TECHNOLOGY EDUCATION IN PRIMARY SCHOOLS: AN OVERWIEV OF TURKEY AND SCOTLAND

Abstract: Technology education varies across countries depending on the goals they set to achieve. Therefore, comparative research on different technology education approaches can provide a holistic perspective and contribute to the literature. This paper compared the technology-focused courses offered by primary schools in Turkey and Scotland. A qualitative research design was adopted. Data were collected using document review and analyzed using descriptive analysis. The results pointed to differences in technology policies, manifesting themselves in the curricula of the courses offered by the schools. However, the courses also had something in common in terms of structure, goal, content, and approach to learning and teaching. We discussed the differences and similarities based on literature. In order to reveal different dimensions of technology education, comparative education studies that address different countries can be suggested.

Keywords: Technology, technology education, primary schools, primary education, comperative studies

Tut, Edip MA
Research Assistant
Primary Education
Ondokuz Mayis University
Turkey
E-mail: ediptut@hotmail.com
ORCID: 0000-0003-2191-6539

Şeren, Nurbanu MA
Research Assistant
Primary Education
Ondokuz Mayis University
Turkey
E-mail: nurbanuseren@gmail.com
ORCID: 0000-0002-0119-1684

Aydın-Çolak, Elif MA
Teacher
Primary Education
Ondokuz Mayis University
Turkey
Email: eliifaydin@hotmail.com
ORCID: 0000-0003-4195-6730

Kıroğlu, Kasım PhD
Professor
Primary Education
Ondokuz Mayis University
Turkey
Email: november@omu.edu.tr
ORCID: 0000-0001-5711-9182

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INTRODUCTION

Educational institutions are responsible for helping students develop life skills. However, those skills change over time. The skills, values, and attitudes one needs to have to be an effective and useful citizen in today's world are more diverse than ever (Snape, 2017). Those changes are parallel to everyday life changes. In other words, changes and developments in everyday life directly affect the scope of education. Technology is one of the factors that has profoundly changed everyday life. It is broadly defined as all kinds of changes people make in nature to meet their own desires and needs (Garmire & Pearson, 2006) or as a process by which technical knowledge is put into practice (Erdemir, Bakırcı & Eyduran, 2009).

Technology is a dynamic and regenerating phenomenon directly related to needs. The scope of technology is constantly transforming because needs and conditions are in a constant flux of change. Based on the definitions, we can state that a simple spear made thousands of years ago was the most novel technological product back then. We are witnessing technological breakthroughs and scientific progress, making the Internet the most novel technological product of today (Şad & Arıbaş, 2010). We can see the transformative power of technology in social, cultural, and political spheres, manifesting themselves as applications that make our lives easier (Yalçın & Yayla, 2016). Each new technology replaces an old one, revolutionizes every sphere of our lives, and lets us go beyond what once seemed like limits (Doğan, 2012; Dinç, 2019). Social changes make technology an integral part of life, affecting all that we do (Hussain, Hashmi & Gilani, 2018; Volk, 2007). Therefore, we need far more complicated and profound skills today than what we used to have. From a broader perspective, societies need people with skill sets that enable them to manage, plan, and use technology in different fields (Soobik, 2014). To achieve that goal, countries have to provide their citizens with an education that meets the needs of the era in a wide variety of fields.

Education helps students keep up with developments (Şimşek et al., 2008). The primary goal of education is to equip them with the skills, knowledge, and attitudes they need to become productive members of society (Yılmaz, 2007; Amankwah, Oti-Agyen & Sam, 2017). Today, children are born into a world dominated by ever-evolving technology. Therefore, they need to know the basics of technology to use it in everyday life (Öqvist & Högström, 2018). Nelson, Palonsky, and McCarthy (2010) also maintain that students should have the technological know-how and positive attitudes towards it to become productive members of society. This requires us to reconsider the role, content, and goals of education (Bellanca & Brandt, 2010). Economic, environmental, industrial, and social changes have pushed for a transformation in technology education (Autio, 2009). Schools are responsible for preparing students for life and teaching them how to use technology to solve problems (Heddens & Speer, 2006). Therefore, we can state that technology is now a permanent and integral component of education (Jimenez, Prieto & Garcia, 2019). One of the primary goals of education today is to turn students into technology-literate people who can access information (Özgüç & Cavkaytar, 2016). Therefore, there is a growing body of research integrating technology into education (Gürfidan & Koç, 2016).

With advances in science and technology, schools have focused not only on teaching students about technology but also on helping them develop the skills they need to use technology effectively and efficiently (Aktay & Güvey Aktay, 2015). Social change, technology, and education are intertwined, with technology having a more guiding role in this relationship (Uça Güneş, 2016). Advances in technology also make it all the more important in education than ever before (Köseoğlu et al., 2007; Seferoğlu, Akbıyık & Bulut, 2008), paving the way for the concepts of "educational technologies" as educational tools (Aktay & Güvey Aktay, 2015) and "technology education" relating to technology literacy (Boser, Palmer & Daugherty, 1998; Şenel & Gençoğlu, 2003).

The term "educational technology" refers to the technology used in education (Çoklar & Bağcı, 2009). The abacus is one of the earliest educational technologies used for arithmetic calculations for almost three thousand years (Akçay, 2017). Teachers today use technology to introduce topics, make presentations, interact, cooperate, record notes, print educational materials, and guide students and help them develop skills (Nelson, Palonsky & McCarthy, 2010). Educational technologies are critical for modern education systems (Al-Alwani, 2014) because it provides effective teaching (Amemado, 2014; Glowatz & O'Brien, 2017). Technology has an important place in students' lives as it makes educational activities more fun (Budinski & Milinkovic, 2017; Aktay & Güvey Aktay, 2015). We must use technology carefully in education and continuously update it and evaluate its effectiveness to enhance learning (Ashford-Rowe & Holt, 2011; Dolenc & Abersek, 2015). Educational technologies play a crucial role in education because they have numerous benefits (Ozan & Taşgın, 2017).

Technology education aims to help students acquire technology literacy (Wicklein, Smith Jr, & Kim, 2009). Technology education provides students with the opportunity to learn technological know-how, techniques, and strategies (Hussain, Hashmi & Gilani, 2018). Technology is everywhere and entwined in our daily lives so much so that schools teach students how to use it to turn into technology-literate individuals (Güngören, Bektaş, Öztürk & Horzum, 2014). Technology education involves teaching students about the pros and cons of technology and how to use, manage, evaluate, and comprehend it (Fantz & Katsioloudis, 2011). In other words, technology education aims to help students understand what technology is and what impact it has on their lives. Students receiving education on technology can use it to make observations, design materials and tools, make mathematical calculations, plot graphs, and understand and do mechanical drawings. Technology education is an interdisciplinary science that achieves the integration of environmental education into school curricula (Karaağaçlı & Mahiroğlu, 2005). Technology education consists of creative experiences and innovative activities that allow students to use their knowledge and skills (McLaren, 2007). Technology education provides students with unique and innovative opportunities to make sense of, control, and use technology (Boser, Palmer, & Daugherty, 1998; Reinsfield, 2016).

Technology education has been introduced to help students develop the skills they need to understand and use technology (Niiranen & Hilmola, 2016). Therefore, it is a promising means of helping students gain self-esteem, develop social skills, and adapt to school (Ernst & Moye, 2013). The goal of technology education is to allow students to acquire the skills they need to perform various practical tasks (Soobik, 2013). Children participating in technology activities can develop research skills and learn to discuss, reflect on, and formulate thoughts and ideas (Tu, 2006).

Technology education has undergone a significant transformation since its onset (Reinsfield, 2016). Current technology education has been designed to promote technological skills, technological literacy, and technological perspective (Seery, Kimbell, Buckley & Phelan, 2019). Today we live in an age of technology. Therefore, technology teaching and research has become a much wider field than ever. Most research emphasizes that schools should provide students with more technology learning-teaching activities (Seery, Kimbell, Buckley, & Phelan, 2019) and incorporate them into all courses (Autio, 2016).

The definition and execution of technology education vary across countries depending on cultural differences and agendas of certain groups (Şenel & Gençoğlu, 2003). This highlights the importance of comparative educational research, whose sole purpose is to solve educational problems by comparing and contrasting the educational concepts, strategies, and options of two or more regions, countries, or continents (Türkoğlu, 2012). Researchers undertaking comparative educational studies make different applications visible and thus pave the way for improvements. When the literature is examined, no study comparing technology education approaches at primary school level has been found. Therefore, this study has been deemed necessary in terms of contributing to the field.

Scotland, an autonomous state in the United Kingdom, places particular emphasis on technology education and technology use in education due to digitalization. Scotland has established a unit under the Ministry of Education to keep up with technological developments and to draw a road map. What is more, primary schools in Scotland offer technology education as a core course. For the past few semesters, the UK has been in the top ten in some international exams [PISA (Programme for International Student Assessment)]. Moreover, schools in Scotland outperform their counterparts in England and Ireland in some fields. Therefore, we think that comparing technology education activities in primary schools in Scotland and Turkey will contribute to the field.

This paper compared technology education in primary schools in Scotland and Turkey. The research questions are as follows:

1. How do primary schools in Turkey provide technology education?
2. How do primary schools in Scotland provide technology education?
3. What are the similarities between technology education in Scotland and Turkey?
4. What are the differences between technology education in Scotland and Turkey?

METHOD

RESEARCH DESIGN

This study adopted a basic qualitative research design to compare the technology education in primary schools in Scotland and Turkey. In the most general sense, basic qualitative research designs are research designs that are not based on phenomenology, grounded theory, narrative analysis, critical ethnography. They focus on how events or facts are understood and interpreted (Merriam, 2015). This study conducted a comparative review of how technology education was understood and used in Scotland and Turkey.

DATA COLLECTION

The analysis of technology education in primary schools in Turkey and Scotland was based on their curricula. Data were collected using document review. Defined as material culture in anthropology, records, documents, artifacts, and archives are rich data sources (Patton, 2014). Document review involves selecting documents appropriate for research purposes. In general terms, document review is a systematic process in which the researcher reviews and evaluates printed or electronic materials (Bowen, 2009). In qualitative research, transcribing interviews turns them into materials or documents. However, the “document” in document review refers to data containing words and/or images recorded without the researcher intervening in the process (Silverman, 2018). We also analyzed written materials and collected data from the current primary school curricula on the official websites of the Ministries of Education of Turkey and Scotland. The analysis was based on Yıldırım and Şimşek’s “five stages of document review” (2018). We collected documents, checked their originality, used and examined them, and analyzed data.

DATA ANALYSIS

Themes were developed to address the educational approach of each country. After analysis, the data were summarized and interpreted under the titles “Technology Education in Primary Schools in Turkey” and “Technology Education in Primary Schools in Scotland.” For transferability, it is necessary to describe the research process and results in detail, which is referred to as “descriptive analysis” by Yıldırım and Şimşek (2018). Therefore, we also elaborated on the research process and results.

Four researchers analyzed the data and discussed the controversial points and differences of opinion until they reached a fully consensus on analyze. They then consulted an expert researcher in research methods about the findings and the process and made revisions based on expert feedback. The analysis was conducted over a long period to review the data repeatedly and prevent possible data loss. In line with Yıldırım and Şimşek's (2018) recommendations for validity and reliability in qualitative research, we compared the results with the raw data and checked for verifiability and understandability at the end of the process. This research is limited to the two countries (Turkey and Scotland) considered and the respective programs obtained from the official websites of these countries.

RESULTS

TECHNOLOGY EDUCATION IN PRIMARY SCHOOLS IN TURKEY

This section addressed how primary schools in Turkey offered technology education and used technology in education. The technology education curriculum of the "Information Technologies and Software" (ITS) course was developed to serve as a roadmap for teachers and was last updated in 2018. The curriculum has some topics in common. For example, the topic of "The Perspective of the Curricula" explains how the curriculum approaches technology education and contains the subtopics of "values" and "qualifications," the latter of which is the first to address the concept of technology. The curriculum talks about several competencies defined as personal, social, academic, and professional qualifications at both national and international levels (Ministry of National Education, 2018). The "Turkey Qualifications Framework" (TQF) research has determined those qualifications. The TQF, designed in harmony with the European Qualifications Framework, is a national framework that refers to all qualifications acquired through vocational, general, and academic curricula, including primary, secondary, and higher education or other learning environments (Vocational Qualifications Institution, 2020). Some of the qualifications are communication in the native language, communication in foreign languages, learning how to learn, social and civic competencies, taking initiatives, entrepreneurship, math competence, and basic science-technology qualifications. The curriculum defines "technology competence" as the execution of knowledge and methodology to meet demands and needs, a competence of which students in Turkey are expected to adopt. "Digital competence" is another skill set in the curriculum. It refers to the skill needed to use "information communication technologies" safely and critically for work, everyday life, and communication (Ministry of National Education, 2018). It involves the effective and efficient use of technologies (computer and Internet).

The ITS course directly addresses technology education in primary schools in Turkey. Its curriculum, as a single file containing all headings, shows teachers how to deliver the course. In the broadest sense, the ITS course aims to teach primary school students how to use information technologies effectively and adopt basic software skills. The course also has a number of unique goals (Ministry of National Education, 2018):

The ITS course helps students

1. Develop awareness of the correct and effective use of information technologies
2. Use technology ethically and safely
3. Recognize that they can use technology for communication and research
4. Use information technologies to develop products
5. Develop problem-solving and computational thinking skills
6. Learn how to design algorithms
7. Use different logic structures to solve problems
8. Use programming languages to design games

The ITS course focuses on four fundamental skills: computational thinking, reasoning, problem-solving, and designing algorithms. The ITS curriculum emphasizes that every student should be involved in learning and that theory and practice should go hand in hand. Students should integrate new knowledge into everyday life experiences and use information technologies to solve real-life problems. The curriculum presents real-life problems to help students develop problem-solving skills. It has a thematic approach that groups topics under themes, which are "Information Technologies," "Ethics and Security," "Communication, Research, and Cooperation," "Developing Products," and "Problem Solving and Programming." The content of the themes is as follows:

Table 1. Themes and Their Contents in ITS Curriculum in Turkey

Themes	*Contents*
Information technologies	Transformation of information and communication technologies (ICTs) throughout history; pros and cons of ICTs; working principles of computer and other components
Ethics and Security	Confidentiality and ethical values for the correct and responsible use of technology
Communication, Research, and Cooperation	Encouraging students to use communication technologies to develop research, collaboration, and communication skills and to access and share the right information
Developing products	Topics to help students develop original products, express their thoughts in different ways, and choose and use the right tools and materials to structure knowledge
Problem Solving and Programming	Designing algorithms, using assignment, sequential logic, decision structure, loop structures, and selecting the appropriate programming to solve problems

Four different competence levels are specified in the themes (D1, D2, D3, and D4) based on individual differences and developmental characteristics in the curriculum. Therefore, learning activities are carried out at different levels. This allows teachers to implement different activities for students with different competence levels in the same classroom. The choice of activity depends on students' readiness, teachers' qualifications, and students' and parents' demands. The beginner level (D1) includes activities related to basic concepts and process flows. The intermediate level (D2) introduces the details of information technologies and programming logic. The upper-intermediate level (D3) involves activities tailored to incorporating information technologies into everyday life and developing applications in block-based programming environments. The advanced level (D4) addresses the proper and safe use of information technologies and complex applications of programming processes. Schools with technological infrastructure can use block-based programming tools and materials (D3), while those with limited technological infrastructure can use alternative computer-free activities (games, drama, paper-pencil activities, etc.)
The ITS curriculum specifies learning outcomes at every theme and level and describes them in detail. The Table 2 shows the number of learning outcomes at every theme and level (Ministry of National Education, 2018):

Table 2. Distribution of Outcomes by Themes in ITC Curriculum in Turkey

The name of the theme	*Competence level*	*Number of outcomes*	*Total number of outcomes*
Information Technologies	beginner level (D1)	4	17
	intermediate level (D2)	5	
	upper-intermediate level (D3)	3	
	advanced level (D4)	5	
Ethics and Security	beginner level (D1)	3	12
	intermediate level (D2)	3	
	upper-intermediate level (D3)	3	
	advanced level (D4)	3	
Communication, Research, and Cooperation	beginner level (D1)	2	12
	intermediate level (D2)	3	
	upper-intermediate level (D3)	3	

	advanced level (D4)	4	
Developing Products	beginner level (D1)	1	4
	intermediate level (D2)	1	
	upper-intermediate level (D3)	1	
	advanced level (D4)	1	
Problem Solving and Programming	beginner level (D1)	7	41
	intermediate level (D2)	11	
	upper-intermediate level (D3)	10	
	advanced level (D4)	13	
Total			86

Each learning outcome was assigned a code specifying the course code, theme no, level no, and the number of learning outcomes. For example, "IT.2.D4.3" refers to the "Information Technologies" course with the theme no "2," level no "4," and three (3) learning outcomes. The theme of "Problem Solving and Programming" has the highest number of learning outcomes. The themes of "Information technologies," "Ethics and Security," and "Communication, Research, and Cooperation" have a higher number of D4 learning outcomes than the others. The learning outcomes are written in the form of statements addressing teachers who may observe those outcomes in students. The curriculum has a total of 86 learning outcomes.
Table 3 shows the different outcomes for different levels. As can be seen in the table, these outcomes differ according to the level they are in.

Table 3. Learning Outcomes from Different Themes and Levels in ITS Curriculum in Turkey

	Themes				
	Information technologies	*Ethics and Security*	*Communication, Research, and Cooperation*	*Developing products*	*Problem Solving and Programming*
Learning Outcomes	IT.1.D1.1 Recognizing common technological tools	IT.2.D1.1 Respecting the rights of others in using technology	IT.3.D1.1 Appreciating the transformation of communication technologies	IT.4.D1.1 Using electronic waste to design toys	IT.5.D1.1 Designing simple everyday life process flows
	IT.1.D2.2 Explaining the relationship between simple hardware and software	IT.2.D2.1 Listing things to do to use information technologies safely	IT.3.D2.1 Explain the software curricula needed to use the Internet	IT.4.D2.1 Using electronic waste to design real-life models	IT.5.D2.6 Pseudo-coding to solve problems
	IT.1.D3.1 Looking into the contributions of information technologies to everyday life	IT.2.D3.1 Providing examples to illustrate disturbing behavior when online	IT.3.D3.1 Conducting simple online research	IT.4.D3.1 Using digital content to create stories	IT.5.D3.1 Explaining the concept of algorithm
	IT.1.D4.3 Distinguishing between the pros and cons of technology	IT.2.D4.3 Detecting fake accounts on social media platforms	IT.3.D4.3 Realizing that not every piece of information on the Internet is credible	IT.4.D4.1 Using digital content to make posters	IT.5.D4.1 Using block-based programming tools to develop accurate algorithms to achieve goals

TECHNOLOGY EDUCATION IN PRIMARY SCHOOLS IN SCOTLAND

This section investigated how primary schools in Scotland approached technology education. Scotland has a curriculum called "Curriculum for Excellence" (CfE) regulating students' learning activities and basic principles at all levels. The curriculum has four main objectives: turning students into (1) successful learners, (2) confident individuals, (3) responsible citizens, and (4) effective contributors. It aims to help students acquire certain attributes and capabilities. It addresses the concept of technology and aims to ensure that all Scottish students grow to be responsible citizens capable of using technology for learning purposes and evaluating environmental, scientific, and technological goals (Education Scotland, 2020a).

The Curriculum for Excellence consists of eight areas, one of which is "technologies" (Education Scotland, 2020b). Primary school technology education has been designed within the framework of the area of "technologies," which consists of three documents: "experiences and outcomes," "principles and practice," and "benchmarks," the last of which consists of statements for teachers on how to plan learning, teaching, and assessment effectively. "Technologies" is considered an indispensable curriculum area for Scotland's economic well-being (Education Scotland, 2020c). The curriculum involves practical and work-related activities to transform students into creative individuals with technological skills, knowledge, understanding, and attributes. The curriculum specifies technological education goals as follows (Education Scotland, 2020c):

Learning in the technologies enables children and young people to be informed, skilled, thoughtful, adaptable and enterprising citizens, and to:

- develop understanding of the role and impact of technologies in changing and influencing societies
- contribute to building a better world by taking responsible ethical actions to improve their lives, the lives of others and the environment
- gain the skills and confidence to embrace and use technologies now and in the future, at home, at work and in the wider community
- become informed consumers and producers who have an appreciation of the merits and impacts of products and services
- be capable of making reasoned choices relating to the environment, to sustainable development and to ethical, economic and cultural issues
- broaden their understanding of the role that information and communications technology (ICT) has in Scotland and in the global community
- broaden their understanding of the applications and concepts behind technological thinking, including the nature of engineering and the links between the technologies and the sciences
- experience work-related learning, establish firm foundations for lifelong learning and, for some, for specialised study and a diverse range of careers.

The curriculum places particular emphasis on the "technologies" area and stipulates that teachers approach the area from an interdisciplinary perspective and provide students with different learning activities based on individual and local characteristics. The curriculum includes the themes of "technological developments," "effective use of information and communication technology to enhance learning," "business," "computing science," "food and textile technology," and "craft, design, engineering, and graphics." When addressing these themes, teachers should consider social, economic, and ethical factors and sustainability and plan their lessons accordingly. The goal of the themes is to help students develop knowledge, skills, attributes, and capabilities related to 13 concepts or areas, which are a broader expression of the themes:

- Awareness of technological developments (Past, Present and Future), including how they work.

- Impact, contribution, and relationship of technologies on business, the economy, politics, and the environment.
- Using digital products and services in a variety of contexts to achieve a purposeful outcome
- Searching, processing and managing information responsibly
- Cyber resilience and internet safety
- Understanding the world through computational thinking
- Understanding and analysing computing technology
- Designing, building and testing computing solutions
- Food and textile technologies
- Designing & constructing models/products
- Exploring uses of materials
- Representing ideas, concepts and products through a variety of graphic media
- Application of Engineering

Students who receive technology education based on the curriculum are expected to acquire the following knowledge and skills:

- knowledge and understanding of the key concepts in the technologies
- curiosity, exploration and problem-solving skills
- planning and organisational skills in a range of contexts
- creativity and innovation
- skills in using tools, equipment, software, graphic media and materials
- skills in collaborating, leading and interacting with others
- critical thinking through exploration and discovery within a range of learning contexts
- discussion and debate
- searching and retrieving information to inform thinking within diverse learning contexts
- making connections between specialist skills developed within learning and skills for work
- evaluating products, systems and services
- presentation and communication skills.
- awareness of sustainability

The curriculum is believed to contribute to the “Skills for Scotland” project prepared by the Ministry of National Education to specify the skills learners are expected to develop. Therefore, the curriculum is based on applied education to help students develop the skills they need in business life. The goal of technology education is to ensure that students develop the following skills:

- curiosity and problem-solving skills, a capacity to work with others and take initiative
- planning and organisational skills in a range of contexts
- creativity and innovation
- skills in using tools, equipment, software and materials
- skills in collaborating, leading and interacting with others
- critical thinking through exploration and discovery within a range of learning contexts
- discussion and debate
- searching and retrieving information to inform thinking within diverse learning contexts
- making connections between specialist skills developed within learning and skills for work
- evaluating products, systems and services
- presentation skills

The curriculum also elaborates on what approaches teachers should adopt to help students develop those skills. According to the curriculum, students’ experience with technology and learning outcomes should appeal to their entrepreneurial drive and encourage them to work and develop practical products because this is how they can learn better. Teachers should incorporate different approaches and allow students to work alone or in teams to enrich their experience. The curriculum states that experiences and learning outcomes should promote out-of-school learning. It also stipulates that teachers focus on problem-solving and collaborative and practical activities to measure and evaluate learning in the "technologies" area. Those activities should determine how well students develop technological skills and understand and use technological concepts. Teachers should monitor progress on a daily basis and choose activities that allow students to put their knowledge and skills into practice. Assessment and evaluation approaches should focus on how students incorporate their knowledge and skills into work and everyday life. The curriculum adopts a holistic approach and relates the "technologies" area to the other areas. It also shows teachers how to do it. The curriculum also has statements that explain to teachers how to develop in-service learning activities and dispel the technology-related misconceptions that students may have.

The curriculum organizes the learning outcomes under different topics. It basically has five subject areas divided into subheadings referring to the content of subject areas. It addresses not only information technologies but also technologies used in different fields. It has a spiral structure in which the subject areas are the same at all grade levels evolving from simple to complex in content. The Table 4 shows the subject areas and their content.

Table 4. Curriculum Organisers and Experiences and Outcomes for Planning Learning, Teaching and Assessment in Technologies Curriculum in Scotland

Curriculum Organisers	Experiences and Outcomes for planning learning, teaching and assessment
Digital Literacy	Using digital products and services in a variety of contexts to achieve a purposeful outcome
	Searching, processing and managing information responsibly
	Cyber resilience and internet safety
Food and Textile	Food and Textile
Technological Developments in Society and Business	Awareness of technological developments (Past, Present and Future), including how they work.
	Impact, contribution, and relationship of technologies on business, the economy, politics, and the environment.
Craft, Design, Engineering and graphics	Design and constructing models/product
	Exploring uses of materials
	Representing ideas, concepts and products through a variety of graphic media
	Application of Engineering
Computing Science	Understanding the world through computational thinking
	Understanding and analysing computing technology
	Designing, building and testing computing solutions

The learning outcomes in the curriculum are written in the tone and style of students to raise their awareness of their own learning. A separate document also contains statements intended to guide teachers for each outcome. Those statements show teachers what each outcome corresponds to in practice and what criteria to adopt to assess them. Each heading of each area has one to three outcomes, and each area has three to five outcomes. The number of outcomes ranges from 15 to 20, depending on the grade level. Each outcome is assigned numbers and letters indicating the area, grade level, subheading, and the number of outcomes, respectively. Some of the areas, content, and outcomes, and related statements are as follows:

Table 5. Outcomes and Benchmarks to Support Practitioners' Professional Judgement in Technologies Curriculum in Scotland

Outcomes	*Benchmarks to support practitioners' professional judgement*
TCH1-01a: I can explore and experiment with digital technologies and can use what I learn to support and enhance my learning in different contexts.	Communicate and collaborate with others using digital technology for example, email, Glow or other platforms. Opens and saves a file to and from a specific location. Identifies the key components of frequently used digital technology and whether it is a piece of hardware or software. Uses digital technology to collect, capture, combine and share text, sound, video and images.
TCH1-04b: I can use a range of tools and equipment when working with textiles.	Uses a range of equipment when working with textiles, for example, scissors, rulers/tape measures, bodkin and wool.
TCH1-05a: I can explore the latest technologies and consider the ways in which they have developed.	Identifies changes to technologies for example, televisions and mobile phones.
TCH1-09a: I can design and construct models and explain my solutions.	Creates and justifies a solution to a given design challenge considering who is it for, where and how will it be used Uses appropriate tools and joining methods to construct a model.
TCH1-14b: I understand how computers process information.	Demonstrates an understanding that computers take information as input, process and store that information and output the results.

DISCUSSION AND CONCLUSION

This study focused on curricula to compare the technology education offered by primary schools in Turkey and Scotland. Primary schools in Turkey employ the Information Technologies and Software (ITS) course curriculum, while those in Scotland employ the Curriculum for Excellence (CfE). The results pointed to some similarities and differences between the two curricula. The first thing they have in common is that they both set their goals clearly. However, there is a difference in content between them. For example, the ITS curriculum sets the goals of acquiring problem-solving and computational thinking skills, using different logic structures, developing an understanding for designing algorithms, and programming to design games. However, CfE makes no mention of those goals. On the other hand, the goals of CfE focus on helping students develop an understanding of technologies and emphasize the local and global impact of those technologies. In other words, CfE aims to raise students' awareness of the global impacts and benefits of technology. Unlike the ITS curriculum, CfE contains items to make students appreciate the environment and sustainable development and help them make informed choices about economic and cultural issues, and develop an understanding of the nature of engineering. Both curricula emphasize product development, ethical and responsible use of technologies, and learning by doing. Ergas (1987) categorizes the technology policies developed by countries into two: mission-oriented and diffusion-oriented. According to him, countries with mission-oriented technology policies (England, America, France, etc.) regard technological innovations and technology education as a means of achieving national goals. On the other hand, those with diffusion-oriented technology policies (Germany, Switzerland, Sweden, etc.) focus on expanding technological capabilities to the industrial structure to promote adaptation and transforming students into employees in the technology sector. Based on the results concerning the "goals" section of both curricula, we can state that Turkey undertakes diffusion-oriented technology policies, while Scotland undertakes mission-oriented technology policies. This may be the major difference between the two curricula.

The second result is that there is a curriculum for each course in Turkey, while CfE is organized based on learning areas. There are structural differences in technology-oriented courses or learning areas between the two curricula. The ITS curriculum focuses directly on technology education at the primary school level. Based on the thematic approach, the ITS curriculum is a single-document curriculum that varies across grade levels. All teachers and educational professionals can use it. On the other hand, CfE addresses subjects and concepts (deemed appropriate for primary school children the earliest) grouped under specific learning areas, one of which is "technologies." The technologies curriculum area is a three-document curriculum that is one for all grade levels. The three documents focus on "experiences and outcomes," "principles and practice," and "benchmarks (for teachers)." Based on the results, we can state that the ITS curriculum and CfE have similar content, although they have been developed in different ways.

Each curriculum groups its content under subject headings. The curricula are similar in this respect, but they differ in the subject content. The ITS curriculum focuses on information technologies and software but does not address technological developments in other areas or knowledge and skills related to those areas. The Science and Social Sciences courses discuss the technological developments in other areas. However, rather than elaborating on technological topics, they only intend to raise students' awareness. On the other hand, CfE encompasses a broader spectrum than the ITS curriculum because it provides information on areas where technology is used effectively, such as digital literacy, food and textile technology, craft, design, engineering, and graphics. Therefore, we can state a significant difference in technology education between primary schools in Scotland and Turkey. There used to be a course called "Vocational Training" offered by primary schools in Turkey. Its content was similar to that of the "food and textile technology" and "craft" areas of CfE. However, the "Vocational Training" course was removed with the amendment made to the curriculum in 2005 and replaced by the "Technology and Design" course covering the design-related subject areas of CfE. After a while, the Technology and Design course has been replaced by the Information Technologies and Software course. Science is the course that discusses engineering-related subjects. The fact that the ITS curriculum focuses on information technologies and software says two things about Turkey: first, it pays particular attention to those areas, and second, it aims to train expert educators who can provide students with in-depth information and help them develop skills in the field of information technologies and software. The ITS curriculum helps students develop problem-solving and computational thinking skills, use different logic structures, acquire an understanding of algorithm design, and program through game designs. It also focuses on goals that require more profound knowledge and skills in those areas. These results show that the ITS curriculum intends to transform students into individuals with deeper knowledge and skills in those areas. On the other hand, CfE has a broader spectrum of subjects that address basic knowledge and skills in multiple areas. With the Curriculum for Excellence, Scotland intends to provide primary school students with information on different technological areas and help them develop related skills in order to turn them into individuals equipped with the necessary attributes of today. Pavlova (2012) also states that technology education in Scotland is based on the basic qualifications model to encourage students to develop transferable personal skills. Dakers (2005) argues that today we are confused about the concept of technology because we used to define it more clearly before it has been broken down into subdimensions (nanotechnology, food technology, etc.). He adds that this confusion manifests itself in technology education curricula. According to Fagerberg (2016), innovations in non-technological fields (climate change, aging, etc.) are becoming more prominent, affecting the education curricula. The points emphasized by Fagerberg (2016) and Dakers (2005) may account for the difference we observed between the ITS curriculum and CfE. Another reason may be the meaning the two countries attribute to basic education, in general, and technology education, in particular.

Both curricula adopt a similar approach to help students develop certain skills. The "qualifications" section in the ITS curriculum is the first to address the concept of technology.

That section focuses on skill sets needed in everyday and work life. Turkey conducted a study on the topic and developed the “Turkish Qualifications Framework” action plan. Based on the framework, it added the “qualifications” section to the curriculum encompassing all courses. Two of those qualifications are directly related to technology. Similarly, Scotland undertook the “Skills for Scotland” project to determine the skills for students to develop and added those skills to the area curricula. Although both countries followed a similar path to determine the target skills, they ended up focusing on different skills. The ITS curriculum targets four fundamental skills: computational thinking, reasoning, problem-solving, and designing algorithms. Of those skills, CfE focuses only on problem-solving and targets different skills. Some of the skills (software use and presentation skills) are directly related to technology. Most CfE skills are life skills, while most ITS curriculum skills are related to information technologies. The global trend in technology education today is not solely about acquiring knowledge and skills but is also about operating all factors (attitudes, emotions, etc.) to acquire qualifications needed to solve complex problems in different contexts (De Vries et al., 2016). According to the model developed by Gibson (2008), technological competence consists of knowledge, values, and problem-solving skills brought together within the framework of the right conceptual knowledge. Therefore, we can state that both ITS curriculum and CfE incorporate knowledge, skills, and values into technology education to promote students' multidimensional development.

Both curricula group the target goals under certain learning outcomes presented with codes. Each code in the ITS curriculum refers to the course name, theme no, learning level, and outcome no. On the other hand, each code in CfE refers to the learning area, grade level, the subheading of the subject area, and outcome no. Both curricula have statements intended to present the learning outcomes to teachers. Those statements assist teachers in evaluating learning. According to Rasinen et al. (2009), the freedom granted to teachers to plan their lessons causes them to overlook technological developments. Therefore, the researchers maintain that it is useful to predetermine learning outcomes and add statements about them to curricula to guide teachers. They have concluded that technology education is adversely affected by teachers not receiving adequate in-service training on technology education. At this point, we recommend that both countries provide teachers with in-service training on technology education on a regular basis.

The Curriculum for Excellence has 15-20 learning outcomes, while the ITS curriculum has 86, indicating that the latter focuses on a large number of learning outcomes. The Curriculum for Excellence has several outcomes for each area but elaborates on those outcomes. Most learning outcomes in the ITS curriculum are under the theme of “Problem Solving and Programming,” while CfE does not concentrate on any particular area.

There are similarities and differences in the learning-teaching approach to technology education between Turkey and Scotland. Both curricula suggest an interdisciplinary approach to technology education. According to Jarvinen and Rasinen (2015), one of the goals of technology education should be to identify problems in other disciplines and find technological solutions. However, they also argue that teachers do not know how to adopt an interdisciplinary perspective to deliver technology education. Technology transforms teachers' roles, and therefore, teacher training programs should emphasize technology education (Andersson, 2006). Academics should transfer their technological knowledge to undergraduates to turn them into effective teachers equipped with the necessary skills (Ritz, 2012). Teacher training programs should inform preservice teachers why technology is used in class and how to do it (Başal, 2015). Therefore, authorities should take these factors into account and revise teacher training policies accordingly. What is more, educational institutions should provide teachers with training on approaching technology education from an interdisciplinary perspective.

The curricula are also similar because they both aim to encourage students to put theory into practice. Both countries adopt an operational learning-teaching approach to technology education and aim to enable students to use learning outcomes in everyday and work life. The literature also corroborates the benefits of the operational learning-teaching approach. Many educational theorists, such as Dewey and Froebel, recommend applied education (McLain, Irving-Bell, Wooff & Morrison-Love, 2019). Learning by doing is at the center of technology education (Rasinen et al., 2009) because it is concerned with finding ways to develop technological environments that respond to students' needs (de Vries, 2009). According to Compton et al. (2011), technological literacy refers to understanding the relationship between the functionality and form of technology. One way to help the young understand the nature of technology is by engaging them in developing new and evolving technologies (Barlex, 2011). Therefore, it is crucial to ensure that students learn by using technological tools and materials. Research shows that there is a strong connection between students' manual skills and the way they learn technology (Jarvinen & Rasinen, 2015) and that students prefer learning by doing to theory-based learning when it comes to technology education (Jarvinen & Rasinen, 2015; Hašková & Dvorjaková, 2016). Therefore, one of the strengths of the curricula is that they provide students with the opportunity to learn about and interact with various technological tools and materials (Jablansky, Alexander, Dumas, & Compton, 2019). Our results show that both Turkey and Scotland have a similar understanding in that regard.

Technology education should be based on effective and practical curricula that ensure students' safety (Mondal, 2021). Therefore, we can state that it is of paramount importance in technology education to ensure that students adopt ethical and responsible behavior. Both ITS curriculum and CfE emphasize the effective/efficient and ethical/responsible use of technology.

Both ITS curriculum and CfE pay particular attention to students' characteristics and have appropriate content. The Curriculum for Excellence has statements that guide teachers on how to go about applying the curriculum based on students' characteristics, but it contains no statements regarding which learning outcome to emphasize depending on which individual characteristic. On the other hand, the ITS curriculum emphasizes that issue and divides the learning outcomes into four levels. Teachers executing the ITS curriculum are at liberty to decide which learning outcome to present to which student, depending on student characteristics and cooperation with parents. The same approach is adopted by Finland because it increases engagement and encourages students to find creative solutions to problems during learning (Rasinen et al., 2009). Given that every student is unique, we think that that approach is likely to receive positive feedback because it takes individual characteristics into account.

Technology education requires infrastructure and tools and materials. Inadequate infrastructure and lack of tools and materials hinder technology education. According to Hašková and Dvorjaková (2016), the approach to technology education depends on the school facilities and technical equipment available. Therefore, the stronger the infrastructure, the more different and effective methods teachers can use to deliver technology education. Some teachers in Turkey work in schools with inadequate infrastructure. Therefore, the ITS curriculum provides them with alternatives regarding the approach they can adopt and the activities they can use under those circumstances. On the other hand, CfE gives no such guidance. This can be accounted for by the difference between the level of confidence Turkey and Scotland have in their infrastructures. In order to reveal different dimensions of technology education, comparative education studies that address different countries can be suggested.

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