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Is ICT Integration A Magic Wand for Education? A Comparative Historical Analysis between Singapore and Turkey

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Abstract

Information and Communication Technologies (ICT) integration has become increasingly important in educational systems of developing countries. However, there is a misconception about children's direct access to technological devices has a positive effect on their productivity and the quality of their learning. Several ICT integration projects have being implemented since 1984 by Ministry of Education in Turkey. In this context, there is a need to determine the necessity of ICT integration in education, mistakes and solutions while planning and implementing the ICT integration. This study presented the international assessment results of Singapore and Turkey in case of education and compared the histories of ICT integration in education process of these two countries. Comparative historical analysis method was used to compare the ICT integration history of two countries. Singapore holds the 1st rank in Network Readiness Index while Turkey holds the 48th rank in Global IT Report 2015. Various indexes were also examined such as quality of education, science and maths education and internet access in schools. Hence, some similarities and differences arose at the end of the comparison. Singapore and Turkey started to implement ICT integration studies in similar time periods. Findings indicated that ICT integration is essential, but it can be effective and beneficial when it will be implemented appropriate for the needs of the age as a supportive material for instruction and learning process. Moreover, it is important to focus on using it in all subject areas of the learning and instruction process instead of focusing on the ability of using the technological devices while planning the ICT integration process. Several recommendations according to the findings and comparisons were discussed in conclusion.

Keywords: ICT in education, information and communicating technologies, ICT integration, Turkey, Singapore

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BT Entegrasyonu Eğitim için Sihirli Bir Değnek mi? Singapur ve Türkiye Karşılaştırmalı Tarihsel Analizi

Öz

Gelişmekte olan ülkelerin eğitim sistemlerinde Bilişim Teknolojileri (BT) entegrasyonu gittikçe önemli bir hale gelmektedir. Bununla birlikte, çocukların teknolojik cihazlara doğrudan erişimlerinin onların üretim becerileri ve öğrenmeleri üzerinde olumlu bir etkisi olduğuna yönelik bir kavram yanılgısı bulunmaktadır. Türkiye'de 1984'ten buyana çeşitli BT entegrasyonu projeleri yürütülmektedir. Bu bağlamda eğitimde BT entegrasyonunun gerekliliği ve BT entegrasyonu planlaması ve uygulamasında dikkat edilmesi gereken durumlar, hatalar ve çözümleri üzerine çalışma yapılması gerekmektedir. Bu çalışmanın amacı, Singapur ve Türkiye'nin eğitim alanında uluslararası değerlendirme sonuçlarını sunmak ve iki ülkenin eğitimde BT entegrasyonu geçmişini karşılaştırarak incelemektir. Iki ülkenin BT entegrasyonu geçmişlerini karşılaştırabilmek için karşılaştırmalı tarihsel analiz yöntemi kullanılmıştır. Singapur, Küresel BT Raporu 2015'e göre BT endeksinde ilk sırada yer alırken Türkiye 48. sırada yer almaktadır. Eğitim kalitesi, fen ve matematik eğitimi, okullarda internet erişimi gibi diğer indeksler de incelenmiştir. Singapur ve Türkiye, teknolojik gelişmelere paralel olarak BT entegrasyonu çalışmalarına benzer tarihlerde başlamışlardır. Karşılaştırmalar sonucunda ülkeler arasında çeşitli benzerlikler ve farklılıklar görülmüştür. Bulgular, BT entegrasyonun gerekli olduğunu fakat öğrenme ve öğretme sürecini destekleyecek şekilde çağın gereksinimlerine uygun olarak uygulanması halinde etkili ve yararlı olabileceğini göstermiştir. Ayrıca, BT entegrasyon süreci planlanırken sadece teknolojik cihazların kullanım becerisine odaklanılması yerine BT'in öğrenme ve öğretme sürecinde tüm konu alanlarında kullanımı üzerine odaklanılmasının önemli olduğu görülmüştür. Sonuç kısmında karşılaştırmalar ve bulgular ışığında çeşitli öneriler sunulmuştur.

Anahtar Sözcükler: bilgi ve iletişim teknolojileri, BT entegrasyonu, eğitimde BT, Türkiye, Singapur

Introduction

Although there is a perception in developing countries that children's direct access to new technologies increases their learning and ICT integration in education is improving in these countries rapidly, it is specified in the Global Information Technology Report published in 2015 that this is not a true belief. There are explanations about why ICT integration in education fails and it also mentions about the importance of focusing on educators instead of children's access to technology (Behar & Mishra, 2015). About 9 years ago, SITES Modules, which were the international comparative studies to help countries (including Singapore) to estimate their current positions in terms of ICT use in education, emphasized the same factors in its report. Increasing the level of computer access did not bring about more learning experiences for students and the impact of ICT use on students appeared to be highly dependent on the pedagogical orientation that teachers adopt in regard to that use (Law, 2008).

United Kingdom aims to cover the 90% of population with superfast internet connection and lowered the computing course age to 5. However, diffusion of ICT, internet connection and student access to internet have no significant effect on education and student productivity (Faber, Sanchis-Guarner & Weinhardt, 2015). Likewise, students' access to ICT has no direct effect on quality of education and course completion rate is 7% in the year of 2013 (Parr, 2013). Giving every child a laptop both enforces the country budget unnecessarily and it has no significant contribution to education (James, 2011; James, 2014; Cristia, 2013). In Singapore, subject area was highly recommended to be considered as an important factor rather than ICT infrastructure while integrating ICT to schools (Tay, Lim & Lim, 2015). In Turkey, big scale projects before FATIH, a project that aims to improve ICT use in schools since 2011, have no significant effect on the quality of education (Özdemir & Kılıç, 2007; Özdemir, 2010). Consequently, all these facts indicate that this situation creates some questions in mind about ICT integration in education: "What is wrong with ICT in education?", "Is ICT integration a necessity for education?" and "How should it be planned and implemented?"

Considering these questions, ICT integration in education has a number of sub-dimensions and it can vary according to region, educational system and grade level. Thus, it is necessary to conduct comprehensive studies to examine and evaluate the ICT integration in education. This can be done through a comparative methodology by examining countries' ICT integration process in education. Therefore, in this study, to gain detailed information about ICT integration process in education, the positive and negative aspects of ICT integration within the scope of formal education have been investigated by comparing Turkey with a country that is successful in international indexes about the quality of education and ICT integration.

ICT Integration in Singapore and Turkey

Several ICT integration projects have been implemented since 1984 by Ministry of Education in Turkey (Goktas, Gedik & Baydas, 2013). At the same time, Turkey

has been participating in TIMSS assessments since 1999 and PISA assessments since 2003 as a developing country. Also Turkey's network readiness index was located in the Global Information Report, a detailed research about information technology across the world published by World Economic Forum. Students in Turkey are below the overall average in basic subjects such as science and mathematics, in 21st century competencies such as creative problem solving and in information technology literacy and also quality of education is below the world average according to the World Economic Forum's report, assessment results such as PISA and TIMSS and ICT integration in Turkey.

Examining the PISA, TIMSS assessment results and global reports, Singapore ranks 1st place in most topics and it ranks in Top 5 all the time in all topics. Moreover, Singapore started to ICT integration implementations at the same time with Turkey and these countries have some similarities in terms of ICT integration process. Because of this reason, it is intended to conduct a study between Turkey and Singapore in terms of ICT in education and to find responses to the questions at the end of the first paragraph. Therefore, the aim of this study is to present the ICT integration of Turkey and Singapore from past to present by analyzing and comparing their history of ICT integration in education and to determine the similarities and differences between them.

According to this aim, subtitles for this study are given below:

- International evaluation results of Singapore and Turkey (PISA, TIMSS, WEF)
- The brief history of ICT integration in education in Turkey within the scope of formal education
- The brief history of ICT integration in education in Singapore within the scope of formal education
- Similarities and differences between Singapore and Turkey in terms of ICT in education.

Method

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

The data resources of the comparative historical analysis are historical records (Babbie, 2013). Therefore, PISA and TIMSS results reports, World Economic Forum

Global Information Technology 2015 Report and Global Competitiveness 2015 Report were examined in order to present the international evaluations about two countries for the first subtitle. Official records and reports about national education of these two countries were examined for the second and third subtitle about the ICT integration history in education. In this context, documents, reports and meeting records of Ministries of National Education of Singapore and Turkey between 1984 and 2015 were accessed. PISA and TIMSS results from the time that Singapore and Turkey participated in assessments were accessed from their own official websites. Global Information Technology Report and Global Competitiveness Report were gained from World Economic Forum's official website. Thus, this study is a detailed analysis and comparison between the histories of ICT integration in education of these countries considering their situation according to the developing countries and entire world.

Findings

International Evaluation Results of Singapore and Turkey

There are four reports included in this study; PISA results, TIMSS results, Global Competitiveness Report and Global Information Technology Report. The Programme for International Student Assessment (PISA) is a triennial international survey, conducted by OECD (The Organization for Economic Co-operation and Development, 2015), which aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students. PISA is described as a unique evaluation because it develops tests which are not directly linked to the school curriculum. The tests are designed to discover what extent students can apply their knowledge to real-life situations and be equipped for full participation in society at the end of the compulsory education (OECD, 2015). Turkey attended PISA in 2003 and Singapore attended PISA in 2009.

Table 1. *PISA 2009 and 2012 Rankings of Singapore and Turkey (in 65 countries*)*

		Reading	**Math**	**Science**	**Creative Problem solving**
PISA 2012	Singapore	3	2	3	1
	Turkey	42	44	43	34
PISA 2009	Singapore	5	2	4	-
	Turkey	39	41	42	-

*Creative problem solving assessment includes 44 countries

In PISA 2009, Singapore ranked 5th in reading, 2nd in mathematics and 4th in science, Turkey ranked 39th in reading, 41st in mathematics and 42nd in science. In PISA 2012, Singapore ranked 3rd in reading, 2nd in mathematics and 3rd in science, Turkey ranked 42nd in reading, 44th in mathematics and 43rd in science (Table 1). Singapore got higher scores in reading and science domains and kept its rank in mathematics domain. However, Turkey got lower scores in all three domains from the previous PISA to the last one. In PISA 2012 report, Singapore ranked 1st in

creative problem solving domain, while Turkey ranked 34th. According to all these rankings, Turkey exhibited lower performance than Singapore.

The Trends in International Mathematics and Science Study (TIMSS) is an international assessment and research project similar as PISA. TIMSS measures trends in mathematics and science achievement at the fourth and eighth-grade levels and also collects information about school and teacher activities (TIMSS, 2015).

Table 2. *TIMSS Rankings of Singapore and Turkey**

		Mathematics		**Science**	
		4th grade	8th grade	4th grade	8th grade
TIMSS 2011	Singapore	1	2	2	1
	Turkey	35	24	36	21
TIMSS 2007	Singapore	2	3	1	1
	Turkey	-	30	-	31
TIMSS 2003	Singapore	1	1	1	1
	Turkey	-	-	-	-
TIMSS 1999	Singapore	-	1	-	2
	Turkey	-	-	-	33

*Attending countries: 2011; 4th grade 52, 8th grade 45 countries. 2007; 4th grade 36, 8th grade 48 countries. 2003; 4th grade 25, 8th grade 45 countries. 1999; 8th grade 38 countries.

In TIMSS 1999, Singapore ranked 1st in mathematics and 2nd in science in 8th grade level and Turkey ranked 33rd only in science 8th grade level. In TIMSS 2003, Singapore ranked 1st in both of 4th and 8th grade levels, Turkey did not participated in that assessment. In TIMSS 2007, Singapore ranked 2nd in mathematics and 3rd in science in 4th grade level and also ranked 1st in both domains in 8th grade level, Turkey participated in 8th grade level assessment only and ranked 30th in mathematics and 31st in science domain. In TIMSS 2011, Singapore ranked 1st in mathematics in 4th grade level, 2nd in mathematics in 8th grade level, 2nd in science in 4th grade level and 1st in science in 8th grade level, but Turkey ranked 35th in mathematics in 4th grade level, 24th in mathematics in 8th grade level, 36th in science in 4th grade level and 21st in science in 8th grade level (Table 2). The TIMSS results have pointed out that Turkey exhibited a lower performance than Singapore as in the PISA results.

The Global Competitiveness Report 2015-2016 assesses the competitiveness landscape of 140 economies by World Economic Forum. This report is not directly related with the quality of education but it has sub dimensions about the quality of higher education and training. It also provides insight into the drivers of the countries' productivity and prosperity. The Global Competitiveness Report remains the most comprehensive assessment of national competitiveness worldwide. According to this competitiveness index, Singapore ranks 2nd for the fifth year in a row. Turkey ranks 51st in 2015-2016 and in 2014-2015 it was 45. This shows that Singapore has a steady situation, however Turkey loses its competitiveness in time. (Global Competitiveness Report, 2015).

World Economic Forum has a special project within the framework of the Global Competitiveness and Risk Team and the Industry Partnership Programme for Information and Communication Technologies called as "The Global Information Technology Report 2015". This report collects data from countries according to different indicators and determines an index about a country's network readiness. According to the Global IT Report 2015, Turkey holds the 48th rank while Singapore holds the 1st rank in 143 countries in network readiness index. Network readiness index includes 4 basic sub-indexes; environment, readiness, usage, impact and there are 53 indicators under these sub-indexes. Not all of the indicators are related with this study's scope, so the indicators related with research aim were chosen and the situations of two countries (Singapore, Turkey) are examined according to these indicators. Rankings of the Singapore and Turkey among 143 countries are given below according to the Global IT Report's some indicators (Global IT Report, 2015).

Table 3. *Network Readiness Index Rankings of Singapore and Turkey*

Global IT Report 2015		**Readiness-Skills**	**Readiness-Skills**	**Impact-Social Impacts**
		Quality of educational system	Quality of math & science education	Internet access in schools
	Singapore	3	2	3
	Turkey	42	44	43

Singapore ranked 3rd in the quality of educational system, 2nd in the quality of math & science education and 3rd in the internet access in schools sub-indexes. However, Turkey ranked 42nd, 44th and 43rd in same sub-indexes (Table 3). Similar to the previous evaluations, Turkey indicated lower performance than Singapore and also Turkey is below the average of participating countries.

Considering all these international assessments, evaluations and reports, Turkey's scores were always below the average and decreased in the rankings. However, Singapore exhibited high performance in rankings, maintained its top position and seemed to be progressing. Despite occasional decreases, Singapore always ranked in top 5 in indexes.

The Brief History of ICT Integration in Education in Turkey

Turkey has started to implement ICT integration since 1980s. In 1984, Computer Education Expertise in Secondary Education Commission was founded (Keser, 2011). 1100 computers were distributed at least one high school in each city in 1995 (Engin, Tösten & Kaya, 2010). Since the academic year 1985-1986, "Computer" course took part as an elective course in secondary education program. Computer labs were constituted in 100 secondary schools selected as pilot schools (Keser, 2011). Two teachers from each school were given in-service training course for 5 weeks (Uşun, 2004).

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. During these applications, 6 billion Turkish Liras were spent, 378 computers were purchased for 18 schools, 2000 hours software of 37 courses were developed, training of 750 teachers was completed. There were some shortcomings determined in these CAI studies by executive committee charged by MONE; educational software were not be prepared appropriate for the curriculum, there were no effective teacher participation to the CAI implementations, there were no enough training for teachers and because of these reasons, CAI took no interest of students and were not be used effectively. Also introduction and advertise done by companies were weak (Uşun, 2004). Thus, this computer assisted instruction implementation were not considered as successful.

In 1990, MONE constituted National Education Development Project for 7 years that supported by World Bank. World Bank supplied 90.2 billion USA dollars to Turkey for the project. In 1991, 5121 computers were purchased. Until this year 11-12% of secondary schools in Turkey had computer labs and most of them were provided by MONE. 70% of the usage time of the computer lab were separated to the computer education, and 30% of it were separated to the computer-assisted instruction. At the end of 1995, 53 curriculum laboratory schools were constituted in order to provide hardware and educational software to other schools. Approximately 250 teachers received training for computer and educational software until 1997 (Uşun, 2004).

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.

In 1998, an agreement was signed between Republic of Turkey and World Bank. As part of this agreement, hardware and software were purchased to the schools, the schools connected to the internet and the teachers were trained about ICT with the support of World Bank (Akkoyunlu & İmer, 1998).

In 2002, MONE signed an agreement with the World Bank for 3 years for ICT integration again (MEB, 2007). Since the 2007-2008 academic year, it was decided that in elementary schools, "Information Technology" course took part as an elective course in the curriculum (Keser, 2011). In 2011, MONE began to implement FATIH project with support of Ministry of Transport and Communication. FATIH project aims the equality in learning and instruction and to enhance the technology in schools, to provide effective usage of information technologies in learning and instruction activities. Accessibility, productivity, effectiveness, measurability and quality are the key factors for success in this project. Also it is aimed to evaluate students not only with their academic achievement but also with their interests, activities and tendencies and to analyze students' all data of their education lives by this way. Thus, students will be better educated and they will be directed to the life

of business according to their own interest and achievements. It is determined in the project mission that students will be active learners with gaining 21st century skills such as technology use, effective communication, analytic thinking, problem solving, collaboration and cooperation. In addition to this, it is planned to provide tablet PCs to all students and to provide interactive whiteboards and laptop computers to all classrooms and to establish internet infrastructure to all schools. This project will provide teacher-student and interactive whiteboard-tablet PC interaction, effective use of information and instruction process with using classroom management. Teacher will share the materials with students, assign homework to students and measure students' learning levels in a more controlled manner. 447.288 interactive whiteboards, 1.437.800 tablet PCs, 41.996 multi functioned printers were distributed and infrastructure and internet access services were provided to 9.052 schools. Totally 424.250 teachers were trained with in-service training about the use of ICT and FATIH project (Ateş, 2013; MEB, 2007). In addition to these implementations, there is an online platform for the content part of the project. EBA (Education and Informatics Network) was designed by Innovation and Educational Technology Head Office as a social platform and it presents safe and true e-contents appropriate for different grade levels to teachers and students (EBA, 2015).

The Brief History of ICT Integration in Education in Singapore

Singapore has started to implement national ICT plans since 1980s (Seng & Choo, 2008). In the 1980s, Singapore Ministry of Education (MOE) initiated projects such as Computer Science as a Level Subject, Computer Appreciation Clubs and School Link Project to bring ICT in schools with the Government's National Computerization Plan. In the 1990s, the Professional Computer Support Program was started. This project aimed that all teachers became proficient in computer software to use them in their educational aims.

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. Accelerating the use of ICT in primary schools program was implemented in six pilot schools and students spent about 10 percent of the curriculum time using educational packages for learning. The program was found to be efficient to most students. Student's and teacher's workbench project was implemented in six secondary schools and it provided digital educational resources for teachers. This pilot study was also found helpful for teachers and students. JCNet was also initiated in 1997 because of the interest in the use of internet in education. JCNet was a research and development project and it was used to support the learning of general paper, physics and chemistry. These pilot studies built the foundation of Master Plans for ICT in Education.

First Master Plan for ICT in Education (1997-2002) was launched by Minister of Education Chee-Hean Teo in 1997. Mp1 had four goals; enhancing links between the

school and the world around it to expand and enrich the learning environment, encouraging creative thinking, lifelong learning and social responsibility, generating innovations in education and promoting administrative and management excellence in the education system. Curriculum and assessment, physical and technological infrastructure, content and learning resources and human resources development were the key dimensions of Mp1. At the end of the Mp1, all schools were provided with the necessary physical and ICT infrastructure for ICT-based teaching and learning. Primary schools had a pupil-to-computer ratio of 6.6:1 and secondary schools had a ratio of 5:1. Teachers gained essential ICT competencies and also they accepted ICT as a pedagogical tool in the classroom (Seng & Choo, 2008).

Second Master Plan (2003-2008) was launched in 2002. Mp1's underlying philosophy ensuring that students gain the necessary skills and knowledge for ICT remained relevant to Mp2. A systematic and holistic approach was adopted to address all key areas relating to the effective use of ICT in education. These key areas are alignment of curriculum, instruction and assessment, provision of ICT-enabled infrastructure and support, availability of ICT-based learning resources, ongoing professional development, research and development on the effective use of ICT-based learning resources, tools and pedagogies and the possible use of technologies in school environments. At the end of the Mp2; students achieved in the use of ICT tools and they learned how to use internet. Teachers were also proficient in the use of ICT tools and 2:3 of teachers supported their classroom teaching with ICT resources. All schools had funds to attain students to computer ratio of 6.5:1 for primary and 4:1 for secondary schools. Singapore MOE has also mentioned that Singapore had done well internationally after these achievements. They ranked 5th in the Global IT Report 2008 and 7th in the Global Competitiveness Report (Seng & Choo, 2008).

Third Master Plan (2009-2014) was launched in 2008 by the Ministry of Education. Mp3 continued the vision of the first and second master plans to transform the learning environments of the students and to equip them with necessary competencies. Minister of Education, Dr. Ng Eng Hen's speech was important to show the past and the future of ICT master plans in Singapore:

> *"Well-trained teachers using technology to multiply their efforts are a formidable combination to achieve our educational goals. Since the launch of our ICT Masterplan, we have witnessed how through sight, sound and interactivity, ICT can enrich the learning environment and better engaged the learner. Teachers now have a valuable tool to customize learning approaches and outcomes for each student. We should press ahead on both fronts-in teacher training and ICT development. If we can do both well, the school environment will be transformed for the better."*

Mp3's goals were included that school leaders provided the direction and created the conditions to harness ICT for teaching and learning, teachers had the capacity to plan and deliver ICT-enriched learning experiences for students to become self-directed and collaborative learners and ICT infrastructure supported learning

anytime, anywhere. There are 5 key strands of Mp3 implementation strategies; ICT in curriculum, pedagogy and assessment; cyber wellness; professional development; research and development; ICT and infrastructure. Achievements of the Mp3 were given in the ICT Connection and OPAL portals for the education shareholders in Singapore. Now Fourth Master Plan (2015-2020) was developed by the Singapore MOE. Mp4 continues to build on the achievements of the first three master plans and tries to improve the self-directed learning and collaborative learning. Mp4 focuses on quality learning and is aligned to student-centric and values-driven education. Students will be future-ready and responsible learners, teachers will be designers of learning experiences and environments and school leaders will be culture builders with the achievements of the Mp4. MOE adopts four approaches to implement the Mp4 regularly in school environments; deeper ICT integration in curriculum, assessment and pedagogy, sustained professional learning, translational research, innovation and scaling, connected ICT learning Ecosystem (ICT Connection, 2015).

Government and MOE worked integrated and implemented systematic approaches year by year, related with past and future. Pedagogical factors, self-directed learning and collaborative learning approaches have always been taken into consideration in ICT integration in schools.

Similarities and Differences between Singapore and Turkey in Case of ICT in Education

It is possible to compare the implementations of two countries in a given period because Singapore and Turkey have started to implement ICT integration projects in similar periods. Thus, there are three similarities and three differences between these two countries.

The similarities are;

- Turkey and Singapore both started to implement ICT projects in 1980s. These were the years when computers became personal computers and started to diffuse on social lives. Both countries kept up with this technological development.
- They have governmental commissions related with ICT integration from the beginning of the first project. In other words, they wanted to discuss this issue as a govern policy and to perform it in a planned and systematic way.
- They tried to equip all schools with latest technologies from the beginning and also trained teachers with essential IT skills.

These are the necessary implementations for the ICT integration. However, considering the quality of education, the efficiency of ICT integration and use in schools and pedagogical concepts of the ICT projects, there are several differences between two countries:

- Singapore started to use ICT for computer-assisted learning and teaching activities in schools from the first pilot studies. However, Turkey has implemented ICT integration projects in order to teach computer skills to students and teachers.
- Singapore has always a vision, mission, goals, key dimensions, implementation approaches and expected outcomes for each project or project phase from the beginning of the first ICT integration process. Also, each phase is a-follow-up of the previous one. Previous step's results were evaluated and the new phase planned and implemented according to the shortcomings and strengths of the previous phase. However, in Turkey, until FATIH project, in other words until 2011, ICT integration projects carried out independent from each other. Previous project's aims, expected outcomes or results were not taken into consideration in the following projects (Özdemir, 2010). For the first time, ICT integration has been tackled with aims for learning and instruction process and with implementation strategies in FATIH project and announced by Ministry of National Education.
- Singapore evaluated results of the phases at the end of each project and related these results with country's success on international indexes about educational field (PISA, TIMSS, Global ICT Report, etc.) and supported the ICT integration process success with these rankings (ICT Connection, 2015). However, Turkey especially focused on quantitative data such as the number of distributed devices or the number of in-service trained teachers instead of the qualitative data such as the quality and effectiveness of educational activities.

Results and Discussion

Turkey started to implement ICT integration with hardware distribution in 1985-1986 and constituted computer laboratories in schools. Moreover, "computer course" started in secondary schools. However, this course included only basic computer skills. In integration policy, "computer-assisted learning or teaching" concepts were missing. 70% of the total time, computer laboratories in schools were used for computer skills education and only 30% of the total time, laboratories were used for computer assisted learning until 1993 (Uşun, 2004). However, in Singapore, they started to equip students with computer skills and then they built their master plans for integrating ICT to all subject areas. The first pilot studies with ICT tools were conducted in different courses (Seng & Choo, 2008).

Turkey continued the ICT integration projects after 1999 with World Bank funds and continued the distribution of hardware to schools. However, there was a pedagogical lack in integration process. First of all, there was no clear information about the results of completed ICT integration projects and following phases have not been planned according to the previous phases' evaluations. The only thing the government did that they bought technological devices and gave them to schools. Teacher training was mentioned in reports but the qualitative dimension of these trainings were also skipped. Teachers stated that they wanted to share their ideas

with implementers of the project but no one consulted them during the integration process. They explained that they had problems such as technical malfunctions and ineffective ICT use in lessons and they emphasized that they did not gain enough favor from the in-service trainings, especially from the online trainings (Altın & Kalelioğlu, 2015). However, in Singapore, from the beginning of the projects, the vision, goals, approaches and key dimensions of them were determined, the projects were developed towards them, these variables were taken into account during the project, and the results of projects were commented towards them. Moreover, the pedagogical issues about ICT integration in all grade levels were defined in every time. In ICT integration, it is important not only to distribute the hardware to schools, but also to provide sustainability, to train teachers regularly and to provide efficient educational software packages. This is a significant difference between two countries.

Turkey started FATIH project in 2011 and it is now in progress. Within the scope of this project, tablet PCs are now being distributed to the students and smart boards are being given to the schools. The key dimensions that Singapore started to use in 1997 are now being used for FATIH project but ICT integration projects are independent from each other in Turkey. Previous projects were completed and technological devices were given to the schools. Now with the new project (FATIH), old computers are being collected and the new ones are being distributed. Ministry of Education tries to make cooperation with academic institutions but every time project team changes, cooperation ends.

Considering the questions at the beginning of the study, big scaled investigations should be conducted to find out comprehensive responses for those questions. In this study those questions are tried to answer by interpreting two countries' comparative situations. The first question was "What is wrong with ICT?" ICT implementations have been conducted in Turkey for many years and one can ask whether or not there is a problem with ICT integration while there is no significant difference in the quality of education. Considering the good practices about successful ICT implementations such as being done in Singapore, only obtaining technological devices and ability to use them and waiting for the positive effect on the quality of education are wrong in terms of ICT integration. Technological devices are only tools and the important point is to integrate those tools to schools to serve educational aims. There is also a general consensus among ICT studies that successful integration of ICT requires the involvement of students, teachers, school leaders and policy makers as part of the process (Fu, 2013).

The second question was "Is ICT is a necessity for education?" Education and training exist since first human being and in this age they can be discussed from various perspectives. However, it becomes a necessity to integrate ICT to the educational environments because of developments such as rapid access to information and admission of the technology into social lives. Tools and materials have importance in instruction and learning because information processing is required mostly in educational environments. Computer access is a necessary but not

a sufficient condition in learning and teaching process (Law, 2008). Thus, using ICT in education can be beneficial with contributing the development of some skills within the possibilities of country. ICT integration is essential, but it can be effective and beneficial when it will be implemented appropriate for the needs of the age as a supportive material for instruction and learning process.

The last question was "How should it be planned and implemented?" According to the histories of these two countries, developing countries should apply for international support for the effective ICT integration and adapt it to their own cultural structure. This suggestion was emphasized many years ago (Özdemir, 2009) that learning from the experiences of other countries is important and essential but today it has to be mentioned again. What have to be done is determining the aims, goals, outcomes while beginning an implementation with a governmental control system. The most important factors are evaluating the previous project or phase's results, determining the weak and strong aspects, transferring them to the following phases, and making the regulations according these aspects in the new implementations. Furthermore, while planning the ICT integration process, it is important to focus on using it in all subject areas of the learning and instruction process instead of focusing on the ability of using the technological devices.

Conclusion and Recommendations

Singapore is far ahead of Turkey in terms of both quality of education and ICT integration in education. This study tried to emerge the components and variables considered in ICT integration by Singapore and Turkey and determine the Turkey's mistakes about the ICT integration process. To summarize, firstly, ICT integration in education means not only obtaining and delivering hardware to schools as in Turkey. It requires adopting technology to the other disciplines and using ICT to gain skills such as creative problem solving, critical thinking, collaboration and communication that the students are expected to have in 21st century. Secondly, both countries started ICT integration together but Turkey skipped the fundamental parts of the effective ICT integration which was universally accepted. Thus, Turkey should review and revise the ICT integration in education policy. Moreover all the stakeholders of the projects (administrators, teachers, students, parents etc.) should be kept in the process of projects, their support should be provided, and the process should be formalized according to their feedback getting their thoughts and views. Furthermore, resources, budget and time should be analyzed well and they should be planned in compatible way with each other. Thirdly, especially in the first years of ICT integration in Turkey, implementations were not planned and performed in a systematic way. This situation led to some problems in management, planning, implementing, evaluating and consequently useless projects. Therefore, for the effective ICT integration in education, the process should be organized systematically according to the results of the previous projects and implementations, international and national studies, tests, reports and evaluations.

This study is limited to compare Turkey and Singapore and it is limited to the PISA, TIMS, Global IT Report and the documents about the educational policies of two countries. It is recommended to investigate the current situations of Turkey and Singapore in terms of their educational policy and ongoing ICT integration process in a detailed manner. Educational technology studies can be investigated to identify the previous and current positions of the two countries. Because of the reason that cultural differences effect both project management (Elena, 2010) and business management (Cullen & Parboteeah, 2008) processes, there is also a need for comparing Turkey with the countries which have similar educational policies or cultural similarities. Finally, it is also recommended to conduct big scaled studies between the OECD countries in order to estimate their current situations, to relate to other countries and to plan and implement their own ICT integration processes effectively.

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