Comparison of Turkey and Kosovo Secondary School Science Curriculum in the Context of Chemistry Learning Area

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Abstract

In this study, Turkey and Kosovo secondary school science curricula were compared in the context of chemistry learning area and it was aimed to analyze the similarities and differences in terms of sub-learning areas, distribution of units according to grade levels, course hours, number of achievements, content and teaching techniques. In this study, in which document analysis, one of the qualitative research methods, was used, written and printed science programs of both countries were considered. As a result of the study, it is seen that the lower secondary education (secondary school) chemistry curriculum in Kosovo is numerically higher than the Turkish secondary school chemistry curriculum in terms of the distribution of units and units, course hours and achievements. In Turkey, at the secondary school level, chemistry is included in the natural science group, and the subjects include spiral learning, a low number of achievements, process-oriented constructivist and competency skills are tried to be gained. In terms of teaching techniques, partially similar techniques and methods are applied in both countries. Rapid advances in science and technology, occurring innovations and developments in the world are directly proportional to the higher quality of science education programs. In addition to this, it is thought that the participation of the Ministry of National Education's educational investments and projects in Kosovo within the scope of agreements between the two countries, which have historical and kinship ties with Turkey, and comparing the curriculum of Kosovo with the curriculum of developing countries such as Turkey, will contribute to the curriculum of Kosovo by comparing the curriculum of Kosovo with the curriculum of developing countries such as Turkey.

Keywords: Curriculum Development, Comparative Education, Science Curriculum, Chemistry Subjects

Introduction

Rapid advances and developments in science and technology have led to radical changes in people's social lives. These developments in science have increased people's interest in science education in order to meet their needs in social life (Dindar & Taneri, 2011).

Countries that want to follow the developments and innovations in the field of science and raise their living standards to the highest level have to give importance to R&D and innovation studies in the field of science and technology (Güven and Gürdal, 2011). It is becoming a necessity for countries to update their science education programs to these changing new conditions. (Yılmazlar and Çınar, 2016; Yücel, 2010). Progress and developments in the field of science and technology have made it necessary to reconsider the subjects and units in the science education curriculum of the countries. For this reason,

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educational objectives have been reviewed and studies have begun on the formation of knowledge (Demirbaş and Yağbasan, 2005), teaching and learning styles. Countries that want to increase the qualification and quality of science education and training programs and the success of their students in science need data and information showing their students' performance among the countries of the world (Eş & Sarıkaya, 2010). Studies conducted by comparing the science education and training programs of the countries (Güven and Gürdal, 2011) and revealing the similarities and differences will contribute positively in terms of organizing the information flow and education programs between the countries. Research and comparisons of education programs between countries contribute to revealing similarities and differences in education systems (Republic of Turkey Ministry of National Education [MEB], 2011). These similarities and differences make an extremely important contribution to the education programs in terms of showing that there can be alternative solutions in the education systems of the countries. Comparative education is expected to guide education administrators and politicians by examining the education systems of the world countries in depth. Comparative education offers deep perspectives to experts and educators with its contributions to the advancement, development and enrichment of educational sciences, as well as theoretical and practical studies (Galo, 2008).

With the globalizing world, the fierce competition and leadership among countries in the fields of technological developments, economic achievements, energy searches and defense industry are increasing their importance day by day (Akgündüz, Aydeniz, Çakmakçı, Çavaş, Çorlu, Öner & Özdemir, 2015). Countries have revised or reformed their education policies in order to keep up with this competition, to exist in the technological development race and to train their human resources according to the new world order (Bozkurt, 2014). Countries that need this revision and reform in their education programs, internationally conducted PISA [The Program for International Student Assessment], TIMMS [Trends in International Mathematics and Science Study], PIRLS [Progress in International Reading Literacy Study] and TALIS [Teaching and Learning International Survey] etc. they direct the teaching programs by comparing the exam outputs of other countries with the exam outputs of other countries (Topaloğlu & Kıyıcı, 2015; MEB, 2016b).

International exams such as PISA and TIMSS enable the success of the science education programs of the participating countries to be compared with other countries. The most important output of these exams is that they enable countries to establish education standards and policies by determining the weak and strong aspects of their education systems in the light of the data obtained as a result of the exams (Topaloğlu and Kıyıcı, 2015; MEB, 2016a).

When the comparative education studies conducted in our country are analyzed in the literature, when the results of exams such as PISA and TIMSS are evaluated in general, it is seen that there are studies on the curriculum of the countries that have achieved certain education standards (Yılmazlar & Çavuş, 2016).

In the 2018 PISA national exam, in which 79 countries, 37 of which are OECD countries, participated in the PISA 2018 exam, our country, an OECD member, ranked 39th in science literacy with an average of 468 points. (MEB, 2019).

Kosovo, which is not a member of the OECD, ranked 75th with an average of 365 points in science literacy in the PISA exams held in 2018 (OECD, 2018).

In the 2019 TIMSS science evaluation, in which 58 countries participated at the fourth grade level, Turkey was ranked 19th with an average score of 526 and ranked 15th among 39 countries at the eighth grade level (MEB, 2020).

The methods of obtaining qualified and accurate data about our education programs are to see our country's educational success by participating in international assessment and evaluation exams such as PISA, TIMSS, PIRLS, and TALIS (MEB, 2016b).

The continuation of the studies conducted in the international arena to compare the science curriculum of our country with the science curriculum of different countries will guide those who shape education policies, researchers, and educators in terms of developing and updating our country's education and training programs.

Due to its historical, social and cultural ties, Kosovo is one of the countries with which it has signed the most bilateral agreements with Turkey on the international platform (Economic Relations Board [DEİK], 2016). Especially since the beginning of the 2000s, Turkey has been developing educational investments and projects with Kosovo, as in many Balkan countries.

Undergraduate, graduate and doctoral scholarship programs specific to Balkan countries, as well as student exchange programs, hundreds of Balkan and Kosovar students have gained higher education opportunities in Turkey (Ekinci, 2017). In this context, it is thought that the cooperation between Turkey and Kosovo in many fields, as well as similar content studies in the education programs, will contribute to meeting the educational needs of the students who will study in the sister country and to the joint education, cultural and economic studies that Kosovo will establish with Turkey (Yılmazlar & Çavuş, 2016; Ekinci, 2017).

In this study, it has been discussed that it declared its independence in 2008 and became the youngest and last independent country in Europe, has a multi-communal, multi-cultural and multilingual diversity, and has historical, cultural and economic ties with our country (Zengin and Topsakal, 2008). The chemistry program of the sister country Kosovo, which is included in the Turkish secondary school science curriculum, and the chemistry programs at the lower secondary education (secondary school) level of the Republic of Kosovo were examined comparatively and their similarities and differences were tried to be revealed.

Method

Research Model

In this study, the document analysis method, one of the qualitative research methods, was used. Document analysis is one of the methods used to analyze the targeted phenomenon or materials covering the facts. Document analysis is a qualitative research method that uses written and visual materials and materials in studies where direct observation and interviews are not possible or to increase the validity of the research (Yıldırım & Şimşek, 2013).

Data Collection Tools

In this study, the science curriculum of the Turkish Ministry of National Education which was put into practice in 2018, and the low-level secondary education (secondary school) chemistry program (MASHT

, 2018a; 2018b; 2019) of the Ministry of Education, Science and Technology (MASHT) of Kosovo were used as data collection tools.

Data Collection and Analysis

As data, the chemistry curriculum, which is included in the science curriculum applied in the secondary school in our country, and the chemistry curriculum applied at the secondary school level in Kosovo were analyzed by document analysis method. It has been tried to reveal the similarities and differences in the chemistry curriculum applied in both countries according to the grade levels, unit, course hours, achievements and contents. Findings related to the chemistry program in the Turkish secondary school science curriculum were used in the "Matter and Nature" and "Earth and Universe" learning area, chemistry-related findings, and the findings related to the Kosovo secondary school chemistry teaching were used from the chemistry curriculum of the Ministry of Education, Science and Technology.

Results

Turkey and Kosovo Secondary School Science Curriculum Structure

Lower secondary education, which is the second level of basic education, covers children aged 12-15 in Kosovo, lasts 4 academic years and is compulsory (Zengin & Topsakal, 2008). In our country, the second level of basic education is called secondary school. In this study, lower secondary education will be called secondary school. In our country, physics, chemistry and biology courses at secondary school level are given with an interdisciplinary approach within the science group, while in Kosovo they are given as separate courses. Physics, chemistry and biology courses in Kosovo are carried out for two hours a week, 74 hours a year. Physics and biology courses are given to 6th, 7th, 8th and 9th grade students, while chemistry courses are given to 7th, 8th and 9th grade students. At the Kosovo secondary school level, the chemistry curriculum consists of three learning areas: "Matter, its properties and transformations", "Earth, environment and universe" and "The World of Living Beings". The content of the curriculum was created according to the linear (vertical) programming approach. With the chemistry course curriculum, it is aimed that students describe chemical phenomena, base observation and experimental studies on scientific process skills, and gain critical thinking skills (MASHT, 2018a; 2018b;2018c; 2019).

In our country, compulsory education was increased from 8 to 12 years by structuring primary, secondary and high school as 4+4+4 in 2012-2013. The science and technology curriculum was updated and the curriculum and the name of the course were named "Science" (Timur, S., Karatay, & Timur, 2013). In the science program, with the update made in 2018, the integrated structure of science has been preserved in an interdisciplinary structure in a way that physics, chemistry and biology teaching programs are together. The aim and vision of the secondary school science curriculum in our country; It has been defined as " raising *all individuals as scientifically literate "*. The main objective is to raise individuals who research and question, have the power of analytical thinking, develop knowledge and skills in science, are sensitive to their environment, and have scientific process skills (MEB, 2018a). For this purpose, the science program, which needs to be updated in 2018, and the basic information of the physics, chemistry and biology teaching programs in our country's science are given under four learning areas: "Earth and Universe, Living Things and Life, Physical Events, Matter and Nature" (MEB,

2018a). Unlike previous programs, the 2018 science program included engineering and entrepreneurship project applications in the field of science. For this purpose, by associating the units with daily life, students are expected to identify a need and problem related to daily life and make solutions or suggestions. The principle of spirality was preserved in the curriculum, and the content was spread over a long period of time by reducing the number of acquisitions, and the program was structured with a student-centered approach. In the 2018 science program, the science course in the 5th, 6th, 7th and 8th grades was determined as four hours (MEB, 2018b). Findings on chemistry subjects applied in the secondary school science curriculum in our country are generally given in the "Matter and Nature" learning area, while some content is given in other learning areas with an interdisciplinary approach (MEB, 2018a).

When we examine the science curricula in Turkey and Kosovo in general, both programs aim to raise individuals who have scientific process skills and critical thinking, while Turkey has clearly expressed its vision, especially by emphasizing the development of students as science literate individuals.

Turkey Secondary School Physics, Chemistry, and Biology Course Hours Information

In Table 1, Turkey secondary school physics, chemistry, and biology course hours information is listed.

Table 1

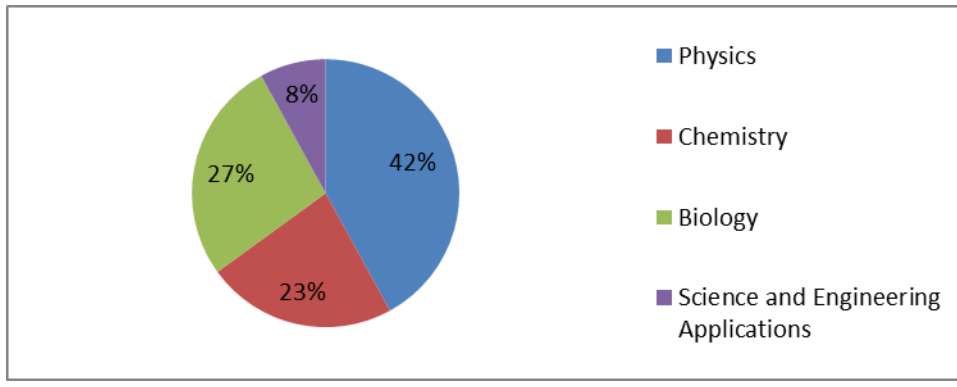
Turkey Secondary School Physics, Chemistry, and Biology Course Hours Information

Grade Levels	Physics Lesson Hours	Chemistry Lesson Hours	Biology Lesson Hours	Science-Engineering and Entrepreneurship Applications	Science Total Lesson Hours
5th grade	64	36	32	12	144
6th grade	62	28	42	12	144
7th grade	70	28	34	12	144
8th grade	44	42	46	12	144
Total	240	134	154	48	576

Physics, chemistry and biology curricula at secondary school level in our country are given with an interdisciplinary approach within the science course. When we examine Table 1, it has been determined that the Turkish secondary school science curriculum has a total of 576 hours, 144 of which are lesson hours in each grade level. It is seen that 240 hours of 576 lesson hours are on physics program subjects, 134 lesson hours are on chemistry program subjects, 154 hours are on biology program subjects and 48 hours are on science and engineering applications. In Figure 1, the percentages of Physics, Chemistry and Biology course hours included in the Turkish Secondary School Science Curriculum are given.

Figure 1

Turkey Secondary School Physics, Chemistry and Biology Course Hours Percent Graph



In Figure 1, when the rate of lesson hours for physics, chemistry and biology disciplines in secondary schools in Turkey is examined, it is seen that the highest rate is physics with 42%, biology with 27%, chemistry with 23% and science and engineering applications with 8%.

Kosovo Secondary School Physics, Chemistry and Biology Lesson Hour Information

In Table 2, Kosovo secondary school physics, chemistry and biology course hours are listed.

Table 2

Kosovo Secondary School Physics, Chemistry and Biology Course Hours Information

Grade Levels	Physics Lesson Hours	Chemistry Lesson Hours	Biology Lesson Hours	Science Total Lesson Hours
6th grade	74	----	74	148
7th grade	74	74	74	222
8th grade	74	74	74	222
9th grade	70	70	70	210
Total	292	218	292	802

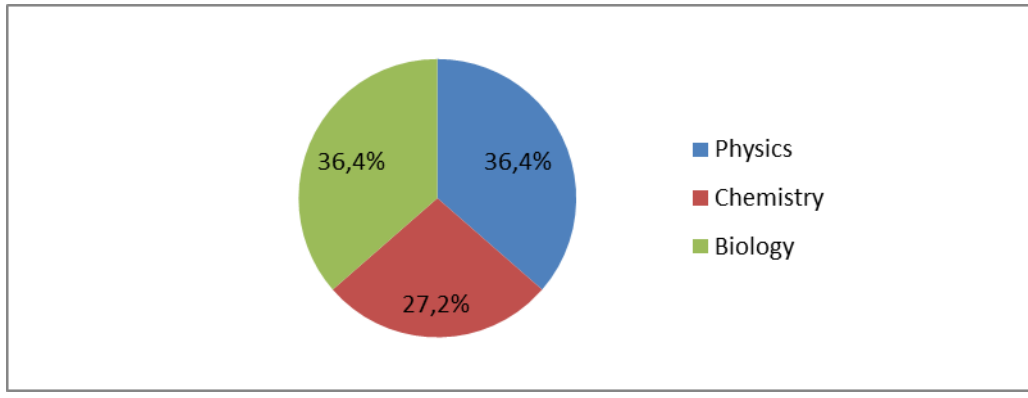
Source: MASHT, 2018a; 2018b;2018c; 2019

Physics, chemistry and biology curricula included in the secondary school level science course in Kosovo are not given as an integrated course but as a separate course. When we examine Table 2, it has been determined that the Kosovo secondary schools science curriculum has 802 course hours in all, of which 148 in the 6th grade, 222 in the 7th and 8th grade levels, and 210 in the 9th grade. It is seen that 292 hours of 802 course hours are on physics program subjects, 218 course hours are on chemistry

program subjects, and 292 hours are on biology program subjects. In Figure 2, the percentages of Kosovo Secondary School Physics, Chemistry and Biology course hours are given.

Figure 2

Kosovo Secondary School Physics, Chemistry and Biology Course Hours Percent Graph



When the rate of Physics, Chemistry and Biology lesson hours in Kosovo secondary school shown in Figure 2 is examined, it is seen that physics and biology programs are included in the secondary school sciences at the same rate with 36.4% and chemistry program at the same rate with 26.2%.

Number of Outcomes of the Chemistry Program in the Science Curriculum at the Secondary School Level in Turkey

The number of achievements of the chemistry program in the science curriculum at the secondary school level in Turkey is given in Table 3.

Table 3

Number of Achievements in Science and Chemistry Program at the Secondary School Level in Turkey

Class	Number of Science Achievements	Chemistry Course Outcome Number	Chemistry lesson Earning Percentage (%)
5	36	10	28
6	59	13	22
7	67	16	24
8	61	20	33
Total	223	59	26

Source: MEB, 2018a

According to Table 3, there are a total of 223 achievements of secondary school physics, chemistry and biology disciplines in Turkey. With 59 of these 223 acquisitions, they constitute the acquisitions of the chemistry program with a rate of 26% in the whole science curriculum. In addition, it has been determined that 10 of the 36 acquisitions of the science curriculum in the 5th grades in the secondary

schools, 13 of the 59 acquisitions in the 6th grades, 16 of the 67 acquisitions in the 7th grades and 20 of the 61 acquisitions in the 8th grades are chemistry-related acquisitions.

Number of Achievements in Chemistry Program at Kosovo Secondary School Program Level

The chemistry program attainment numbers at the Kosovo secondary school program level are given in Table 4.

Table 4

Number of Achievements in Science and Chemistry Program at Kosovo Secondary School Program Level

Class	Number of Science Achievements	Chemistry Course Outcome Number	Chemistry lesson Earning Percentage (%)
7	164	52	32
8	220	70	32
9	182	52	28
Total	566	174	31

Source: MASHT, 2018b; 2018c; 2019

In Table 4, it has been determined that a total of 566 acquisitions of science disciplines are included at the Kosovo secondary school level. It is seen that 174 of these 566 achievements belonging to science disciplines are the achievements of the chemistry program with a percentage of 31%. It has been determined that 52 of 164 learning outcomes in 7th grades, 70 out of 220 outcomes in 8th grades, and 52 of 182 outcomes in 9th grades of Kosovo secondary schools chemistry curriculum are chemistry-related outcomes.

Turkish Secondary School Level Chemistry Curriculum Learning Areas and Units

The learning areas and units with chemistry content included in the science curriculum at the secondary school level in Turkey are given in Table 5.

Table 5

Chemistry Learning Areas and Units at the Secondary School Level in Turkey

	Class	Learning Area	Unit Sequence No.	Units
Secondary School	5	Earth and Universe	1	Sun, Earth and Moon
		Matter and Nature	4	Matter and Change
	6	Matter and Nature	4	Matter and Heat
	7	Matter and Nature	4	Pure Substances and Mixtures
	8	Earth and Universe	1	Seasons and Climate
		Matter and Nature	4	Substance and Industry

Source: MEB, 2018a

When the findings in Table 5 are examined, chemistry subjects in the science curriculum in our country are included in the "Matter and Nature" learning area at every grade level. In the 5th and 8th grade levels, the "Earth and Universe" learning area related to chemistry subjects was included. In the 5th grade, there is the "Sun, Earth and Moon" unit depending on the "Earth and Universe" learning area, and the "Matter and Change" unit under the "Matter and Nature" learning area. In the 6th grades, the "Matter and Heat" unit was included under the "Matter and Its Nature" learning area, and the "Pure Substance and Mixtures" units in the 7th grades. In the 8th grades, there is a "Seasons and Climate" unit in the "Earth and Universe" learning area, and a "Matter and Industry" unit in the "Matter and its Nature" learning area.

Learning Area and Units Containing Chemistry at Kosovo Secondary School Program Level

At the level of Kosovo secondary school curriculum, the learning area and units with chemistry content are given in Table 6.

Table 6

Learning Area and Units Containing Chemistry at Kosovo Secondary School Program Level

	Class	Learning Area (Category)	Units (Sub Category)
Secondary School	7	Properties of Matter and Conversions	Nature of Matter
			Chemical Reaction
			Water and Aqueous Solutions
		Earth, Environment and Universe	Earth and atmosphere
		World of Creatures	Human health
	8	Properties of Matter and Conversions	Classification of Inorganic Compounds
			Types of Chemical Reactions
			Chemical Kinetics and Equilibrium
			Chemical Calculations
			Classification and Properties of Elements
			Environmental Pollution and Protection
		Earth, Environment and Universe	Materials and Components of Rocks
	9	Properties of Matter and Conversions	Fundamentals of Organic Chemistry
			Fossil Fuels and Polymers
			Oxygenated Organic Compounds
			Vital Compounds

Source: MASHT, 2018b; 2018c; 2019

When the findings in Table 6 are examined, the chemistry content program at the Kosovo secondary school level, the "Properties of Matter and Transformations" learning area at the 7th grade level is three (3) units, the "Earth, Environment and Universe" learning area is one (1) unit and the "Living World" learning area is one (1) unit. There are five (5) units in total, of which the learning area is one (1) unit. There are six (6) units in total, with the "Properties of Matter and Transformations" learning area five (5) units and the "Earth, Environment and Universe" learning area one (1) unit at the 8th grade level. At the 9th grade level, the "Properties of Matter and Transformations" learning area is included with four (4) units.

Comparison of Similar and Different Subjects in Turkey and Kosovo Secondary School Chemistry Curriculum

Findings related to the Turkish Secondary School chemistry curriculum are given in Table 7.

Table 7

Turkey Secondary School Science Chemistry Curriculum

Grade Levels	Learning Area	Unit	Program Content
5th grade	Earth and Universe	Sun, Earth and Moon	Structure and Properties of the Sun The Moon's Structure and Features
	Matter and Nature	Matter and Change	Change of State of Matter Distinctive Features of Matter Heat and temperature Heat Affects Substances
6th grade	Matter and Nature	Matter and Heat	Particulate Structure of Matter Intensity Matter and Heat Fuels
7th grade	Matter and Nature	Pure Substances and Mixtures	Particulate Structure of Matter Pure Substances Mixtures Separation of Mixtures Domestic Waste and Recycling
8th grade	Earth and Universe	Seasons and Climate	Formation of the Seasons Climate and Weather Movements
	Matter and Nature	Substance and Industry	Periodic System Physical and Chemical Changes Chemical Reactions Acids and Bases Interaction of Matter with Heat Chemical Industry in Turkey

Source: MEB, 2018a

In the 5th grade chemistry program, which is the first level of secondary school in Turkey , the chemical formations of the Sun and the Moon are mentioned, albeit partially, in the unit "Sun, Earth and Moon" in the "Earth and Universe learning area". With the "Matter and Change" unit of the "Matter and Its Nature" learning area, the state change properties of matter, its distinguishing features, the concept of heat and temperature and how heat affects substances are mentioned.

In the 6th grade, which is the second level of secondary school in Turkey, in the "Matter and Nature" learning field in the "Matter and Heat" learning area in the chemistry program, "Particulate Structure of Matter", "Density", "Matter and Heat" and "Fuels" place is given. It is aimed that the students at the 6th grade level of secondary school gain the movement of the particles of matter and the void structure with the subject of "Particulate Structure of Matter", the definition of physical density with the concept of "Density", the definition of physical density, the comparison of the densities of solid and liquid states of water, and the comparison of the densities of liquids that do not dissolve in each other. With the subject of "Matter and Heat", studies on the conductivity of heat, insulating, insulation, insulation materials, and with the subject of "Fuels" on the gains of the concepts of solid, liquid and gaseous fuels are included.

In the 7th grade chemistry program, which is the third level of secondary school in Turkey, the principle of spirality was continued and the particulate structure of matter, pure substances, mixtures, separation of mixtures, domestic wastes and recycling were included under the "Matter and Nature" learning area. It is aimed to acquire the structure of the atom and its basic particles, ions, molecular models, classification of pure substances as elements and compounds, knowing the names and symbols of commonly known elements in the periodic system, classification as mixtures, homogeneous and heterogeneous, recyclable materials in household wastes.

In the 8th grade chemistry program, which is the last level of secondary school in Turkey, the principle of spirality was continued and the "Matter and Nature " learning area and the " Earth and the Universe" learning areas. "Earth and Universe" With the learning area under the title of "Seasons and Climate" unit, it is aimed that the students acquire skills about the changes in the formation of seasons and climates and global climate changes. Under the "Matter and Nature" learning area, the periodic system, classification of elements, chemical bonds, acids and bases, chemical reactions and the chemical industry in Turkey were included under the "Matter and Industry" unit. These topics include the formation of groups and periods in the periodic system, "electron-layer relationship", classifying elements as a metal, nonmetal and a noble gas, explaining the concept of chemical bonds, knowing the general properties of acids and bases, explaining the causes of acid rain, knowing the types of chemical reactions, Gains such as learning the development of the chemical industry in Turkey from past to present are given. With the title of "Interaction of Matter with Heat" , it is aimed to teach the achievements of basic conceptual expressions such as core heat, heat-mass, temperature-mass and heat-substance relationship, melting/freezing heat and heating-cooling curves. The learning outcomes of the companies and business lines that produce in the field of chemistry to the country's economy in daily life are included.

In the first year of Kosovo secondary school, the chemistry program is not implemented, and the chemistry curriculum begins to be implemented in the 7th grade, which is the second level of secondary school. The findings related to the 7th grade chemistry curriculum of Kosovo Secondary School are given in Table 8.

Table 8

Kosovo Secondary School 7th Grade Chemistry Curriculum

Learning Area	Sub Learning Area	Program Content
Properties of Matter and Transformations	Nature of Matter	• Chemistry and Its Historical Development • Substances and Mixtures • Atomic structure, Properties and Periodic Table • Chemical Types and Interactions
	Chemical reaction	• Chemical Reactions
	Water and aqueous solutions	• Water and Its Properties • Solution and Types
Earth, Environment and Universe	Earth and atmosphere	• The Structure of the Soil and the Components of the Atmosphere
World of Creatures	Human health	• Substances Harmful to Organisms and Their Effects on Human Behavior and Health • Vitamins and Their Importance

Source: MASHT, 2018b

When Table 8 is examined, the learning areas of "Matter Properties and Transformations", "Earth, Environment and Universe" and "Living World" and sub-learning areas in the 7th grade chemistry program, which is the second level of secondary school, and sub-learning areas "Nature of Matter", "Chemical reaction", " Water and aqueous solutions", "Earth and atmosphere" and "Human health" fields are included. With these fields, it is aimed to teach basic concepts such as students' chemistry and historical development, substances and mixtures, pure substances, mixture types, separation of mixtures, atomic structure and periodic table, ions, ionic and covalent bonds, chemical reactions, solution and solution types, soil structure and atmosphere gases, human health harmful chemical organisms and vitamins. Findings related to Kosovo Secondary School 8th grade chemistry curriculum are listed in Table 9.

Table 9

Kosovo Secondary School 8th Grade Chemistry Curriculum

Learning Area	Sub Learning Area	Program Content
Properties of Matter and Transformations	Inorganic Compounds	• Inorganic Compounds • Acid, Base, Salt and Indicators
	Types, Kinetics and Equilibrium of Chemical Reactions	• Rate of Chemical Reactions • catalysts • In Chemical Reactions Reduction and Oxidation • Electrolysis
	Chemical Calculations	• Amount of Substance and Mole Calculations
	Classification and Properties of Elements	• Periodic Table and Its Properties • Metals • nonmetals
	Environmental Pollution and Protection	• Recycling of Waste Materials • Air pollution • Acid rains • Pollution and Cleaning of Waters • Soil Pollution and Conservation
Earth, Environment and Universe	Materials and Components of Rocks	• Elements in the Earth's crust • Elements in Rocks and Their Obtaining • Contribution of Elements in Rocks to the Economy of the Country

Source: MASHT, 2018c

When Table 9 is examined, "Matter Properties and Transformations" and "Earth, Environment and Universe" learning areas and sub-learning areas "Classification of Inorganic Compounds", "Types, Kinetics and Equilibrium of Chemical Reactions" in the 8th grade chemistry program, "Chemical

Calculations", "Classification and Properties of Elements", "Environmental Pollution and Protection" and "Materials and Components of Rocks" which is the third level of Kosovo secondary school are included.

With the "Earth, Environment and Universe" learning area and sub-learning area, students' getting to know the elements that make up the earth's crust and the elements in the rocks and their contribution to the economy are included. The findings related to the 9th grade chemistry curriculum of Kosovo Secondary School are given in Table 10.

Table 10

Kosovo Secondary School 9th Grade Chemistry Curriculum

Learning Area	Sub Learning Area	Program Content
Properties of Matter and Conversions	Fundamentals of Organic Chemistry	Introduction to Organic Chemistry
		Nomenclature and Properties of Alkanes
		Alkenes Nomenclature and Properties
		Nomenclature and Properties of Alkynes
		Aromatic Hydrocarbons
		Benzene and Its Properties
	Fossil Fuels and Polymers	Structure of Fossils Fuels
		Polymers and Properties
	Oxygenated Organic Compounds	Alcohols Nomenclature and Properties
		Nomenclature and Properties of Aldehydes and Ketones
		Carboxylic Acids
		Esters
	Vital Compounds	Fats (Lipids)
		carbohydrates
		Proteins
		vitamins

Source: MASHT, 2019

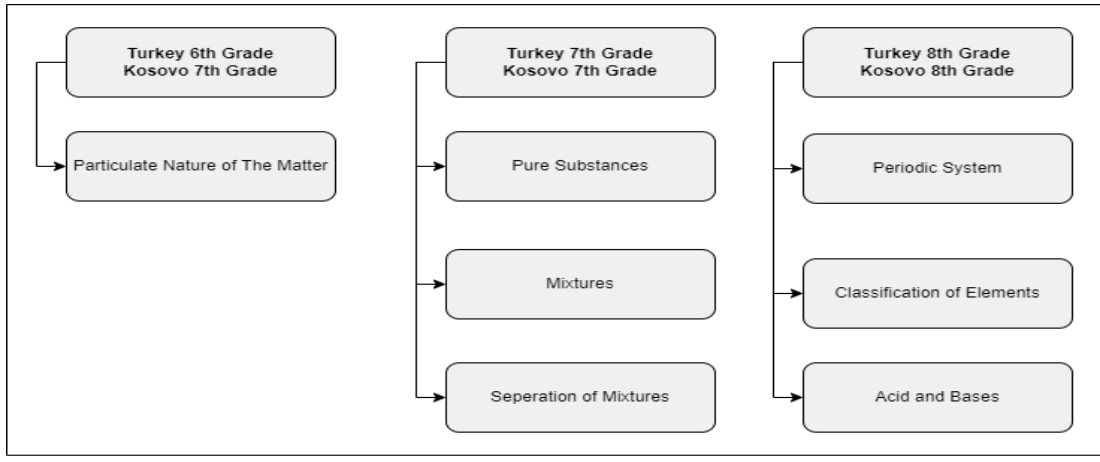
When Table 10 is examined, the "Properties of Matter and Transformations" learning area and sub-learning areas "Basics of Organic Chemistry", "Fossil Fuels and Polymers", "Oxygenated Organic Compounds" and "Vital Compounds" are included in the chemistry program of the 9th grade, which is the last level of secondary school. With the "Properties of Matter and Transformations" learning area and sub-fields, students' introduction to organic chemistry and naming alkanes, alkenes, alkynes, benzene rings consisting of carbon and their derivatives and recognizing their properties, learning the basic concepts of fossil fuel and polymers chemistry, organic compounds carrying oxygen in their structure and their derivatives alcohol , aldehydes, ketones, carboxylic acids and esters are aimed to be named and to comprehend their basic properties.

Recognizing the structure of carbohydrates, fats, proteins and vitamins, which are vital for living things, and teaching their properties are included.

In Figure 3, common chemistry subjects in secondary school sciences in Turkey and Kosovo are given.

Figure 3

Common Chemistry Topics in Turkey and Kosovo Secondary School Sciences



When Figure 3 is examined, it is seen that the common subjects of science and chemistry subjects in secondary schools in Turkey and Kosovo are dominant in 7th and 8th grades. It is seen that the subjects of Particulate nature of the matter in 6th grades of Turkey secondary school and 7th grades in Kosovo secondary school, separation of pure substances, mixtures and mixtures in 7th grades of secondary schools in Turkey and Kosovo, periodic system in 8th grades of Turkey and Kosovo secondary schools, classification of elements, acid and bases are common in the curricula of both countries.

Comparison of Science Chemistry Teaching Methods in Turkey and Kosovo Secondary School Level

Comparison of science and chemistry teaching methods at secondary school level in Turkey and Kosovo is given in Table 11.

Table 11

Comparison of Science Chemistry Teaching Methods in Turkey and Kosovo Secondary School Level

Turkey	Kosovo
• student-centered	• direct narration
• constructivist	• Problem solving
• Problem solving,	• Question answer
• Project-based teaching,	• Brainstorming
• generating arguments,	• critical thinking
• Collaborative learning etc.	• Project-based teaching;
• Out-of-school learning spaces	• demonstration and experiment
• Researching and questioning of informal learning environments	• Use of technology in education (Computer etc.)
• Discover and experiment	• Informal teaching

Source: MEB, 2018a; MASHT, 2018b; 2018c; 2019

When the science and chemistry teaching methods at secondary school level in Turkey and Kosovo are examined in Table 11, student-centered education is clearly expressed in the chemistry teaching methods of secondary schools in Turkey. Teaching methods that construct, investigate, question and problem-solve knowledge have been adopted. In addition, it has been stated that out-of-school experience and discovery, cooperative learning methods are the main methods used by making use of informal learning environments.

When the chemistry teaching methods in Kosovo secondary schools are examined, it is seen that traditional teaching methods such as direct narration and question and answer are included, but on the other hand, it shows similarities with Turkish science chemistry teaching methods with applications that center the student such as examination, discovery, project-oriented, critical thinking, and informal teaching environments.

Discussion

In this study, the structure and purpose of the chemistry program in Turkey and Kosovo secondary school science curriculum, the similarities and differences in terms of learning areas, units, number of achievements, number of course hours and teaching methods have been tried to be revealed. First of all, the structure and purpose of science education in Turkey and Kosovo were examined.

Physics, chemistry and biology courses at secondary school level in our country are included in the science course. While science education in Kosovo is given with interdisciplinary teaching, physics, chemistry and biology are given as separate courses. "Science Curriculum" in Turkey secondary schools science curriculum includes the fields of physics, chemistry and biology by considering the integrated

approach (Filiz & Kaya, 2013). An integrated science curriculum is implemented in many European countries. A holistic approach in science teaching prepares an environment for establishing connections between interdisciplinary teaching and new knowledge, thoughts, events and facts (MEB, 2011).

The chemistry curriculum is given in the 5th grade, which is the first level of secondary school in our country, in the science course, and in the same way, the subjects are continued in a spiral manner in the 6th, 7th and 8th grades. With the principle of spirality, it is based on the principle of reinforcing the subjects by referring to the things learned retrospectively and going into details without changing the general framework of the subjects as the classes progress (Filiz & Kaya, 2013). In Kosovo, the chemistry curriculum is not given in the 6th grade, which is the first level of secondary school, but in the 7th, 8th and 9th grades. The subjects in the Kosovo secondary schools chemistry program were arranged from easy to difficult and the program was created according to a linear (vertical) approach (Filiz and Kaya, 2013).

The aim of the secondary school science curriculum in our country is to "*raise all individuals as science literate*". For this purpose, it aims to raise individuals who produce and construct knowledge, use scientific and life process skills actively, respect values, are aware of their responsibilities, and are sensitive to society and environmental problems. When we examine the science curriculum in Kosovo in general, it aims to raise individuals who have scientific process skills, have the power of critical thinking, and are focused on problem solving. When comparative education studies in the literature are examined, it is seen that "training individuals as science and technology literate" is given importance or targeted as the main goal in science programs of developed or developing countries (MEB, 2005).

When the vision of the chemistry teaching curriculum of economically and socially developed countries such as U.S.A., England, Canada and Australia is examined, it is emphasized that individual differences and the need for all students to be educated with scientific literacy skills, regardless of culture (Aydın, 2006).

In Turkey, the secondary school science curriculum includes 134 lesson hours in all, including 36 lesson hours in 5th grades, 28 lesson hours in 6th grades, 28 lesson hours in 7th grades and 42 lesson hours in 8th grades. It is seen that chemistry curriculum has a rate of 23% in terms of course hours in science. In the Kosovo secondary school science curriculum, there are 222 lesson hours in chemistry teaching program, including 74 lesson hours in 7th grades, 74 lesson hours in 8th grades and 74 lesson hours in 9th grades. It is seen that chemistry curriculum has a rate of 27.2% in terms of course hours in science. Turkey has a rate of 11% with the time allocated for four hours of science lessons per week (MEB, 2018b). Although the weekly course hours vary in each grade level in Kosovo, the rate of weekly course hours devoted to science teaching is 16% in 6th grades, 21% in 7th grades, 20% in 8th grades and 17% in 9th grades. This rate is 14% in Singapore, 19% in England, 11% in Korea and 9% in Japan, which are successful countries with integrated science curriculum. In some countries, such as Romania, Slovenia, Macedonia, Moldova, Russia, Hungary and the Czech Republic, where science lessons are taught as separate subjects, the time allocated to science education reaches up to 25% (Kılıç, 2002).

When the chemistry subjects in the Turkish secondary school science curriculum are examined in terms of the number of achievements, it is found that 59 of the 223 achievements in the sciences are chemistry-related gains. Of these 59 acquisitions, 10 are in the 5th grade, 13 in the 6th grade, 16 in the 7th grade and 20 in the 8th grade. Kosovo chemistry subjects consist of 174 chemistry-related learning outcomes.

52 of these gains are in 7th grades, 70 in 8th grades and 52 in 9th grades. Chemistry gains are 31% in science. When the research findings are examined, it is seen that the chemistry-related subject gains in Kosovo are more than the chemistry-related subject gains in Turkey. While the number of chemistry-related gains in the secondary school science curriculum in our country was 194 in the 2005 science curriculum, it was put into practice as 144 in the 2013 science curriculum and 59 in the 2018 science curriculum. The reasons for the reduction in the gains in the program can be cited as the feedback received from the teachers and the consideration of the cognitive and developmental periods of the students (Timur et al., 2013; MEB, 2018a).

Turkey secondary school science and chemistry subjects are given in two learning areas as "Matter and Nature" and "Earth and Universe". In the 5th grades, there is a unit on the learning areas of "Matter and Its Nature" and "The World and the Universe". In the 6th grades, the "Matter and Its Nature" learning area is one (1) unit, in the 7th grades the "Matter and Its Nature" learning area is one (1) unit, in the 8th grades the "Matter and Its Nature" learning area and the "Earth and the Universe" learning area. There is one unit for each (Table 5). In the Kosovo secondary school chemistry program, the learning areas are given with three (3) learning areas: "The Properties and Transformations of Matter", "Earth, Environment and Universe" and "The World of Living Things". In the 7th grades, the "Properties and Transformations of Matter" learning area is four (4) units, the "Earth, Environment and Universe" and "Living World" learning areas are one unit each, and in the 8th grades the "Properties and Transformations of Matter" learning area is five (5) units, and the "Earth, Environment and Universe" learning area includes one (1) unit and the "Properties of Matter and Transformations" learning area and four (4) units in 9th grades (Table 6). In the literature, the titles used in the science curriculum vary in many European countries, supporting the research findings (MEB, 2011). Similarly, in the "Turkey and Australia" example of the science curriculum comparison study, it was concluded that learning areas were different in terms of title and content (Topaloğlu & Kıyıcı, 2015). In addition, in the science programs comparison study of different countries, it was concluded that our country has similar content studies with Canada, New Zealand and Ireland (Yücel, 2010).

When we examine the subject contents of the Turkish science and chemistry curriculum, we examine the "Matter and Nature" learning area in a spiral manner at each grade level, and the states of matter, matter and heat, structure and properties of matter, periodic system, classification of elements, acids and bases It has been determined that the components in the earth's crust, air, soil, water pollution, and weather events are included in the learning area of "Ya and the Universe". As the subject content of the Kosovo chemistry curriculum, the "Properties and Transformations of Matter" learning area in the 7th grade, and the substance and its structure were entered in detail, and the properties related to the substance were given under many headings. With the unit of chemical reactions, types of reactions, thermodynamic reactions, constant rates and chemical calculations are included. With the unit of inorganic compounds and their classification, it has been determined that acid, base, salt and electrolytes are the subjects. In the 8th grade, the "Properties and Transformations of Matter" learning area includes chemical calculations, speed and balance in chemical reactions in detail. In the 8th grade, it was found that the second learning area "Chemical Elements and Their Classifications" and nonmetal, metalloids, metal and environmental protection units were included. With these units, the properties of metal and nonmetal elements and certain metal and nonmetal elements, environmental protection and air, water, soil and acid pollution are included. In the 9th grade, it was determined that the "Properties

and Transformations of Matter" learning area included the basic concepts of organic chemistry, hydrocarbons and their derivatives, oxygenated and nitrogenous compounds and their derivatives, and carbohydrates. It has been determined that basic subjects such as particulate structure of matter, mixtures, periodic system, acids and bases, weather events are included under similar titles in chemistry curriculums in Turkey and Kosovo. It has been determined that Kosovo chemistry subjects are more than Turkey, both numerically and in terms of information. In his study, Kılıç (2002) included the findings of TIMSS-R on how far the countries teach science subjects as a result of primary education. Accordingly, Turkey stated that it aims at 95% as the aim of teaching science. It has been determined that Taiwan, which is in the top five, teaches 69%, Japan 62%, Singapore 79% and Korea 60%. The international science teaching average is 63%. When Turkey 2005, 2013 and 2018 science curriculum are compared, it is aimed to reduce the acquisitions of the subjects and to provide detailed knowledge and skills on the subject (Kılıç, 2002; Timur et al., 2013; MEB, 2018a).

When the science and chemistry teaching methods in Turkey and Kosovo secondary schools are examined, student-centered education is clearly expressed in the chemistry teaching methods of Turkish secondary schools. Teaching methods that construct knowledge, investigate, question and problem-solving are adopted. When the chemistry teaching methods in Kosovo secondary schools are examined, it is seen that direct expression is more prominent, but it has been determined that contemporary teaching methods such as examination, discovery and project-oriented are also emphasized in the program. In modern teaching methods, effective learning occurs with the learning experience and the organized structuring of knowledge in classroom environments (Aksu & Doğan, 2015).

As in many European countries, Turkey implements an integrated program in science. Subjects with chemistry content in Turkish sciences are included in every grade level with the "Matter and Nature" learning area, based on the principle of spirality, based on the principle of "less knowledge is the essence". In addition, in the "Earth and Universe" learning area, chemistry-related topics related to the daily environment were included. Kosovo secondary schools science program is given as separate courses in physics, chemistry and biology. Chemistry subjects are not included in the first level of Kosovo secondary school. Chemistry subjects are included in 7th, 8th and 9th grades.

In this study, the following suggestions can be made as a result of examining the similarities and differences in terms of the structure, purpose, learning areas, units, number of achievements, number of course hours and teaching methods of chemistry subjects in the content of secondary school science programs in Turkey and Kosovo.

It is thought that studies should be carried out to renew and revise the chemistry program at secondary school level in Kosovo in accordance with its socio-economic and cultural structure, taking into account the science curricula in both Turkey and the European Union countries in terms of course hours, achievements, units and contents.

Comparative education is a field of study that examines how the problems and solutions for similar problems are produced by comparing the education systems of the countries, revealing their similarities and differences. For this reason, it is thought that comparative education studies will contribute to the development and progress of the education programs of young states such as Kosovo.

Comparative education studies related to Balkan countries with which we have shared values, with which we have historical and cultural ties, will be of guiding importance for both the Balkan countries and the education system of our government.

Research Ethics

In this study, Since the officially approved science curriculum and chemistry curriculum documents of the Republic of Turkey Ministry of National Education and Kosovo Ministry of Education and Technology were used as data collection, the decision of the ethics committee was not required.

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