IJERE International Journal of Educational Research Review

Comparison of Turkey and Canada (Ontario) Science Curriculum in the Context of Physics Learning Area

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Article History:
Received 01.10.2022
Received in revised form 09.02.2023
Accepted
Available online 01.03.2023

This study aims to determine the similarities and differences of both programs by analyzing physics subjects, vision, purpose, learning areas according to grade levels, units, course hours and number of learning outcomes in the context of physics learning area of secondary school science curricula in Turkey and Canada (Ontario). This research uses the document analysis method, which is one of the qualitative research methods. This research demonstrates that the aims of Turkey secondary school science curriculum are to be expressed longer and more intensely than Canada (Ontario) secondary school science and technology curriculum. Moreover, while spiral approach is used in Turkey science curriculum, modular approach is used in Canada (Ontario) science and technology curriculum. Both countries are similar in terms of their vision to raise scientifically literate individuals. The Turkish science curriculum includes numerically more physics-containing Units, course hours and the number of learning outcomes numerically compared to the Canadian (Ontario) physics curriculum. Canada (Ontario) physics curriculum is completely associated with daily life in terms of learning outcomes compared to the Turkish physics curriculum.

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Keywords: Physics subjects, comparative education, science curriculum

INTRODUCTION

Societies provide their development with their economic power. It has become a situation related to the development of that society in scientific fields and integrating it into technology, rather than being the workforce of that society that underlies this economic power. For this reason, the development of societies is provided by studies in scientific fields, the number of patents received, and the contributions made to technology. For these reasons, it is expected from the individuals living in the society that they are intertwined with science and technology and put these two phenomena at the center of their daily life. They should follow these two areas, have up-to-date information, and use this information both on their own and transfer them to other individuals. The strength of countries in terms of technology, industry, and economy depends on a strong education system. In order for countries to compete with world economies, they need to strengthen their education systems. Since the middle of the twentieth century, the race and competition between developed and developing countries has shown itself in the field of technology and informatics. This race and competition brought along the need for manpower trained in the field of science and technology. At the same time, it has led countries to review their science and mathematics programs and make necessary revisions and updates (İnce et al., 2018). Physics, chemistry, and biology courses, which are in the basic sciences class and gathered under the roof of science, are an important tool that directs students to look at the events taking place in and around nature from a scientific perspective (National Research Council [NRC], 1996).

More and more qualified manpower is needed in the world and in Turkey. This need manifests itself mostly in the fields of science and technology. This situation reveals the importance of science teaching programs in the basic primary education period (Korkmaz, 2002). Science education is an education of both the anatomical functioning of the child's own body and how the natural events that occur around him. This education is an education that should be done in a simple and concrete way with appropriate methods and tools in line with the child's interests, wishes, development and needs (Özcan, 2020). The developments in science and technology in the 21st century have made it compulsory for individuals to receive science literacy education. In addition, individuals who have undergone this training facilitate their lives by using this knowledge in their daily lives by gaining the ability to learn the steps leading to scientific processes and research methods, by having researching, questioning and critical thinking skills and competence (Kömürkaraoğlu, 2011; Yılmazlar&Çavuş, 2016).

Studies in this field reveal the importance of science literacy (Ministry of National Education [MoNE], 2006; MoNE, 2013; MoNE, 2018). In line with the changing needs of the time we live in, there is a need for individuals who have the qualifications to understand and direct these needs. In line with these needs, it is seen that science and technology have reached an indispensable importance in human life, and from this situation, science and technology literacy has become central in science teaching. Based on this reason, countries have made changes in their curricula and have included science literacy in all its dimensions. In this context, it has been planned and put into practice in a way that will enable us to raise individuals who

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do research, question, think critically, have scientific research process skills, employ them, have problem-solving skills, integrate science and technology with daily life, and contribute to lifelong learning in countries' education programs.

The fierce science and technology competition between countries has enabled countries to examine their own education programs in comparison with the education programs of other countries. Studies conducted to compare the similarities and differences of comparative education programs are important because they analyze the level of education of countries among the countries of the world (Maya & Yakut, 2021). Due to this fierce competition and rapid advancement of technology, countries have recently updated or revised their education curricula (Serçe&Acar, 2021). For this purpose, countries use PISA (International Student Assessment Program) and TIMSS (International Mathematics and Science Trends Survey) etc. By participating in international student assessment exams, it compares the educational outcomes of its countries with the results of other countries and develops education policies according to these results. With the TIMSS exams organized by the International Association for the Evaluation of Educational Achievement (IEA), countries reach the criteria for evaluating their students in the international arena by obtaining data on mathematics and science education. Organized by the Organization for Economic Co-operation and Development (OECD), the PISA exam will test students' basic reading skills, mathematics and science literacy competencies. Skills Assessment Survey measures the verbal and numerical skills of adults aged 16-65. PISA exams appear as one of the best international comparative education assessment exams, which are known to be given great importance by countries today (Cingöz, 2020; Yeşilyurt, 2020; Yılmazlar&Çınar, 2016). While international assessment and evaluation exams provide information about the quality of human resources of countries, they also provide important opportunities for education politicians to reviewand improve the education curricula of countries (Cingöz, 2020). Within the scope of 21st century competencies and skills in Turkey, as a result of the educational outputs obtained from international measurement and evaluation tools, such as international measurement and evaluation tools like PISA, the curriculum was revised in 2017 at the level of all classes and courses. In terms of gains in the programs, besides the cognitive knowledge dimension, skill-based gains are mainly discussed. This revision, albeit partially, had a positive effect in the field of science literacy in PISA 2018 (Yeşilyurt, 2020). While Turkey was ranked 54th in science literacy with 425 points in the 2015 PISA, in which 72 countries participated, it was ranked 39th with 468 points in the 2018 PISA exam, in which 79 countries participated. Turkey's science literacy has increased by 15 ranks from PISA 2015 to PISA 2018. While Canada ranked 7th with 528 points in science literacy in PISA 2015, it ranked 8th in PISA 2018 with 518 points. Canada, on the other hand, maintained its place in science literacy despite a decline in PISA 2018 (MoNE, 2016; MoNE, 2019).

Within studies on the science curriculum in the literature on comparative education in the field of science in Turkey and Canada; while Güven and Gürdal (2011) comparatively examined the secondary school science and technology curricula of Turkey and Canada (State of Ontario) in terms of objectives, İnce and Yıldırım (2018) have comparatively examined the Canada (Ontario) and Turkey Science Curriculum in terms of purpose, learning areas and measurement and evaluation at the 5th grade level. Derman (2015) also made a comparative analysis of the environmental education outcomes in the Turkish science program and the environmental education program outcomes in Australia, Singapore, Ireland and Canada in terms of target and content. Tariq et al. (2020) comparatively examined and analyzed environmental education analysis and practices in primary school science curriculum in Canada, Turkey and Pakistan.

In this study, after revising the science and technology program of Canada (Ontario) in 2007, based on the limited and insufficient studies on this program, according to the vision, purpose, classroom in the context of physics learning field in the secondary school science curriculum of Turkey and Canada (Ontario), It is aimed to determine the similarities and differences of both programs by analyzing learning areas, units, course hours, number of learning outcomes according to their levels.

METHOD

Model of the Research

In this research, document analysis method, one of the qualitative research methods, was used as a method. Document analysis is the process of bringing together existing records and documents and examining them under a certain systematic and criteria (Ormancı & Cepni, 2019) . Which data is important for the researcher

in document analysis is related to the problem statement. In the field of education, especially as data sources, textbooks, curricula, lesson and unit plans, educational documents, etc have an important place (Yıldırım&Şimşek, 2011).

Sample of the Research

The sample of this research is 2018 Turkey Ministry of National Education Secondary School Science Curriculum and 2007 Canada (Ontario) Secondary School Science and Technology Curriculum.

Data Collection and Analysis

Turkey and Canada (Ontario) secondary school science curricula were obtained from the official websites of countries [Turkey (MoNE, 2018) and Canada (Ontario) (The Ontario Curriculum [TOC], 2007)]. Science curricula of both countries in the context of physics learning area, vision, purpose, learning areas according to grade levels, units, course hours, number of learning outcomes were analyzed and the similarities and differences of both programs were analyzed and the findings were presented in tables comparatively.

RESULTS

Comparison of Turkey and Canada (Ontario) Secondary School Science Curriculum

Due to the rapid development, change and needs in science and technology in the Turkish secondary school science curriculum, partial revisions and updates were made in 2018. The 2018 Science curriculum is based on raising individuals who are committed to national and cultural, universal and scientific moral values and equipped with knowledge, skills and competence. Basic disciplines physics, chemistry, and biology are not applied as a separate course, but as an integrated program under the science course (Forsthuber et al., 2011) . In primary school 3rd and 4th grades, science lesson is 3 hours, 40 minutes per week, a total of 108 lessons in a year, and at secondary school level, 5th, 6th, 7th and 8th grade students have 4 lessons of 40 minutes per week and 144 hours of Science courses are given in a year (MoNE, 2018). In the 2018 Science Curriculum, there are 2 basic learning areas, namely "Knowledge" and "Skill". While the "Knowledge" learning area consists of 5 sub-learning areas, the "Skill" learning area is considered as 3 sub-learning areas (Topçu&Koçulu, 2020). By preserving the principle of spirality, the subjects were given place to repetition gains at each grade level. Unlike previous programs, emphasis was placed on individual differences throughout the program and maximum variety and flexibility were applied in measurement tools that focus on gaining values and skills and take individual differences into account in measurement and evaluation. In addition, with an interdisciplinary approach, there are science, engineering, and entrepreneurship practices for students to develop solutions and suggestions for the problems they encounter in daily life related to the subjects in the units (MoNE, 2018).

Canada (Ontario) Grades 5, 6, 7 and 8 are at the secondary level. Canada (Ontario) science and technology course takes an interdisciplinary approach in science courses 1-8. It is processed between classes. In Canada (Ontario), physics, chemistry, and biology disciplines are applied as an integrated science program under the roof of science and technology. School duration across Canada is 180-200 days, which is equivalent to an average of 190 days. This period is determined as 27 weeks in weeks, and the duration of a lesson is 50 minutes. When we examine the Canada (Ontario) science and technology course on the basis of year, week, and time, it is seen that 4 course hours per week are taught. Apart from this, no specific time is allocated per acquisition or per subject (TOC, 2007).

Comparison of Turkey and Canada (Ontario) Secondary School Science Curriculum Visions

The findings of the comparison of Turkey and Canada (Ontario) secondary school science curriculum visions are given in Table 1.

Table 1. Comparison of Turkey and Canada (Ontario) Secondary School Science Curriculum Visions

Turkey	Canada (Ontario)
Science Curriculum vision; It is defined as *"raising all individuals as scientifically literate"*.	Vision of Science and Technology Curriculum; It is defined as "It is *aimed to raise all individuals as science and technology literate"*.

When Table 1 is examined, the vision of the Turkish science course curriculum is defined as *"raising all individuals as science literate"* (MoNE, 2018). Canada (Ontario) stated its vision as "aiming *to raise all*

individuals as science and technology literate" as an overarching goal, since science and technology have a great impact on people's lives. A science and technology literate individual can understand common media reports on science and technology, present and evaluate critical information, engage in discussions involving science and technology, and make decisions with confidence. In addition, the curriculum aims to develop students' knowledge, skills and attitudes (TOC, 2007). When the science curricula of Turkey and Canada (Ontario) are compared in terms of vision, it is seen that the science programs of both countries aim to train individuals as "science literate".

Comparison of the Objectives of the Secondary School Science Curriculum in Turkey and Canada (Ontario)

The findings of the comparison of the objectives of the secondary school science curriculum in Turkey and Canada (Ontario) are given in Table 2.

Table 2. Comparison of the Objectives of the Secondary School Science Curriculum in Turkey and Canada (Ontario)

Turkey	Canada (Ontario)
1. To provide basic information about astronomy, biology, physics, chemistry, earth and environmental sciences and science and engineering applications, 2. In the process of discovering nature and understanding the relationship between human and environment, adopting scientific process skills and scientific research approach and producing solutions to the problems encountered in these fields, 3. To realize the mutual interaction between the individual, the environment and the society; To develop awareness of sustainable development regarding society, economy and natural resources, 4. To take responsibility for the problems of daily life and to ensure that science knowledge, scientific process skills and other life skills are used in solving these problems, 5. To develop career awareness and entrepreneurship skills related to science, 6. Helping to understand how scientific knowledge is created by scientists, the processes through which this knowledge is created and how it is used in new research, 7. To raise interest and curiosity about the events that occur in nature and its immediate surroundings, to develop an attitude, 8. To raise awareness of safe working by recognizing the importance of safety in scientific studies, 9. Developing reasoning ability, scientific thinking habits and decision-making skills by using socioscientific issues, 10. To ensure the adoption of universal moral values, national and cultural values and scientific ethical principles (MoNE, 2018).	1. To understand the relationship of science and technology with society and the environment, 2. To develop mental skills and strategies to solve scientific and technological problems, 3. To understand the basic concepts of science and technology (TOC, 2007).

When Table 2 is examined, while 10 basic objectives are taken as basis in the Turkish science curriculum, there are 3 basic objectives in the Canadian (Ontario) science curriculum. In terms of science curriculum purposes in both countries, it is seen that the acquisition goals for basic disciplines, nature, environment, individual and society, scientific research and scientific process skills are the main goals in both countries. It is seen that Turkey emphasizes universal and scientific moral principles and values in the aims of secondary school science curriculum. Such an emphasis has not been found in Canada (Ontario) secondary school science curriculum objectives.

Comparison of Learning Areas in Turkey and Canada (Ontario) Science Curriculum

The learning areas in the Turkish secondary school science curriculum consist of two areas: "Knowledge" and "Skill". No such distinction has been identified in the Canadian (Ontario) secondary school science curriculum. In this study, the science curriculum learning areas of both countries were examined under the "Knowledge" learning area. The findings of the comparison of the learning areas in the science curriculum of Turkey and Canada (Ontario) are given in Table 3.

Table 3. Comparison of Learning Areas in Turkey and Canada (Ontario) Secondary School Science Curriculum

Turkey	Canada (Ontario)
1. Creatures and Life	1. Living Systems.
2. Matter and Change	2. Structures and Mechanisms
3. Physical Events	3. Matter and Energy
4. Earth and Universe	4. Earth and Space Systems (TOC, 2007)
5. Science, Engineering and Entrepreneurship Practices (MoNE, 2018)	

As can be seen in Table 3, the science curriculum in Turkey has "five" sub-learning areas , namely "Living Things and Life", "Matter and Change", "Physical Phenomena", "Earth and Universe" and "Science, Engineering and Entrepreneurship Practices". In Canada (Ontario) science curriculum, there are learning areas of "Life Systems", "Structures and Mechanisms", "Matter and Energy" and "Earth and Space Systems".

When science curricula in Turkey and Canada (Ontario) are compared in terms of "Knowledge" learning areas, "Living and Life ″ learning areas in Turkey, can be defined as" Life Systems" in Canada (Ontario), " Matter and Change" learning area in Turkey is equal to "Matter and Energy" in Canada (Ontario), " Physical Events" learning area in Turkey is"Structures and Mechanisms" in Canada (Ontario) in Turkey, "Earth and Universe" learning area in Turkey is "Earth and Space Systems" learning area in Canada (Ontario).

Physics Learning Area and Units in the Turkish Secondary School Level Science Curriculum

Information on physics learning areas and units in the science curriculum at the secondary school level in Turkey is given in Table 4.

Table 4. Physics Learning Area and Units in the Turkish Secondary School Level Science Curriculum (MoNE,2018)

Learning Space	Units			
	5th grade	6th grade	7th grade	8th grade
Physical Events	Measuring Force and Friction	Force and Motion	Force and Energy	Pressure
	Propagation of light	Sound and Features	Interaction of Light with Matter	Simple Machines
	Electrical Circuit Elements	Conduction of Electricity	Electric circuits	Electrical Loads and Electrical Energy
Matter and Nature	Matter and Change	Matter and Heat	-	Substance and Industry
Earth and Universe	Sun, Earth, and Moon	Solar System and Eclipses	Solar System and Beyond	Seasons and Climate

When the findings in Table 4 are examined, it is seen that the learning areas are formed according to the spiral principle at each grade level. When we examine Table 3, there are 3 units in 5th, 6th, 7th and 8th grades under the title of "Physical Events" Learning Area. While there is 1 unit in the 5th, 6th and 8th grades in the "Matter and Its Nature" learning area, the material and nature learning area is not included in the physics program in the 7th grades. In the "Earth and Universe" learning area, there is 1 unit in 5th, 6th, 7th and 8th grades.

Physics Learning Area and Units in Canada (Ontario) Secondary School Science Curriculum

Canada (Ontario) secondary school science curriculum topics related to physics learning are given in Table 5.

Table 5. Physics Learning Area and Units in Canada (Ontario) Secondary School Science Curriculum (TOC, 2007)

Learning Space	Units			
	5th grade	6th grade	7th grade	8th grade
Structures and Mechanisms	Acting Forces To Structures and Mechanisms	Flight	Form and Function	Mobile Systems
Matter and Energy	Substance and Properties	Electric and Electric Devices Safety precautions in use	--	--
Earth and Space Systems	Conservation of Energy and Resources	Space	Ambient Temperature	---

When the findings in Table 5 are examined, physics subjects in the 5th, 6th, 7th and 8th grade science and technology curriculum of Canada (Ontario) are handled with a modular approach. For example; Under the "Structures and Mechanisms" learning area, there are forces acting on structures and mechanisms in 5th grades, flight in 6th grade, form and function in 7th grade, and mobile systems units in 8th grade.

Similar Units in Turkish Science Curriculum and Canada (Ontario) Science and Technology Curriculum

The units with similar content in the secondary school physics learning field in Turkey and Canada (Ontario) are given in Table 6.

Table 6. Turkey and Canada (Ontario) Secondary School Physics Learning Field Similar Units

Turkey			**Canada (Ontario)**		
Class	Learning Space	Subject	Class	Learning Space	Subject
5th grade	Physical Events	Measuring Force	5th grade	Structures and Mechanisms	Force Concept
	Matter and Nature	Substance and Distinctive Features	5th grade	Matter and Energy	Substance and Properties
	Physical Events	Electrical Circuit Elements	6th grade	Matter and Energy	Electrical circuits and working systems
6th grade	Matter and Energy	Matter and heat Fuels	7th grade	Earth and Space Systems	Ambient Temperature
6th grade	Earth and Universe	Solar system Solar and Lunar Eclipses	6th grade	Earth and Space Systems	Space

When Table 6 is examined, the learning fields of "Physical phenomena" and "Matter and Nature" in the secondary school science curriculum in 5th grades in Turkey and Canada (Ontario) are similar. It is also the topics of “Force", "Matter and Properties" under the learning areas of "Structures and Mechanisms", "Matter and Energy" are similar in the secondary school science curriculum in Canada (Ontario) and Turkey. The subjects of "Electrical Circuits and Working Systems" have similar contents in Turkey 5th grade science curriculum and Canada (Ontario) 6th grade science curriculum. "Matter and heat Fuels" topic under “Matter

and Energy" learning area in 6th grades in Turkey, "Heat in the Environment" in 7th grades in Canada (Ontario) in "Earth and Space Systems" learning area, and the subject of "Solar System" under the "Earth and Universe" learning area in 6th grades in Turkey, and "Space" under the "Earth and Space Systems" learning field in 6th grades in Canada (Ontario) are shown to have similar content.

Physics Learning Area, Units, Learning Outcomes and Course Hours in the Science Curriculum at the Turkish Secondary School Level

Physics learning area, units, learning outcomes, and course hours information included in the science curriculum at the secondary school level in Turkey are given in Table 7.

Table 7. Turkey Secondary School Physics Learning Area, Units, Learning Outcomes and Course Hours (MoNE, 2018)

Class	Learning space	Unit	Number of gains	Gain percentage	Lesson hours	Class hour percentage
5th grade	Physical Events	Measuring Force and Friction	5	18.5	12	12
		Propagation of Light	6	22.2	22	22
		Electrical and Circuit Elements	3	11.1	16	16
	Matter and Nature	Matter and Change	6	22.2	26	27
	Earth and Universe	Sun, Earth and Moon	7	25.9	24	25
	Total		27	100	100	100
6th grade	Physical Events	Force and Motion	5	13.5	14	15.5
		Sound and Features	9	24.3	22	24.4
		Conduction of Electricity	5	13.5	12	13.3
	Matter and Nature	Matter and Heat	13	35.1	28	31.1
	Earth and Universe	Solar system and Eclipses	5	13.5	14	15.5
	Total		37	100	90	100
7th grade	Physical Events	Force and Energy	9	24.3	20	28.5
		Interaction of Light with Matter	6	16.2	26	37.1
		Electric circuits	12	32.4	8	11.4
	Earth and Universe	Solar System and Beyond	10	27.0	16	22.8
	Total		37	100	70	100
8th grade	Physical Events	Simple Machines	2	7.9	10	11.6
		Pressure	3	15.8	10	11.6
		Electrical Loads and Electrical Energy	11	15.8	24	27.9
	Matter and Nature	Substance and Industry	17	18.4	28	32.5
	Earth and Universe	Seasons and Climate	3	42.1	14	16.2
	Total		38	100	86	100
	The overall total		139	100	346	100

When the findings in Table 7 are examined, the subjects with physics content at the secondary school level in the Turkish Science Curriculum are under the learning fields of "Physical Phenomena", "Matter and Its Nature" and "Earth and Universe" 27 in 5th Grades, 37 in 6th Grades, 37 in 7th Grades and in 8th grades; 38 learning outcomes, with a total of 139 outcomes. Physics-related subjects in the Science Curriculum are given as a total of 346 lesson hours, of which 100 in the 5th grade, 90 in the 6th grade, 70 in the 7th grade and 86 in the 8th grade.

Physics Learning Area, Units and Number of Outcomes in the 5th, 6th, 7th and 8th Grade Science Curriculum in Canada (Ontario)

The information on the number of attainments of physics subjects in the 5, 6, 7 and 8th grade science curriculum in Canada (Ontario) is given in Table 8.

Table 8. Canada (Ontario) Secondary School Level Physics Learning Area, Units and Number of Achievements (TOC, 2007).

Class	Learning Space	Units	Number of Learning Outcomes	Number of Learning Outcomes Total
5th grade	Structures and Mechanisms	Acting Forces To Structures and Mechanisms	13	41
	Matter and Energy	Substance and Properties	16	
	Earth and Space Systems	Conservation of Energy and Resources	12	
6th grade	Structures and Mechanisms	Flight	13	41
	Matter and Energy	Electric and Electric Protection from Devices	17	
	Earth and Space Systems	Space	13	
7th grade	Structures and Mechanisms	Form and Function	16	32
	Earth and Space Systems	Ambient Temperature	16	
8th grade	Structures and Mechanisms	Mobile Systems	18	18
Total				132

When Table 8 is examined, it is seen that the science curriculum in Canada (Ontario) includes 41 physics-related acquisitions in the 5th and 6th grades, 32 in the 7th grade, and 18 in the 8th grade in total. In this curriculum, there is no information about the course hours in which the learning outcomes will be applied. This lesson hour is left to the practitioner according to the situation of the classroom where the application is made.

When the number of physics-related subject acquisitions in the secondary school science curriculum of Turkey and Canada (Ontario) is examined, it is seen that the number of acquisitions is very close to each other. While there are 139 acquisitions in our country, there are 132 acquisitions in the secondary school science and technology curriculum in Canada (Ontario). However, while these gains are processed in 4 years in our country, they are processed in 3 years in Canada (Ontario). While the annual number of physics learning outcomes in our country is 34.75 on average, the annual number of physics achievements in Canada (Ontario) secondary school science and technology curriculum is 33 on average. When the course contents are examined in terms of subject, it has been determined that there are more subjects in our country.

DISCUSSION

In this study, physics learning areas in Turkey and Canada (Ontario) Secondary School Science Curriculums were analyzed according to vision, purpose, grade levels, units, course hours, and number of learning outcomes. The similarities and differences of both programs were analyzed according to that.

Turkey and Canada secondary school physics learning area is not given as a separate course in both countries, but within the science curriculum. (MoNE, 2018; TOC, 2007). In many European countries, science curriculum is implemented in an integrated manner (MoNE, 2011). Physics, biology, and chemistry subjects in the discipline of science cannot be isolated from each other. Because this will not only create an artificial way to teach science, but it will not reflect the truth. Therefore, the complexity of the natural system or the corresponding scientific problems require interdisciplinary understanding informed by multiple disciplinary backgrounds (Wiyanto et al., 2018). Integrated learning begins by identifying overlapping concepts, skills, and attitudes in various domains. Students who actively participate in exploration evaluate the learning process holistically and meaningfully (Fitria et al., 2018).

Turkey and Canada (Ontario) define the vision of science curricula in both countries *as "raising all individuals as science literate"* (MoNE, 2018; TOC, 2007). The power of science education in influencing and shaping the future of societies has revealed the importance of science literacy, which is accepted as a 21st century skill (AydınCeran, 2021). Science learning and scientific literacy are explained as an individual's capacity to blend science and technology. Literacy arguments are accepted as a skill used in real-life situations to assess the quality of knowledge and science (Mtsi et al., 2021).

The main objectives of the Turkish science curriculum are to learn the basic concepts and principles about astronomy, basic sciences physics, chemistry and biology, the discovery of nature and the interaction of the individual with his environment, scientific process skills for daily life problems and their solution, and compliance with scientific research principles, as well as to raise individuals who assimilate career, entrepreneurship, universal ethic and moral rules in this field and protect their national and spiritual values (MoNE, 2018). In Canada (Ontario), it is necessary for all individuals to be science and technology literate. Its main purposes are learning the basic concepts of science and technology, the interaction of science and technology with society and the environment, scientific research for problem solving and developing mental skills for process strategies (TOC, 2007). Developing science education in Europe and many developing countries, especially at the end of the 20th century, has been a strategic goal of national importance for countries. In order to increase the interest and curiosity of students in science and to keep their motivation at a high level, they have determined the main objectives in science education programs from the early school years. These aims are generally to encourage students in all European and developing countries to learn basic concepts, scientific literacy, natural sciences and technologies in basic disciplines (Physics, chemistry and biology, etc.) (MoNE, 2011).

(MoNE, 2018; TOC, 2007) In secondary school science curriculums in Turkey and Canada (Ontario) are named with similar names, other learning areas are not similar. Science curriculum learning areas and subject headings can be given under different headings in Europe and many countries (MoNE, 2011). We can see examples of this in the literature, for example; in the comparative science education studies conducted by Karaer (2016) "Turkey and Estonia" and Karalı et al. (2021) "Turkey and Singapore", it was concluded that primary school science learning fields and subject headings were named differently.

While subjects with physics content in Turkey secondary school take place with 139 acquisitions, subjects with physics content are included in the secondary school science and technology curriculum of Canada (Ontario) with 132 acquisitions. It is seen that the number of gains in both countries is close to each other. While the course hours and durations are specified in detail in the science learning program for the units, subjects and achievements in the physics learning field in Turkey, only the number of achievements in the Canadian physics learning field are specified and it is not specified how much time will be allocated for the learning outcomes. It is known that flexible curriculum periods allow teachers to reach curriculum goals by making their lessons more interesting by using different teaching methods (Karalı et al., 2021).

CONCLUSION

In this study, physics learning areas in Turkey and Canada (Ontario) Secondary School Science Curriculum were examined in terms of vision, purpose, unit, course hours, and number of learning outcomes. When science curricula in Turkey and Canada (Ontario) are examined, it is seen that the vision of

"raising science and technology literate individuals" is aimed in both curricula. In both programs, it is seen that the subject gains are given in detail. While the subjects are given in a spiral way in the science program in Turkey, in Canada (Ontario) they are given in a modular manner.

When the curricula are examined in terms of learning areas, learning areas of physics-related subjects in our country are "Physical Phenomena", "Matter and Nature" and "Earth and Universe", while in Canada (Ontario) there are " Structuresand Mechanisms", "Matter and Energy" and " Earth " learning areas. It is seen that the learning areas and units that have the same content in the science curriculum of Turkey and Canada (Ontario) are named differently. In addition, a unit in the Canadian (Ontario) science and technology curriculum can take place in more than one learning area.

When the findings of the number of learning outcomes in physics-related subjects in the science curriculum of Turkey and Canada (Ontario) are examined, it is seen that the number of learning outcomes is very close to each other. While there are 139 acquisitions in Turkey, there are 132 acquisitions in Canada (Ontario) science and technology curriculum. However, while these gains are processed in 4 years in Turkey, they are processed in 3 years in Canada (Ontario). While the annual number of physics learning outcomes in Turkey is 34.75 on average, the annual number of physics learning outcomes in the 5th, 6th, 7th and 8th grade science and technology curriculum in Canada (Ontario) is 33 on average. When the course contents are examined in terms of subject, it has been determined that there are more subjects in Turkey.

SUGGESTIONS

In this study, the following suggestions can be made as a result of the analysis of the similarities and differences of the learning areas, units, course hours and learning outcomes according to the vision, purpose, grade levels of the physics learning field in the Secondary School Science Curriculum of Turkey and Canada (Ontario).

When the comparative education studies in Turkey and Canada are examined in the literature, although there are studies that deal with the education system and the science education system in general, it is seen that the comparison studies at the grade level are limited as a separate course for the science group (physics, chemistry and biology). It is thought that it would be beneficial to increase and encourage studies in this field.

Although the physics curriculum in the Turkish secondary school science group is given in more detail and spirally than the Canadian (Ontario) physics curriculum, it is less in terms of outcomes. Canada (Ontario) secondary school physics curriculum is given with a short and modular approach and the subjects are related to daily life. Although the recently revised Turkish secondary school science curriculum subjects are associated with projects as science and engineering competencies and skills, and daily life at the end of the unit, they should be associated with all units and subjects, not just end-of-term projects.

In addition, the application of course hours given to the learning outcomes in the Turkish science curriculum should be abandoned, instead, the learning outcome should be given and time management should be left to the practitioner according to the situation of the class. Arrangements to be made in Turkey's curriculum as a part of daily life in science and technology will contribute to the motivation of students to learn science. In this sense, along with theoretical knowledge, practices should be included and adequate opportunities should be provided.

This study is limited to the 2018 secondary school science curriculum of the Ministry of National Education of Turkey and the 2007 secondary school science curriculum of the Canadian (Ontario) Ministry of Education and Training. The findings of the study are limited to the sources obtained from document review and secondary school 5th, 6th, 7th and 8th grade science programs. In this study, it has been tried to analyze the similarities and differences of the learning areas, units, course hours and achievements according to the vision, purpose, grade levels of the physics learning field in the Secondary School Science Curriculum of Turkey and Canada (Ontario) have not been examined in terms of teaching methods and measurement and evaluation.

Declarations

Conflict of Interest

No potential conflicts of interest were disclosed by the author(s) with respect to the research, authorship, or publication of this article.

Ethics Approval

In this study, since the science curriculum and physics curriculum documents that were used as data collection tools were officially approved by the Ministry of National Education of the Republic of Turkey and the Ministry of Education and Training of Canada (Ontario), ethics committee decision was not required.

Funding

This study did not receive any financial support from any institution.

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