge because the subjects and concepts in the units were simple and understandable, the content of units was short, the number of learning outcomes given was few, and the subjects were related to the real-life situations.

In fact, these results bring to light science subjects which teachers consider important. The teachers participating in the research study specified the following units less which contained physics subjects like electricity (%3.5), mechanics (%6.5) , chemistry subjects (%6.5) like structure of matter and its features, states of matter and heat, and biology subjects like systems in our body (%13) and heredity (%18.5) (Appendix2). These findings make us think that teachers consider the given subjects more important. In fact, when the science curriculum up-dated in 2013 is examined (Appendix 1), what draws attention is that there are many learning outcomes in the units specified by the teachers. It was considered that the teachers overemphasized the specified units because of their number of learning outcomes so they did not put less emphasis on them. There are studies in literature which teachers determine that they have to be overemphasised because the concepts in the units designated especially subjects and concepts in the electricity unit are used a lot in daily life and their level of usability with other disciplines is quite high [51,78]. In addition to this, science teachers teaching the 8th grade science courses determined that they overemphasised the subjects and concepts in these units as there were more questions from them in the centralized exams held nationwide. These findings clearly reveal that an education based on centralized exam has been given especially in the 8th grade.

Considering these results, the following recommendations were made:

1. Considering the fact that with the foundation of Turkish Space Agency, the generations which will make contributions to space explorations and research get the first and basic information about space and astronomy within the scope of these units, the units containing space and astronomy embedded in the last weeks of education year in the science curriculum can be replaced by the units containing biology subjects like ecology, living things, the relationship between environment and energy because their content is simple and understandable, they draw student interest as they are related to the real-life situations and students come to the class having prior knowledge about them.
2. The studies carried out reveal that education given in planetariums and observatories are more effective in learning basic astronomy concepts than traditional teaching methods practised in class settings [79,80]. Thus, trips can be organized to different planetariums in our country (Amasya, Bursa, Samsun, Konya, Gaziantep, Mersin and etc;) to increase student motivation and to have them gain learning outcomes with the units containing space and astronomy. These trips which will be organized for space and astronomy subjects and concepts intended to be taught in May and June in the curriculum may offer opportunities for students to learn with fun. These trips will especially offer the 8th graders who will sit at centralized exam with an opportunity to relax and to learn the last subjects of the unit more effectively.
3. Teachers who do not have an opportunity to organize trips can teach subjects containing space and astronomy with alternative activities performed in the schoolyard.
4. It would be suitable for teachers to have make-up lessons at the weekends to catch up on science curriculum due to the holidays, meetings, and exams held apart from the intended ones in the curriculum.
5. The centralized exams held in place of the 2nd exams in both terms in Turkey can be held in place of the 3rd exams.
6. Science course hours can be increased.
7. The findings of this study carried out with 302 science teachers from 28 cities must be supported with large-scale studies.

Appendix

Appendix 1. Subject areas, units, unit content, the number of outcomes and suggested weekly course hours for the science course curriculum taught in the 5th grade through the 8th grade in secondary schools in Turkey

Subject Area	Grade	Unit	Unit Content	Nos. of outcomes	Suggested course hour
Living things and Life	5	1.Let's solve our body puzzle	Types of food, healthy and balanced diet, harms of smoking and drinking, digestive system and its health teeth and teeth care, excretory system and its health	13	36
	6	1. Systems in our Body	Plant and animal cells, the relationship between cell-tissue-organ-system and organism, support and locomotor system and its health, respiratory system and its health, circulatory system and its health	14	32
	7	1. Systems in our Body	Digestive system, excretory system, regulatory and supportive systems, sense organs and their health	16	28
	5	5. Let's Learn the World of Living Tings	Characteristics and Classification of living things, microscopic organisms, fungi, plants, animals, environmental problems occurring as a result of human activities and their solutions	3	12
	7	5. The Relationship between Human Beings and Environment	Ecosystem, causes and effects of environmental issues, biodiversity, extinct and endangered living things and what to do to save these living species	4	10
	8	6. The Relationship between Living Things and Energy	Food chain, cycles of matter, sustainable development and promoting life awareness, using sources economically, bio-technology applications	11	16
	6	5. Reproduction, Growth, and Development of Plants and Animals	Reproduction, growth, and development of plants and animals, factors affecting growth and development, taking care of a plant or an animal	4	16
	8	1. Cell Division and Heredity	DNA and genetic code, mitosis and meiosis, reproduction, growth, and development processes of human beings , precautions to take for adolescent health	13	24
Physical Events	5	2. Measuring the Magnitude of Force	Forces existing in nature, measuring the magnitude of force, frictional force, place and importance of frictional force in our life	2	12
	6	2. Force and Movement	Features of force, resultant force, balanced and unbalanced force, route for constant speed movement, the relationship between speed and velocity	6	16
	7	2. Force and Energy	Mass and weight , the relationship between force and pressure in solids, factors affecting pressure in solids, the relationship between force- work and energy, types of energy and energy transformation	9	24
	8	2. Force and Movement /Simple Machines	Simples tools and areas of usage	3	16
	5	4. Diffusion of Light and Sound	Diffusion of light and sound in different settings, linear diffusion of light, diffusion of sound in a physical environment throughout waves , interaction of light and sound with matter, formation of umbra and factors affecting the size of a shadow	7	24
	6	4. Light and Sound	Reflection of light on smooth and uneven surfaces , reflection and absorption of light and technologies developed about this subject	5	12
	7	4. Reflection in Mirrors and Absorption of Light	Types of mirrors and areas of usage, absorption of light, objects looking colourful within this context and the ways to use solar energy	6	16
	8	4. Sound	Refraction of light, lenses and their types, where the lenses are used, factors affecting the speed of sound	6	14
	5	6. Electricity: Indispensable in our Life	Electric circuits, symbols of circuit components , drawing a circuit diagram, importance of circuit diagrams with regard to common language	3	16
	6	7. Transmission of Electricity	Factors which electrical resistance depend on, transmission of electrical energy, characteristics of conductors, where conductors and insulators are used in daily life	5	16
	7	6. Electrical Energy	Connection in parallel and series, use of ammeter and voltmeter, Ohm's Law, technological applications of electrical energy and conversion of electrical energy into heat energy, light energy, and motion energy	12	20
	8	7. Electricity in our Life	Electric charges, attraction and repulsion forces between electric charges , earthing or grounding system, electroscope and its features	6	16

Appendix 1. ***Continued***

Subject Area	Grade	Unit	Unit Content	Nos. of outcomes	Suggested course hour
Matter and Change	5	3. Change of Matter	Melting, freezing, boiling, condensation, vaporization, sublimation, and desublimation, separating pure matter by using melting, freezing, and boiling points, heat and temperature concepts and expansion and contraction	6	20
	6	3. Granular Structure of Matter	Properties of matter, changes to matter, physical and chemical changes, the relationship between mass, volume and density	7	20
	7	3. Structure of Matter and its Features	Structure of atom, proton, neutron and electron, electron exchange , formation of ion, pure and impure matter, classification of elements, compounds and mixtures, separation techniques used for eluting mixtures, symbols of elements, formulae of components, dissolution event, controlling domestic solid and liquid wastes and recycling	22	30
	8	3. Structure of Matter and its Features	Metal, non-metal and inert and periodic table displays, the relationship between chemical bonds and chemical reaction, concepts of acids –bases , acid-base reaction, combustion reactions and causes and effects of acid rain	16	24
	6	6. Matter and Heat	Conduction and insulation of heat, heat insulation technologies, types of fuel, effects of fuels used for heating on environment	7	16
	8	5. States of Matter and Heat	The relationship between heat and mass and temperature and specific heat, changes in states of matter based on heat received or given off	7	16
The Earth and Universe	5	7. The Mystery of Earth's Crust	Elements making up the composition of the Earth's crust, the effect of erosion and landslide on the Earth's crust, surface water, underground water, and air, land, and water pollution	10	24
	6	8.Our World, The Moon, and the Sun, The Source of Life	Relative size and shapes of the Earth, the Moon, and the Sun, earth's layers, Moon's Revolution and Rotation, the relationship between the Earth and Moon considering motion	4	16
	7	7. Solar System and Beyond	Celestial bodies. Concept of system, importance of telescope is astronomy, space research	9	16
	8	8. Natural Processes	Earthquake, fault lines, measures taken against earthquake and things to do during an earthquake, causes of weather events occurring in atmosphere, how weather forecasting is done, climate and global climate changes, the science of earthquakes, meteorology and climate science (climatology)	16	18
			Total	252	576

Appendix 2. Frequency and Percentages Distribution of Science Teachers' Views about Subject Areas and Units

Subject Area (Learning domain)	Grade	Units	f	%	Subject Area Total (%)	Final Total
Living things and Life	5	1. Let's Solve The Mystery of Our Body	48	16	13	23
	6	1. Systems in our Body	33	11		
	7	1. Systems in our Body	36	12		
	5	5. Let's Visit and Learn The World of Living Things	99	33	37	
	7	5. The Relationship between Human Beings and Environment	153	51		
	8	6. The Relationship between Living Things and Energy	81	27		
	6	5. Reproduction, Growth, and Development of Plants and Animals	96	32	18.5	
	8	1. Cell Division and Heredity	15	5		
Physical Events	5	2. Measuring Magnitude of Force	30	10	6.5	10
	6	2. Force and Movement	18	6		
	7	2. Force and Energy	24	8		
	8	2. Force and Movement /Simple Machines	6	2		
	5	4. Diffusion of Light and Sound	54	18	20.25	
	6	4. Light and Sound	66	22		
	7	4. Reflection in Mirrors and Absorption of Light	30	10		
	8	4. Sound	93	31		
	5	6. Electricity: Indispensable in our Life	3	1	3.5	
	6	7. Transmission of Electricity	12	4		
	7	6. Electrical Energy	9	3		
	8	7. Electricity in our Life	18	6		
Matter and Change	5	3. Change of Matter	36	12	7.25	6.5
	6	3. Granular Structure of Matter	27	9		
	7	3. Structure of Matter and its Features	18	6		
	8	3. Structure of Matter and its Features	6	2		
	6	6. Matter and Heat	30	10	6.5	
	8	5. States of Matter and Heat	9	3		
The Earth and Universe	5	7. The Mystery of Earth's Crust	165	55	60.5	60.5
	6	8.Our World, The Moon, and the Sun, The Source of Life	171	57		
	7	7. Solar System and Beyond	180	60		
	8	8. Natural Processes	210	70		

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