

# The Integration of Information And Communication Technologies For Education: Comparative Analysis of Turkey And Singapore\*

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### ABSTRACT

The integration of information and communication technologies into education has become increasingly important in recent years. Especially with the revolution of industry 4.0, digital transformation in education has accelerated. Therefore, this transformation has shaped the educational policies of many countries. National and international economic or political environments, educators, academics, students, parents, society and scientists are effective in determining these policies. As a result, they have different expectations about how the integration process should be in education. This diversity reveals the necessity to address all these differences in a holistic way in order to better understand the integration process and its effects.

In this study, it was aimed to reveal the purpose, policies and practices of information and communication integration in education, its effects and criticisms directed to the effects compared with Turkey and Singapore. The level of development of the countries and the results of Pisa (The Program for International Student Assessment) were effective in sample selection. For this purpose, ICT integration aims and policies of both countries, changes in ICT practices in the process, educational reforms, important implementations and criticisms of the process were discussed.

As a result of the document reviews, ICT integration in education was analyzed in three different periods. It can be said that policies followed during the period of 1980-1990 are aimed at raising awareness of the ICT skills of the society, developing ICT skills in the period of 1990-2010, and raising individuals who use ICT skills in the fields of environmental, social and economic fields in 2010 and beyond.

However, there are findings and discussions about the impact of ICT integration in education on the differentiation of countries subject to comparison, especially in PISA results. According to all these results, the reflection of ICT integration in education in societies has been addressed and made several suggestions for educational policies of countries.

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## **INTRODUCTION**

General purpose of comparative education analysis; The aim of this course is to compare education systems applied in various societies, countries, regions and historical periods according to various criteria. In the comparison, common and useful aspects are determined and it is aimed to give direction to education, theory and practice, education policy, education planning and innovation studies. (Demirel, 2012). As a result of the studies on education systems, countries find the opportunity to make changes by seeing the strengths and weaknesses of their education systems. Therefore, comparative education studies are seen as an important field of study in order to recognize the educational systems of countries comparatively.

The integration of information and communication technologies (ICT) into education has been an important issue on the agenda of educational policies, practices and educational technology since the mid-eighties. In the literature, this process is discussed in a very wide way with different educational and social dimensions. However, two important problems are encountered in integration research.

The first of these problems is that scientific studies are often inadequate to present the integration process in a holistic way. Today, in different regions of the world for various economic, social and educational purposes; affecting education systems from policy development processes to teaching activities, from the meanings attributed to education to the roles and responsibilities of school environments in almost all aspects; In addition, ICT integration processes are carried out in education which creates various sociocultural effects. However, due to this broad and complex nature, scientific studies on integration activities can concentrate on a limited set of variables at school or district level rather than revealing the general and multidimensional situation in the world. In a very limited number of studies conducted by international organizations in particular, although ICT integration processes on a country-by-country basis are addressed, ranging from educational policies to classroom practices; they focus on the change in policies that are often envisaged in a set of target variables and cannot provide in-depth and contextual findings on the actual impacts and effectiveness of the process.

The second problem is that most of the integration policies and practices as well as the scientific research produced in this field are based on positive expectations without considering critical approaches to this process. However, there are important criticisms about the philosophy, purpose, implementation method, educational and social effects of ICT integration. They should not be taken into consideration, and the resulting short and long-term effects cannot be fully and accurately interpreted; therefore, the problems in the education system cannot be put forward, improved and managed correctly (Lewis, 2007; Halpin, 2001; Apple, 1999). These problems include ICT integration in education, policies developed in different societies; thus, the implementation of the educational system components (such as school ICT infrastructures, curriculum, learning-teaching activities, staff training / development processes, the functioning of the school institution and stakeholder roles and responsibilities); These activities are discussed with a holistic perspective that covers the impacts of scientific researches and criticisms against all these processes.

In the literature, two technological advances have been placed at the source of the integration process. The first is that computer applications in education, especially since the mid-1980s, provide opportunities for creating more effective and efficient learning-teaching environments. The second is the development of Information Technology and knowledge economy skills in economic and social life with the second reflection of the twentieth century, and the educational reform efforts that derive their source from the development of these skills

(Hepp et al., 2004; Molnar, 1997).

However, both the evolution of the integration process over the past century and the different perspectives that emerged in this process seem to be closely related to the philosophical approaches developed over the effects of technology on humanity's future, development policies and their reflections on education systems. In order to better understand the issue, it is thought to be useful to focus on the educational use of ICT resources from the beginning of the twentieth century to the present.

This diversity reveals the need to examine all these differences together and in a holistic way in order to understand the integration process and its effects. In this study, training in ICT integration objectives, policies, and practices, the effects revealed by the integration of Turkey and Singapore countries aimed to uncover the comparison. The level of development of the countries and the results of Pisa (The Program for International Student Assessment) were effective in sample selection. For this purpose, ICT integration aims and policies of both countries, changes in ICT practices in the process, educational reforms, important implementations and criticisms of the process were discussed.

In particular, examinations comparing the achievement of students in different countries are an important source for comparative education studies. Some of the international projects organized by the OECD assess the student achievement of countries and the results of these assessments show how the countries are in terms of student achievement. PISA (Program for International Student Assessment), which is one of these implementations and is carried out every three years since 2000, evaluates 15 age group students in OECD member countries and other participating countries (approximately 90% of the world economy) according to various criteria (MoNE, 2013). Such international status determination studies, which are applied periodically in the field of education, provide wide opportunities for researchers to evaluate the performance of students coming from similar and different education systems in a common assessment framework (Bilican, Demirtaşlı & Kilmen, 2011).

### **OVERVIEW OF ICT INTEGRATION IN EDUCATION**

Beginning in the mid-1980s, research and project-based teaching practices began to come to prominence, where students discovered problems in real life and produced solutions through computers. In these years, it is seen that computer applications in education started to spread rapidly all over the world, especially in USA and UK. The proportion of schools with computer systems, which was 18% in the US education system in 1981, approached 100% in the mid-1990s. In 1981, 16% of schools used computers for teaching purposes, while in 1991 this ratio increased to 98%; the ratio of students per computer, which was 1/125 in schools in 1981, reached 1/18 in 1991 (Cuban, 1994). While the number of computers in schools in England did not exceed a few in 1980, it increased to 100 computers per school by the 1990s. The ratio of students per computer which was 1/120 in primary education and 1/60 in secondary education in 1985; In 1990, it reached 1/40 in primary education and 1/20 in secondary education (Twining, 2002).

Developments in the 1970s and 1980s have removed computer systems from teaching machines or systems that operate as standard; teacher, school administrator or student by means of individual learning or different educational purposes. With the 1980s, the rapid spread of computing in industrial and social areas brought about the inclusion of ICT skills in basic professional skills. This has placed a new responsibility on the education system, such as "educating tech-literate individuals" (Bardakçı ve Keser, 2017). In the 1980s, microcomputer technology spread rapidly in schools and classrooms, but not enough educational writing could be developed. This situation highlighted the necessity of teachers to develop the teaching

software they need and brought the necessity of increasing computer competencies with pre-service and in-service trainings (Schifter, 2008). With the expansion of microcomputer technology in the early 1980s, the word “computer” in the concept of computer applications in education, which describes the use of the facilities offered by computers in educational policies as well as in educational applications at school and grade level, is used to describe the use of the data storage and processing facilities offered by computers in educational settings in parallel with technological developments in the late 1980s “Information Technology/ Information and communication technologies (ICT)” (Pelgrum and Law, 2003).

Since the early 1990s, the computer and internet offered multimedia, video and audio transmission, simulation, access to different information and human resources, as well as technologies such as laser discs have enabled the development of learning environments envisaged by the constructivist learning understanding by using ICT resources. In the 2000s, blogs, wikis, video and audio sharing environments, simultaneous and asynchronous online communication facilities and mobile technologies have been involved (Wheeler S, Yeomans and Wheeler D, 2008).

By 2007, the United Nations Educational Scientific and Cultural Organization (UNESCO) defines the concept of ICT in a very wide range of terms: The term information and communication technologies (ICT) describes the forms of technology employed for the purpose of transmitting, processing, storing, creating, presenting, sharing or changing information electronically. This broad definition of ICT includes equipment and services such as radio, television, video, DVD fixed or mobile telephones, satellite systems and computers, computer networks, as well as video-conferencing, e-mail and blogs related to these technologies (UNESCO, 2007). From the mid-1990s to the 2010s, both in the literature and in reports and reviews published by various national or international initiatives, it is seen that information technologies and information and communication technologies concepts are emphasized during the integration process. Law and Plomp (2003) also point out that the two concepts can be used in the same sense and characterize ICT resources in various texts; It also states that similar synonyms can occur for concepts such as computer literacy-ICT literacy, ICT integration in education-ICT integration in curriculum.

Today, it is possible to talk about three basic functions of instructional, administrative and sociocultural within the education system of ICT. Instructional practices were initiated in the 1960s with the aim of increasing effectiveness and efficiency in behaviorism-based teaching processes, and by the mid-1980s, a student-centered transformation in teaching strategies and methods was underway. Sources such as multimedia applications, access to information, online learning and social interaction that ICT resources have offered since the 1990s; it is aimed to both support and make traditional teaching processes more effective and to design and develop instructional environments by using constructivist approach (Leionen, 2005).

ICT resources have three levels of influence in the education system: classroom, school and educational system.

At the class level; the learning-teaching activities, except for parent-teacher-student interaction; at school level; It is used for keeping student records, increasing efficiency in administrative processes, providing fast and continuous communication and information flow with other school and ministerial units, and organizing school-environment relations. At the system level, it affects a wide range from the development of educational policies to the structuring of curricula, the determination of teacher competencies and the pre-service and in-service training processes of education system employees. The use of ICT resources in education affects the thinking, attitudes and competences of students, teachers, administrators and parents regarding these technologies. Thus, ICT resources have an impact on the social and cultural

structure of the school environment and therefore of the general public.

## **METHOD**

### **Research Model**

The research was carried out in accordance with the holistic multiple case study design, one of the qualitative research designs. Case studies are research approaches in which one or more events, environments, programs, social groups or other interconnected systems are examined in depth (McMillan, 2000). In the holistic multi-state pattern, there is more than one case that can be perceived as a whole by itself. Each situation is handled in its entirety and then compared with each other (Yıldırım & Şimşek, 2006). In this research, qualitative research design of the holistic multiple case study design chosen because research the problem in line with relevant countries (Singapore and Turkey) is compared periodically about the integration of ICT policy in the education system.

### **Method**

This study was used in comparative historical analysis method, because it examines the ICT integration process in the history of Singapore and Turkey's education. Comparative historical research is a method that emphasizes the process over time and uses a systematic and conceptualized comparison (Mahoney & Rueschemeyer, 2003). This method involves examining the situations of societies or other social units according to some facts and comparing them with each other. It is a comparative analysis because it allows to discover common patterns that emerge in different times and places and is a qualitative method of discovering patterns in the historical processes of different cultures (Babbie, 2013; 2015).

### **Sample Selection**

When the integration of ICT into education projects carried out by international organizations in different countries is examined (Exp. Second Information Technology In Education Study-SITES, World Links for DevelopmentWorLD), socioeconomic as a grouping criterion in country selection development levels.

Scientific researches about the effects of the integration process in different countries also group countries according to their socioeconomic level and tend to differentiate between these two groups (See Plomp, Pelgrum and Law, 2007; Plomp and Voogt, 2009). As a result of his studies dealing with ICT integration projects in international education, it shows that there are significant differences in the policies and practices towards ICT integration in developed and developing countries. From this point of view, socioeconomic development level is considered as a basic criterion in country selection.

When the World Bank Country Classification is examined, according to the socioeconomic ratio GDP (per capita); low income level (\$ 975 and less), lower-middle income level (\$ 976-3855), upper-middle income level (\$ 3856-11905) and high income level (\$ 11905 and above). However, low, low and middle income countries are grouped under two socioeconomic sets as "developing" and "developed" countries (WorldBank, 2010).

As a second criterion in country selection, PISA (The Program for International Student Assesment) results.

As a third criterion, it is considered that the study countries should be selected from different geographical regions. Accordingly, the United Nations World Countries Macro-geographical Classification (United Nations-UN, 2010), the World Bank Classification of Country Groups by Developing Countries Regions (WorldBank, 2010a), and various researches in the ICT integration process with distinctive features of countries (UNESCO , 2003).

## Data Collection

Document analysis, one of the qualitative data collection methods, was used to obtain the research data. Document analysis involves the analysis of written materials containing information about the cases and cases targeted for investigation (Yıldırım & Şimşek, 2006). After reviewing the relevant literature for document review, the criteria that can be used to compare ICT integration processes in education of countries were determined and data were collected within this framework. In the process of data collection, data obtained from the official institutions of the countries (Ministries of National Education, National Education Institutions, Universities, etc.) and international research reports were used.

Review dimensions defined in the pre-review framework of online search engines and academic databases are discussed. In this context; "ICT in (education, educational system, instruction, curriculum, teacher education, schools), ICT integration in (education, educational system, instruction, curriculum, teacher education, schools), educational computing, (ICT, ICT in education, national education) policies, ICT implementations, ICT infrastructures, ICT education, ICT (teacher, specialist, teacher education), ICT (curriculum, instruction, lessons, national curriculum" online searches for review countries were made using keywords such as. For each country, the web sites of the National and State Education Ministries and ICT integration initiatives in education were visited.

Table 1 shows the scientific studies (thesis, article, book section report), documents and reports published by the government, institutions and organizations and the distribution of corporate web pages by country.

**Table 1:** Distribution of documents for the countries covered by the review

Development Levels	Countries	Scientific Research	Political Texts, Institutional Review And Reports	Corporate Web Pages.	Total
Development Countries	Singapore	17	32	18	67
Developing Countries	Turkey	38	42	13	93
<b>Total</b>		55	74	31	160

Document studies for selected countries were carried out between April 2018 and May 2019. As a result of the screening studies, 160 documents were reached to be handled in the research. Table 1 shows that 55 (34.4%) of these documents were scientific research, 74 (46.3%) were political texts, institutional review and reports, and 31 (19.3%) were corporate web pages.

## Data Analysis

The data obtained in the study were analyzed by descriptive analysis method. The criteria used to compare ICT integration processes in countries' educational systems were determined by the researchers by searching the related literature. Singapore and Turkey's current ICT integration processes were examined and compared against the criteria specified later. The criteria used in the comparison of the countries concerned are; ICT Integration In Education Objectives, Policies And Practices.

When the ICT integration process in education is examined, it is seen that there is a transformation in the meaning, integration policies and practices of ICT and information society, which are loaded into the integration process in parallel with the transformation experienced in the human resource needs of the information society. In this respect, it is thought that the effects of integration and policy and implementation situations in different countries with changes over

time may reveal more meaningful and useful findings.

## **FINDINGS AND COMMENTS**

In this section, ICT integration in education of selected countries is compared in terms of objectives, policies and practices

### **ICT Integration in Education Objectives, Policies and Practices: Turkey-Singapore**

#### **Turkey**

It is observed that the First policies for the use of new technologies in education and training processes in Turkey began to be developed in the early 1950s (Elgin, 1984). Within the educational policies of the 1950s and 1960s, new technologies stand out as three key concepts. These are the integration of new technologies such as visual and audio education tools and related radio and television into teaching environments. To this end, a new organization within the Ministry of National Education and an improvement in the programs of teacher training institutions (MoNE, 1962; MoNE, 1963 Reisoğlu et. al., 2013).

In the 1970s, it was observed that the new technology applications, which were handled within the educational policies, expanded into the distance education, public education and higher education processes; Since the middle of the period, it has been seen that elements such as the establishment of Training Tools Laboratories have been taken into consideration in order to regulate the use of audiovisual sources on a school basis (MoNE, 1970; Milli Eğitim Reformu Stratejisi, 1972; MoNE, 1974;).

In the 1980s, it is seen that new technologies are a fundamental necessity in the educational environment and especially the teacher education and educational technology specialization field is emphasized within Turkish educational policies (MoNE, 1982). The use of computers in education within Turkish educational policies begins in the 1980s. In this period, two areas of interest in new technologies within the policies are computer teaching and computer aided teaching (Milli Eğitim Gençlik ve Spor Bakanlığı-MEGSB, 1984). In 1984, Computer Education Expertise in Secondary Education Commission was founded (Keser, 2011). By the end of the 1980s, new technologies had become an area of emphasis in Turkish education policies. Indeed, one of the seven main topics discussed in the XII. National Education Council is "new technologies in education" (MoNE, 1988). In 1989, The Ministry of National Education (MONE) made an agreement with 9 companies and the companies executed computer assisted instruction (CAI) implementations in 58 schools (Çetin and Solmaz, 2017).

In 1990, the Ministry of National Education carried out the National Education Development Project supported by the World Bank. For this project, the World Bank, 90.2 billion US dollars was donated to Turkey. In 1991, 5121 computers were purchased within this scope. In this pre-project, the 11-12% of computer labs in secondary schools in Turkey while this ratio increased by up to 30%. Within the scope of the project, approximately 250 teachers received training on computer and educational software (Uşun, 2004).

In the 1990s, the center of integration policies is to develop the skills of all citizens towards new technologies and the information society (MoNE, 1990). A significant change in ICT integration processes in education in the 1990s was the beginning of cooperation with the World Bank and the development of various joint projects (See Alkan, 1998; Akkoyunlu and Orhan, 2001; Turkmen and Pedersan, 2002).

In the 1990s, the "Information and Information Security Advanced Technologies Research Center" (BİLGEM) was established within TÜBİTAK (The Scientific And Technological Research Council Of Turkey) in order to support the integration of schools in infrastructure and personnel

development processes (Özar and Aşkar, 1997). By 1993, “curriculum Laboratory Schools (MLO)” and “computer trial schools” projects realized in connection with ICT integration in education have emerged as an important application dimension (EARGED, 1999).

In the mid-1990s, it was seen that the transition to the information society and the development of ICT and 21st century skills within the national policies started to be prioritized. Indeed, "VII. The five-year development plan" focuses on the effective recruitment of ICT resources in the education and training processes. (DPT, 1996). When national education policies were examined in the late 1990s, the expansion of technology education to all levels of education from primary to higher education; In addition, it is seen that at the secondary level, students are taught about 21st century skills as well as providing a “technology culture”. As a matter of fact, ICT integration is envisaged in vocational and technical education processes. Accordingly, vocational secondary education process will be restructured considering ICT and contemporary distance education opportunities. (MoNE, 1999).

In the academic year 1997- 1998, as part of Improving Education Project 2000 that costed 6 billion dollars, MONE determined that computer labs would be constituted to at least two primary schools in each city and country. In the project it was planned that 70000 schools connected computer network (Çetin and Solmaz, 2017).

An important development in the 1990s was the ICT field courses, which were recognized at the basic level of Education. In the Turkish national education system, there are ICT courses in the basic education programs in the secondary education program from 1991-92 and in the primary education level from 1998. In the 1991-1992 school year, secondary schools were ranked 10th and 11th. an elective “Science and technology I” Course program was prepared to be taught in their classes and pilot application was initiated. By the 1995-1996 school year, 10. and 11. it is included in the curriculum of elective “Information Technology I-II” courses to be taught in classrooms. 1100 computers were distributed at least one high school in each city in 1995 (Engin, Tösten & Kaya, 2010).

Since 1998, “computer” courses have been included in the elementary programs as a course that can be selected as one or two hours in the middle schools. In 1998, Computer and Instructional Technology Education (BÖTE) departments were opened within the faculties of education in order to train computer teachers to primary and secondary education institutions (Deryakulu, 2008).

In 1998, a protocol was signed between the Republic of Turkey and the World Bank. Under this protocol, hardware and software were purchased in schools. Afterwards, teachers in schools received hardware and software training on ICT. (Akkoyunlu and Imer, 1998).

By the 2000s, it is seen that the national development strategies have been centred on their ability to produce, use, disseminate knowledge and lifelong learning skills in order to remain compatible with the changing environment (Pak, 2006). In the early 2000s, the two prominent concepts in integration policies were “education and the internet” and “information literacy”. In this period, education and internet orientation were recruited by ICT resources for the purpose of enriching the teaching environment from kindergarten to higher education process, increasing student-environment interaction and increasing student access to information; and the information literacy orientation focuses on increasing the ability of the society to benefit from information resources (DPT, 2001). In 2003, the "e-transformation Turkey Project" was implemented, which aims to move all social systems ' services to online environments and raise citizens to the level of competence to benefit effectively from the services. One of the eight sub-dimensions of the project is Education and Human Resources, which focuses on equipping the young population with the skills to meet the needs of the



knowledge economy (DPT, 2004; 2005).

An important agenda of Turkish education policies in the mid-2000s is the reorganization of basic education programs from a student-centered perspective. Based on eight key skills such as critical thinking, problem solving, scientific research, creative thinking, entrepreneurship, and effective use of information technologies and Turkish, ICT and ICT-based 21st century skills are at the center of the Turkish basic education program. An important agenda of Turkish education policies in the mid-2000s is the reorganization of basic education programs from a student-centered perspective. This transformation is based on eight basic skills such as critical thinking, problem solving, scientific research, creative thinking, entrepreneurship, effective use of information technologies and language. In addition, ICT and ICT-based 21st century skills are at the center of the Turkish basic education program with structural transformation (Turkmen and Pedersan, 2005).

In 2010, a new trend in integration policies started with the “Movement of Enhancing Opportunities and Improving Technology” (FATİH) project. The FATİH project focuses on two main objectives: improving school ICT infrastructures and equalizing access to information resources for students and teachers (MoNE, 2010). The FATİH project has five application dimensions (MoNE, 2013a):

1. Provision of hardware and software infrastructure
2. Providing and managing educational e-content
3. Effective use of bits in teaching programs
4. In-service training of teachers
5. Ensure conscious, safe, manageable and measurable use of ICT

When Turkey's integration of ICT in education policy situation during the period examined in 2010, is an important element Fatih project highlights. The project, which focuses on providing infrastructure and e-content on all classes, students and teachers, thus creating equal opportunities for access to ICT resources throughout the country, also envisages transformations in curricula and teacher training processes. FATİH also focuses on the safe and ethical use of ICT resources, monitoring and evaluation and R & D studies. An important feature of the term policies is that it focuses on the transition to project-based learning in teaching methods and strategies. In this context, an interaction and continuous development approach is recommended for students, schools and society.

This project will contribute to teacher-student and interactive whiteboard-tablet PC interaction, as well as effective use of knowledge and teaching in classroom management. In addition, the teacher will give homework to the students by sharing the materials with the students and will measure the learning levels of the students in a more controlled way. In total, 447,288 interactive whiteboards, 1,437,800 tablet PCs and 41,996 multifunction printers were distributed to 9052 schools. In addition, necessary infrastructure and internet access services were provided. A total of 424,250 teachers were provided with in-service trainings on the use of ICT and FATİH projects (Ateş, 2013; MoNE, 2007). In addition to these applications, there is an online platform for the content of the project. EBA (Education and Information Network) was designed by the General Directorate of Innovation and Educational Technologies as a social platform and offers secure and real e-content to teachers and students for different class levels (EBA, 2015).

**Figure 1:** Main Components of FATİH Project



In figure 1, within the scope of FATİH Project, integration applications are carried out in five basic dimensions: Provision of hardware and software infrastructure; providing and managing educational e-content; effective use of ICT in curriculum, in-service training of teachers; ensuring informed, safe, manageable and measurable use of ICT (MoNE, 2013).

### **Singapore**

ICT practices in Singapore schools started in the 1980s. When the ICT policies of Singapore in the first period are examined, it is seen that computers are considered as the tools to be employed in managerial processes in schools. However, it has been found that this view has changed rapidly over the next few years after the use of computers in the education system. In fact, in the 1980s, this perspective was transformed into a form of “training individuals with technical expertise skills on ICT resources” (Seng & Choo, 2008).

The structural and rapid transformation of education policies in Singapore is based on the national development policies developed from the 1980s and based on ICT in particular. By the mid-1980s, it was seen that an important branch of the country's industry became an ICT sector, especially through the investments of the international knowledge economy. In parallel with this transformation in the economic system, skills related to new technologies and a technology-intensive curriculum understanding have been placed at the center of the country's educational policies since the early 1980s (Koh and Lee, 2008; Mun, 2008).

Since the beginning of the 1990s, the systematic development of students' skills in technical computer and computerized office applications has been introduced within the policies. This situation has created new dimensions such as school ICT infrastructures, teachers' ICT skills and improving students' access to ICT resources. In the early 1990s, the “Professional Computing Support Program” was launched to improve teachers' ICT skills. The main objective of the program is to develop the skills of teachers to use educational and managerial software related to their profession. In the mid-1990s, various pilot implementations were initiated to expand ICT resources in primary and higher education institutions besides secondary schools. One of them is the “Accelerating the Use of ICT in Primary School Programme” project launched in 1995 (Koh and Lee, 2008).

Since the 1990s, a new National ICT strategy has been developed in the country, which is

called Information Technologies 2000 (IT 2000), which aims to access ICT resources from everywhere (school, home, workplace). It appears that this strategy creates three new visions for ICT integration policies and practices in education: the development of ICT skills of students and teachers, the development of school infrastructures, the integration of schools with information resources across the country and the world (Koh and Lee, 2008).

In 1994, computer applications project (CPA), a skill-based subject, was integrated to secondary schools. In 1996, the elements of office administration (EOA) subject was launched in secondary schools in order to improve secondary students' academic and technical skills. In these periods, some pilot studies were conducted in primary and secondary schools (Çetin and Solmaz, 2017).

In 1997, first "Master Plan for ICT in Education" was developed in Singapore. When the 1997 Plan is examined, it is seen that the two main emphasis is on meeting the human resources of the future and enriching learning environments with the opportunities offered by ICT resources (Singapore Ministry of Education, 1997). The 1997 master plan aims at four main objectives in the integration process: to strengthen the relationship between the school and the world through ICT resources, to develop students' critical thinking, lifelong learning and multi-faceted thinking skills; to provide innovation in education and to improve the administrative processes of schools (Koh and Lee, 2008). The main plan for this purpose is the integration of ICT infrastructures; renewal of curricula and evaluation processes; ICT-based learning resources and teachers' professional development needs are addressed in four dimensions such as meeting (Looi and Hung, 2004). With the 1997 master plan, CD-based educational content packages were developed for all learning areas in the curriculum. A central learning and content resource management unit has been structured to develop ICT-based learning materials, provide schools with appropriate resources for their needs, guide their use and evaluate their effectiveness. A "The Educational Software Procurement" scheme was developed to regulate the software needed by schools, procurement and communication to the school-supplier (Looi and Hung, 2004; Koh and Lee, 2008).

ICT policies developed in the country during the 1990s aimed to train human resources for the growing knowledge economy. Since the 2000s, policies have focused on developing social capital on the basis of skills such as creativity, critical thinking and entrepreneurship, as well as economic growth (Kozma, 2008). As a result of ICT implementations in the training held in Singapore in accordance with the 1997 Master Plan, ICT infrastructures of all country schools were strengthened and internet and intranet-based network infrastructures were completed in the early 2000s (Koh, Lee and Foo, 2009).

Since the early 2000s, the industry and knowledge of education policies of the country have the skills that the economy needs, although moral, intellectual, social, and aesthetic values aim to train good people and citizens. In line with this aim, it is seen that "innovation-based growth" is directed by giving importance to meeting learning and development needs (Looi and Hung, 2004). Accordingly, Singapore should be individuals who are constantly innovating as a dynamic part of ICT-based innovation in the world, who can see global business opportunities in the process of innovation and take risks to evaluate them. This new vision envisages an innovation in ICT integration in education that encompasses the student, teacher, school and community and extends from student to community (Singapore Minister of Education, 2002). In 2002, the second IT in Education Masterplan 2003-2008 was developed. The 2002 Master Plan focuses on the wider and more effective implementation of ICT integration processes in the curriculum initiated in accordance with the 1997 master plan, and on increasing the participation (attachment) of students in learning processes by leveraging ICT resources. With this perspective, the 2002 Master Plan addresses ICT integration in education in six dimensions

(Singapore Ministry of Education, 2002):

- More efficient integration of ICT resources both in the curriculum and in the teaching and evaluation processes,
- Configuring ICT based learning resources,
- Establishing a vision for the development of ICT infrastructures and support services,
- Providing continuous professional development opportunities for teachers,
- To improve the ICT competence and competence of the school,
- To improve R & D capacity

In 2002, the development of interactive and adaptable learning objects gained momentum; the importance of accessing these resources to teachers and students at any time, from anywhere and with different ICT devices (computers, PDAs, mobile phones) and different operating systems. A learning platform called "edu.MALL" has been developed to share learning objects and various web-based learning environments (Koh, Lee and Foo, 2009). It can be said that the 2002 Master Plan dealt with integration over three basic pillars. The first one is the learner. The Plan envisions the structuring of authentic problem-and project-based learning environments where the learner can learn effectively through ICT resources. The second pillar is school capacity and leadership. The Plan imposes significant autonomy in the development of infrastructures and the structuring of learning environments. The third pillar is research. The plan aims to increase monitoring and evaluation of ICT resources in both teaching and learning processes; It is foreseen that teachers' observations regarding the application should be utilized within the action-research approach (Koh, Lee and Foo, 2009; Looi ve Hung, 2004).

In 2008, the third plan (Master plan for ICT in Education 3) was developed in the country. The third master plan focuses on four main objectives, such as improving self-controlled learning skills, creating learning environments that allow each student to learn in the most appropriate way, enabling students to develop student products in the learning environment, and expanding the learning environment out of the classroom environment and structured teaching activities. Within the framework of these objectives, it sets out various integration strategies such as placing ICT at the core of the learning process; integrating ICT skills with teachers' pedagogical approaches; sharing successful integration practices and examples of innovation and upgrading school ICT infrastructures in line with future requirements (Singapore Ministry of Education, 2008).

The two key innovations discussed in the 2008 Master Plan are the determination of the autonomy levels of schools and the enrichment of e-learning resources and access to them. The master plan envisages redefining the autonomy level of each school in line with ICT competence and requirements. Thus, different degrees of autonomy emerge for schools in the country's integration process. In the field of e-learning, re-planning of learning content and services such as interactive textbooks, online games, live video broadcasts, avatars, three-dimensional content, online social interaction (Legislative Council Secreteriat, 2009).

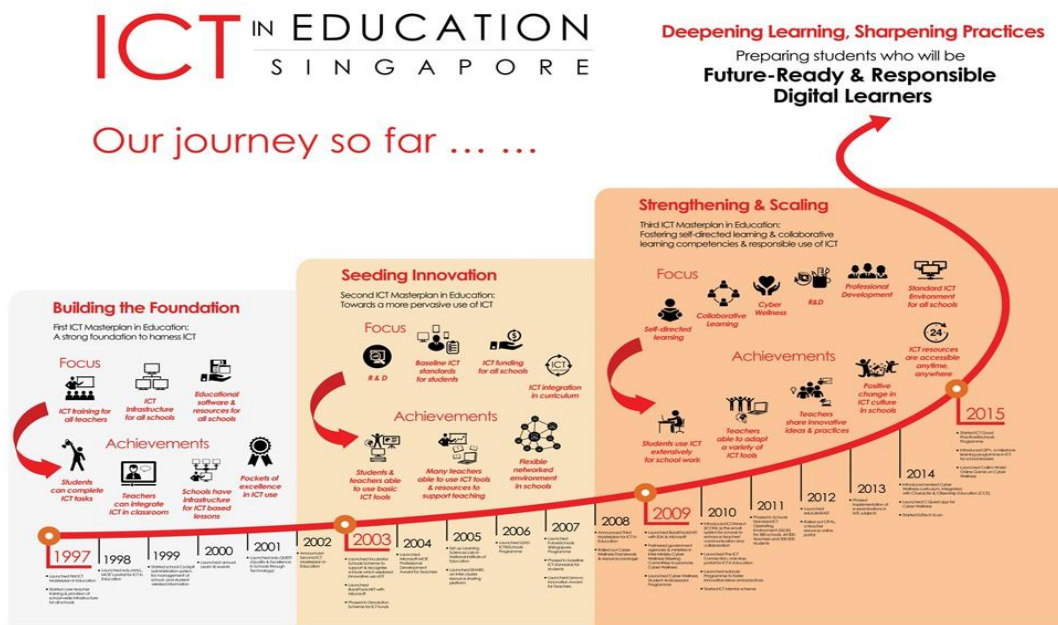
It is observed that the integration policies in the country have changed quite rapidly in 2000s. A distinctive feature of the period is the aim of developing social capital at the core of the integration process. The main purpose of education with this period is to educate good people and citizens. This new type of man has moral, social and aesthetic values. A characteristic feature of the period is its focus on school autonomy. Although it was thought that increasing school autonomy in integration in the early 2000s would accelerate innovation, in the following years this situation created an inequality across the country in terms of school resources, access

facilities and in-class ICT usage patterns. In 2008, a solution to this inequality was focused on grouping schools in line with their progress in the integration process and providing different levels of autonomy for each group. A distinctive feature of the period is the importance it attaches to R & D and monitoring and evaluation activities. During this period, the idea of utilizing teacher experiences with the logic of an action research was developed in monitoring-evaluation processes.

In 2010, the Ministry of Education reveals four main characteristics of the student who wants to be educated by ICT integration: The self-supervised learner is an active contributor, a citizen, a safe individual, sensitive to social and global events (Singapore Ministry of Education, 2010). In 2011, Singapore's ICT integration policies in education are progressing by taking three components to the foundation in line with the 2008 Master Plan. These are values education, student-centeredness and 21st century skills. The 2011 policies focus on increasing the quality of ICT integration in learning processes, ensuring that all young people are ICT literate and training a workforce with e-savvy; strengthening and scaling up integration processes (Singapore Ministry of Education, 2011).

The historical development adventure of ICT integration in the Singapore education system, described in detail periodically above, is summarized in Figure 2 below.

**Figure 2:** ICT Integration in The Singapore Education System



Source: <https://ictconnection.moe.edu.sg/masterplan-4/our-ict-journey>

Today, when Singapore curricula are examined, it is seen that knowledge and 21st century skills are at the center of the curriculum. In the primary, secondary and higher education programs, these two skills groups and the language around the kernel, including project work (English and native language); learning areas such as mathematical sciences and social sciences-art studies. When primary education programs are examined, it is seen that there is no ICT course (Singapore Ministry of Education, 2013). Orta Technology and Design içerisinde in mathematics-science group in secondary education programs; In the technical secondary education program, there is a “computer applications” course at levels 1 and 2 (Singapore Ministry of Education, 2012).

When the ICT applications in education are examined in terms of objectives, policies and practices in terms of 10 years, some key concepts are reached and various similarities and differences are encountered in these countries. In chronological analysis of the objectives, policies and practices in the integration processes of the countries, some key concepts and various similarities and differences are reached within them. In this respect, the key concepts related to ICT integration objectives, policies and practices of countries are expressed in Tables 2.

**Table 2:** ICT Integration in Education Process Similarities and Differences Between Singapore and Turkey: A Comparative Analysis Seasonal

	<b>Turkey</b>	<b>Singapore</b>
<b>Before 1970</b>	The new technology practices discussed in the education policies have expanded to include distance education, public education and higher education processes; Establishment of Training Tools Laboratories to regulate the use of audiovisual sources on a school basis.	In the 1950s and 1960s, Singapore adapted a "survival-oriented" system to its industrialization program to provide a skilled workforce and reduce unemployment. The Ministry of Education (MOE) was established in 1955.
<b>1970-1980</b>	Skills in using new technologies, problem solving and working together. Both a component of the teaching environment (in order to increase effectiveness in traditional teaching processes) and new technologies as a subject area. Organization of the use of new technology in education. School ICT Infrastructures: Educational technology laboratories in pilot schools. Curriculum: Technology courses in secondary education. Organization: Bilateral organization structure (Ministry of Education General Directorate of Educational Tools, school based education technology laboratory).	Between 1970 and 1980, there were various problems in the education system. The main reason was the difficulty of the rigorous education system in achieving differences in students' learning abilities through common curricula and exams. In order to eliminate this problem, they have structured educational policies and practices to ensure that each child learns at a pace that suits his or her ability. As a matter of fact, the New Education System (NES) was established in 1979.
<b>1980-1990</b>	Transition to knowledge economy and society. To improve students' basic computer literacy and advanced usage skills. Computer Specialized Commission in Secondary Education. Computer education in secondary education and planning of transition to computer assisted education. Organization of educational technology framework organization. Structuring educational technology as an area of expertise. ICT as an independent subject area in secondary education programs. School ICT Infrastructures: 10-30 computers in pilot schools establishment of laboratories. Curriculum: Computer course for secondary education program development. Provision of computer-assisted teaching practices in selected schools. Professional Development Processes: Training of teachers selected from pilot schools on computer and computer assisted education. Organization: Establishment of the Computer Education Commission in secondary education.	Increasing the technical ICT skills of the students who want to. Structuring the national ICT network. Utilization of ICT in school management processes. School ICT Infrastructures: School computer networks. Curriculum: Elective computer science courses. School computer clubs.
<b>1990-2000</b>	Cooperation with international organizations. Information economy requirements. To develop skills in information society, global workforce and competitiveness, to preserve national culture. ICT integration in education, including basic education, higher education and lifelong learning processes expansion: (School ICT infrastructures, basic education program, professional development processes for teachers / administrators, ICT integration in faculty of education programs, ICT	An important development regarding ICT practices in the country during this period is the 1997 ICT Master Plan in Education. Undertake a constructivist transformation of the curriculum in accordance with the principal, including access to student-centered and independent learning environments. Managing Human Resources in the Knowledge Economy. ICT, communication, creativity, independent and multifaceted thinking, lifelong learning skills, Speed in the integration process. Infrastructures, teaching programs, professional development of teachers, teacher training institutions, online learning resources,

	<p>field teachers). School ICT infrastructures: School IT classes, computer laboratories  Curriculum: In the basic education program, ICT to be defined as learning area (grades 4-8 and 10-11).  Professional Development Processes: The adoption of a pyramid model for the development of teachers' ICT use skills in ICT and teaching. To train instructor computer formator teachers to train formator computer teachers.  Organization: Dual structuring in MLO schools (Educational Technology Center School technology groups).  Expert Human Resources: Trainer computer formator teacher. Computer formator teacher.  Computer and instructional technology teacher.</p>	<p>managerial processes. Increasing the school's innovation power. Creating a culture of innovation in school. School ICT infrastructures: School computer laboratories. Ensuring country-wide standardization of school ICT resources.  Curriculum: Student-centered and basic education program A constructivist transformation. ICT integration in all learning areas in primary education; ICT learning area courses in secondary education. Professional Development Processes: To train basic education teachers about ICT usage from ICT and teaching processes throughout the country. Educational content development processes: Development of educational content suitable for the needs of all learning areas and export of this content abroad.</p>
<p><b>2000-2010</b></p>	<p>Cooperation with international organizations. To educate individuals who dominate technology, use ICT resources consciously, produce information through them and convert them into economic benefit. Developing information literacy skills of students and society. School ICT infrastructures, online learning and information resources, ICT usage in managerial processes, ICT based and student-centered innovation in curriculum, R &amp; D processes. Planning the integration budget by including R &amp; D processes. ICT as an independent learning area in the basic education program. School ICT Infrastructures / Access Facilities: Increasing IT classes, providing school internet infrastructures. Teachers Laptop Computer acquirement.  Increasing online learning opportunities: Developing the MoNE Education Portal.  Curriculum: To address ICT, information processing and information society skills among the objectives of the curriculum. A transformation towards student-centeredness and flexibility in teaching programs.  Professional Development Processes: Developing the skills of teachers, administrators and supervisors towards ICT and ICT usage in teaching. Managerial Processes: Development of MEBBIS system. Providing schools with access to administrative documents through the MoNE website.</p>	<p>A prominent dimension in this period is the curriculum. ICT, information society and self-regulated learning skills are at the heart of the country's curricula; accordingly, a more student-centered and constructivist approach to learning is directed. To educate people by considering the social capital of Singapore as well as the knowledge economy. To educate entrepreneurial, risk-taking, innovation-based thinking, participating in social processes, connected thinking, competitive individuals. Quick change. Raising good people and citizens. Gradual school autonomy. Deploying tablet computer to students. Integration of student and teacher mobile resources into integration. E-learning system, national education technology center, ICT coordinator, constructivist learning.  School ICT Infrastructures: Ensure equality in access to ICT resources. Teacher and students distributing tablet computer. Integration of teacher and student mobile resources into integration.  Curriculum: ICT, information society, self-regulated learning and student-centered transformation take the center of the basic education program.  E-Content Development Processes: Development of interactive learning objects and learning object sharing platforms. Increasing online learning opportunities.  Professional Development Processes: Developing e-learning modules for teachers' professional development.  Organization: Increasing school autonomy in integration. School ICT Development of norms. Autonomy groups according to ICT development level creation.  R &amp; D Processes: National and school-based research projects and conducting longitude studies.  Cultural Transformation at School: Integrating integration with school culture, developing a sense of ownership at school level.</p>
<p><b>After 2010</b></p>	<p>ICT-based continuous development for students, schools and the community. Ensure equality in access to ICT resources both inside and outside the school. School ICT infrastructures, development of e-content; ICT integration in curricula; professional development processes; Conscious, reliable, measurable and manageable use of ICT resources; monitoring and evaluation activities. IT ethics. Media literacy. School ICT Infrastructures / Accessibility: IT classes, IT-supported classes, Fast internet infrastructures, interactive whiteboards. Deploy tablet computer to students and teachers.</p>	<p>Values education, 21st century skills, self-regulated learning, self-awareness, participation in learning communities. Raising good citizens. Safe and healthy use of ICT resources. Student-centeredness Blended learning (recruiting online learning communities in formal education) Techno-pedagogical competences. School ICT Infrastructures: Information sharing platforms between schools.  Curriculum: All learning in the basic education program ICT, information society skills and values education at the center of their fields. Independent ICT learning in secondary education area.</p>

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E-Content development processes: Multimedia content of all the content being taught in basic education programs supported electronic books (zbooks).  
Curriculum: An independent ICT learning area at secondary level (Information technologies and software). Inclusion of ICT and media literacy in the basic education program.  
Professional Development Processes: Organizing in-service trainings to improve teachers' ICT usage skills in ICT and teaching environment.  
Managerial Processes: E-school applications  
Healthy, Safe and Correct Use of ICT Resources: Establishing a traceable and manageable network infrastructure.

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R & D Processes: Sharing innovative works. Taking organic propagation power (the level of transformation of the school environment) as an evaluation criterion.  
Raising Expert Human Resources: School ICT mentor (4 mentors per school): To integrate ICT into one syllabus per school year and to mentor 2 teachers.  
ICT in elementary teacher education programs, recruitment of ICT in teaching processes, ICT integration in various learning areas; various ICT specialization courses in the secondary education teacher program.

According to the table, in Singapore;

In the 1980s, it was seen that the students started to develop ICT skills and to increase the effectiveness and efficiency of traditional teacher-centered teaching strategies. Differences in the direction of raising the manpower needed by the knowledge economy in the 1990s; In the 2000s, they expanded to provide social development and to create a culture of partnership in society as well as information society skills by focusing on people rather than technology. In 2010, it was seen that dynamic adaptation, self-regulated learning, thinking related to learning communities and good citizenship were added to the goals. When the development of ICT applications in education is examined; they gained systematism in the 1980s and a considerable diversity in the 1990s. Applications of the 1980 period generally included school ICT infrastructures, transformation in teaching programs and professional development processes of teachers; In the 1990s, dimensions such as access to ICT resources, educational digital content, online learning opportunities and expert human resources for integration processes were added. With the 2000s, the scope of the practices included lifelong learning, teacher training and transformation in school culture; With the years 2010, sustainability and protection of individual, community and environmental health are expanding.

According to the table, in Turkey;

In the 1980s, it was aimed to integrate new technologies with community culture, to initiate the transition to information society, and to develop ICT literacy of students and other segments of society. With the 1990s, it is seen that the aims are directed towards meeting the manpower requirement of the global knowledge economy. In the 2000s, it is seen that increasing ICT skills alone does not provide the expected progress in development, so policies focus on development of local ICT industry and students' entrepreneurial and competitiveness skills for this purpose. From this point of view, with the 2010 period, it takes innovation-based growth into its policy focuses and joint cognitive development and collective learning processes in order to achieve a social cohesion in innovation.

### **CONCLUSIONS AND RECOMMENDATIONS**

Turkey ICT integration in education policies examined in the course of 1980, the basic education level computer training given to students accepted the information society and an essential pre-condition in the transition economies; For this purpose, it is seen that specialized commissions and advisory boards composed of scientists have been formed. Another key concept of the period is education technology. When the integration of ICT in education policies include Turkey examined the course of the 1990s, a fundamental characteristic attention is cooperation with international organizations such as the World Bank. At the beginning of the period, policies based on preserving the national culture while developing the information society skills are directed to new areas such as global labor and competitiveness within these



cooperation processes. In this period, ICT integration includes basic education, vocational secondary education, higher education and lifelong education areas with teaching and management processes, and the scope of ICT education is expanding from primary to higher education.

In the mid-2000s, an area of engagement in ICT integration policies in education was the transfer of education services to the online environment. In this direction, two main orientations are to perform online transformation in managerial processes and to improve online learning resources and accessibility of teachers and students. During this period, policies are the development of an "Access to Information Portal" to provide online materials and environments for the educational needs of their environment such as students, teachers and administrators.

Turkey ICT integration in education policy when we look at the trend in the 2000s information-processing skills, resources and information online is emerging in the form of three key concepts continue its cooperation with international organizations. The policies of the period tend to create information age people who know technology, use ICT resources consciously, produce information through them and turn this information into economic benefit. In this context, information literacy of students and the society refers to the elements such as the completion of the internet infrastructure and access to information in formal and non-formal education processes, and the transfer of the administrative processes of educational institutions to online environments. A prominent concept in the 2000s was the increase of online information resources in Turkish. Thus, it is aimed to increase the equality of opportunity in education by providing access to more educational resources at home and to provide education services to Turkish citizens living abroad. Another characteristic is program reform at primary education level. With this reform, the core of all learning areas is the information society, thus ICT and ICT-based information access and processing skills and student-centered learning strategies. Another feature is the planning of R & D activities by considering budget facilities.

In the 1990s change of ICT integration policies in Singapore's education system, the first element is speed. At the beginning of this period, ICT education in country schools was only given to students who wanted to, and by the end of the course, the policies were to improve the knowledge society skills of the learners; ICT infrastructures in education, curriculum, professional development of teachers and teacher training institutions; online learning resources and ICT integration into the education management process. Another factor that attracts attention in the policies of the period is to increase the innovation power of the school. Innovation is characterized as a managerial and cultural component of the school's development of dynamic adaptation to technological and social changes.

Singapore is one of the prominent aspects of ICT in education in the 2000s. In this period, ICT, information society and self-controlled learning skills are at the center of the curricula of the country; accordingly, a more student-centered and constructivist approach to learning is directed. An important part of the applications is interactive learning objects and increasing their accessibility. In this period, learning object sharing platforms were developed on a national and school basis. Similarly, e-learning activities in the country have varied to meet student and teacher needs. Devices such as tablet computers were distributed to students and teachers as solutions to equality problems in access. An application to access problems in these 150 periods is to increase accessibility with mobile devices. An important feature of the period is to increase school autonomy in the integration process and to develop some school integration norms in parallel. To this end, specialized ICT teachers have been employed to coordinate school ICT processes. When the 2010 ICT integration practices in education are focused on in Singapore, the first element that draws attention is the addition of ICT and 21st century skills as well as national and universal values to the core of basic education programs. The second important

element is the organization of meetings and studies of teachers to share and disseminate examples of good integration in the professional development process. An innovation that emerged in the term practices is the school ICT mentor. Four ICT mentor teachers are assigned to each school during this period. In 2010, all courses in Singapore's basic education programs are aimed at improving students' ICT and 21st century skills and value systems.

An important change in the integration policies of the countries is the expansion of the scope that occurred over time. Policies that focused on school ICT infrastructures and teachers' ICT skills in the 1980s, national integration strategies in the 1990s, ICT integration in curricula, increasing online learning resources, ICT use in managerial processes, increasing teacher training institutions and school's innovation power. begin to receive. In the 2000s, this enlargement process included the organizational structure of integration, increasing school autonomy, the use of e-learning resources in formal and non-formal education processes, the technopedagogical competence of teachers, the use of secure and ethical ICT, administrative and technical support; as well as the need for experts in the integration process, the workload of these experts and their professional organization continues to cover such dimensions. Since 2010, it has been observed that elements such as R & D processes, school and community monitoring and evaluation studies, sustainability, teacher and mobile teaching practices, online learning communities and values education are expressed in integration policies. The fundamental philosophy of integration in the country's policies is a shift from technological optimism to technorealism over time. When the policies were examined, it was observed that the possible negativities of ICT resources in the 1980s and 1990s were not taken into consideration; From the 2000s onwards, it is understood that, in parallel with their experiences in this area, a realism is also taken into consideration.

Common feature in ICT integration in educational expectations of developing countries such as Turkey, as well as social policy to reduce the separation is intended by the creation of various social expectations as more democratic and egalitarian society. On the other hand, these expectations are considered as the natural consequences of the diffusion of ICT resources in the society rather than being an objective in integration. In some of these countries in the 2010s, it was observed that although the objectives of education system and the expectations of the society were taken into consideration during the integration process, they remained only within the vision dimension and could not be implemented. When the policies of the country are examined, similar to the developed countries, an expansion parallel to time is observed. In this direction, the scope of policies focusing on dimensions such as ICT infrastructures, educational software and professional development of teachers in 1980s, educational TV applications in formal education since 1990s, organizational structure of integration, school autonomy, teacher training processes, monitoring-evaluation and accountability. In the 2000s, equality in ICT access to this expansion process, increasing online learning resources and maintaining integration in a multi-project structure. In 2010, it was observed that components such as e-content, access to information sources outside the school, R & D, sustainability and, in part, protection of school, community and environmental health were added. One of the prominent elements of developing country policies since 1990s is international cooperation in integration practices.

### **SUGGESTIONS**

Based on the results of the research, a number of recommendations have been made to improve ICT integration policies and practices in education.

In the process of development of ICT integration policy in education, especially in countries with Turkey, and other developing technologies always optimistic stipulating that a positive impact (utopian) instead approaches, a perspective envisages also be faced with

adverse and unexpected situations Besides the positive effects should be adopted. In integration policies, especially in Turkey and other developing countries in the information next to the hardware training individuals to require that the ability of the economy should focus on the social needs and objectives in sensitive to social and cultural values, reliable and ethical individuals should go to a conversion for cultivation. In both developing and developed countries policies, sensitivities should be increased to detect and take into account unexpected and negative effects; accordingly, the short and long term and multidimensional effects of integration should be addressed.

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