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Innovations in Education Curriculum and Teaching Innovation in secondary school - a comparative case study between Turkey and Portugal

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É AUTORIZADA A REPRODUÇÃO PARCIAL DESTA DISSERTAÇÃO APENAS PARA EFEITOS DE

INVESTIGAÇÃO, MEDIANTE DECLARAÇÃO ESCRITA DO INTERESSADO, QUE A TAL SE COMPROMETE.

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Innovations in Education Curriculum and Teaching Innovation In Secondary School - A Comparative Case Study Between Turkey And Portugal
Esra Tetik
Master of Science in Education - Specialization in Curriculum Development and Educational Innovation
University of Minho – 2017

Abstract

This research work seeks to explore one of the areas of greatest debate and controversy in recent times in the context of education: innovations in secondary school education. In this sense, this project aims to describe and analyse the innovation performances in secondary schools from its conceptualization to its operation, based on the following countries: Turkey and Portugal.

The study adopted both qualitative and quantitative approach and case study methodology to gain a deeper understanding of possibilities and difficulties of implementing innovations in science classes of studied countries. It also emphasizes the need to promote 21st century skills for students. The key participants are 20 Turkish students, at 8th grade from Tekneli Secondary School in Turkey, 20 Portuguese students at 9th grade from Group of Schools of Póvoa de Lanhoso in Portugal, and the Turkish teacher of Science -27 years old- who works in the Turkish school that studied, finally the Portuguese teacher of Biology -52 years old- who works in the Portuguese school studied as well. The data sources collected in this research questionnaires and the interviews with the participant students' science teachers.

The findings showed that both the teachers and the students are willing to innovations in their classes, yet, in reality, conditions are not helping to realize innovations as the teachers or students want. Firstly, because of the classrooms' being lack of equipment; especially technologic tools to do innovations. Secondly, the analysis revealed that even if the teacher wants to do innovation in her/his classroom, she/he doesn't receive enough support from her/his colleagues, school administration.

Research findings suggest that in order to provide innovative education, the teachers must work together on innovative projects and they should not be afraid of taking risks. Also, the classrooms should be well equipped through 21st-century needs and teachers and students should have course/education of effective ICT usage.

Key Words: Innovation, innovation in education, 21st-century skills, Turkey, Portugal

Inovações No Currículo De Educação e Ensino Inovação no Ensino Médio - Um Estudo
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RESUMO

Este trabalho de investigação procura explorar uma das áreas que suscita debate e controvérsia nos dias de hoje, relativo à educação: inovações no ensino secundário. Neste sentido, este projeto tem como objetivo descrever e analisar os desempenhos no ensino secundário desde a sua conceitualização até sua operacionalidade/ funcionamento, baseado em análises dos seguintes países: Turquia e Portugal.

O estudo adotou abordagens tanto qualitativas e quantitativas de aproximação no estudo de caso da metodologia para obter uma compreensão mais aprofundada das possibilidades e dificuldades de implementar inovações em classes de ciência dos países estudados. Também se destaca a necessidade de promover as habilidades do século XXI, para estudantes. O grupo principal de participantes são; 20 estudantes turcos, do 8°ano da escola Secundária de Tekneli na Turquia; 20 estudantes Portugueses do 9°ano, pertencentes a um grupo de escolas da Póvoa do Lanhoso em Portugal; uma professora de 27 anos de origem turca e que leciona na escola analisada. Por último, participa também uma professora de biologia, 57 anos de idade, que trabalha na escola portuguesa abordada anteriormente. As fontes de dados recolhidas nestas questionários as entrevistas com os professores e dos estudantes participantes.

Os resultados mostraram que tantos os professores como os alunos estão dispostos a introduzir inovações nas suas aulas. No entanto, na realidade, as condições não proporcionam a introdução dessas inovações como os professores ou alunos querem. Em primeiro lugar, devido à falta de equipamentos, nomeadamente ferramentas tecnológicas, que possam introduzir inovação. Em segundo lugar, as análises efetuadas revelaram que mesmo que um professor queira introduzir inovação nas suas aulas, este não recebe apoio suficiente dos seus colegas, administrador escolar. Os resultados de pesquisa sugerem que, na medida de providenciar uma educação inovativa, os professores devem trabalhar em conjunto em projetos inovativos e não ter receio de encarar os riscos que possam existir. Tambem, as salas de aula devem estar bem equipadas adaptadas às necessidades do século 21. Professores e alunos devem ter curso / educação de uso efetivo de TIC.

Chaves: Inovação, inovação na educação, habilidades do século XXI, Turquia, Portugal

TABLE OF CONTENTS

CHAPTER II

Methodology of the Research

CHAPTER III

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND ACRONYMS

P21: The Partnership for 21st Century Learning

ICT: Information and Communication Technology

PT: Portuguese Teacher

TT: Turkish Teacher

PS: Portuguese Student

TS: Turkish Student

LIST OF APPENDIXES

INTRODUCTION

The Global Innovation Index (GII) which is published by Cornell University, INSEAD, and the World Intellectual Property Organization, in partnership with other organisations and institutions[1], is an annual ranking of countries by their capacity for, and success in innovation. In 2016, this year the GII published a report under the theme of 'Winning with Global Innovation' in order to explore global innovation levels.

The rankings and findings of GII 2016 report results show that Portugal is the thirtieth most innovative country while Turkey ranks forty-second overall 128 countries which participated the research (Innovation, 2016).

Among similar lines, Figure 1 shows the heat map of The Innovation Output Indicator (IOI) 2014 report, which was developed by the European Commission at the request of the European Council in order to benchmark national innovation policies and to monitor the EU's performance against its main trading partners. The IOI measures the extent to which ideas stemming from innovative sectors are capable of reaching the market, providing better jobs and making Europe more competitive. The indicator on innovation focuses on four policy axes: growth via technology – (patents); jobs (knowledge-intensive employment); long-term global competitiveness (trade in mid-/high-tech commodities); and future business opportunities (jobs in innovative fast-growing firms) (Vertesy and Deiss, 2016).

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[1] Information gathered: https://en.wikipedia.org/wiki/Global_Innovation_Index

Figure 1. Below shows a heat map of country's IOI levels with a scale between 0-100. Through the results of IOI, Turkey's innovation score is 63.8 while Portugal's 73.0 in innovations.

Figure 1: Heat map of innovation output by country
(EU Member States' comparison, 2014)

Problem Statement

The question is: Why Portugal and Turkey has different innovation levels of multi-dimensional facets (economic growth, education etc.)? What is the reason that one is more innovative than other? And most importantly; *how can we make our countries more innovative?*

The world is becoming aware of the need of innovations. Innovations/R&D and Education are the two main targets of the five headline targets which have been agreed for the whole *EU for Europe 2020 goals*. The techniques of encouraging and stimulating innovation is one of the main objectives of European policies.

Why innovation is so important for the development of a country? One of the important lessons of the past two decades has been the pivotal role of innovation in economic development. The build-up of innovation capacities has played a central role in the growth dynamics of successful developing countries. These countries have recognised that innovation is not just about high-technology products and that innovation capacity has to be built early in the development process in order to possess the learning capacities that will allow "catch up" to happen (*OECD Science, Technology and Industry Outlook, 2012).*

The key to development in any country is truly education and innovation. Because those that are educated can govern their countries well and solve a country's problems. In a well-educated country, the citizens will behave more consciously and sensitively, they will have more successful economists, engineers, doctors and so on which will carry their country to the highest in terms of the level of development. Moreover, innovations and educational improvements help employability of a country and reduce poverty at the same time make countries more competitive and create new

job opportunities. As a result, we can say that innovations and education quality of a country with directly to its welfare level (*OECD Science, Technology and Industry Outlook, 2012).*

According to Global Partnership for Education; education has the power to make the world a better place because, firstly, it reduces poverty, boosts economic growth and increases income. It increases a person's chances of having a healthy life, reduces maternal deaths, and combats diseases such as HIV and AIDS. Education can promote gender equality, reduce child marriage, and promote peace. In sum, education is one of the most important investments a country can make in its people and its future. *In short, education has the power to make the world a better place* (Global Partnership for Education, 2016).

For this purpose, *how can we educate our children better? How can we/our children innovate? Which skills are needed in 21st-century? In this term what are the barriers and solutions? And more importantly, what is innovation in education?*

Understanding the processes of these questions will guide us about the 21st-century education, the pros and the cons of it, and the possible changes for a better qualified education. As a result, it will help us to shed light for the future of today's children and provide them skills that they will need in the unknown future to success in their life.

To quote from Pacheco (2012, p.14): *We cannot provide the answers but only on understanding process, the words we can now exchange together will be responsible for what one day our students will retain about their past.*

Finally, this study aims to develop a better understanding of the perceptions of innovations in secondary school science classes in Turkish

and Portuguese education system toward clarifying needs of 21st century skills.

Country Profiles[2]

In order to be able to speak about a countries education system first, we need to look their historical, cultural, political and geographical backgrounds of that country. In terms of innovations in education in Portugal and Turkey, firstly we would check the features of these two countries.

Portugal

Portugal, officially the Portuguese Republic, is a country on the Iberian Peninsula, in South-western Europe. It is the westernmost country of mainland Europe, being bordered by the Atlantic Ocean to the west and south and by Spain to the north and east. The Portugal–Spain border is 1,214 km (754 mi) long and considered the longest uninterrupted border within the European Union.

As of 1 January 2017, the population of Portugal was estimated to be 10 283 105 people.

The government type of the country is a republic; parliamentary democracy and the official language of the country is Portuguese with the major religion Christianity.

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[2] Sources for Country Profiles:
https://en.wikipedia.org/wiki/Portugal, http://countrymeters.info/en/Portugal, http://countrymeters.info/en/Turkey
http://www.bbc.com/news/world-europe-17758217, http://www.bbc.com/news/world-europe-17988453

Turkey

Turkey, officially the Republic of Turkey is a parliamentary republic in Eurasia, largely located in Western Asia, with the smaller portion of Eastern Thrace in Southeast Europe. Turkey is bordered by eight countries: Syria and Iraq to the south; Iran, Armenia, and the Azerbaijani exclave of Nakhichevan to the east; Georgia to the northeast; Bulgaria to the northwest; and Greece to the west. The Black Sea is to the north, the Mediterranean Sea to the south, and the Aegean Sea to the west. The Bosporus, the Sea of Marmara, and the Dardanelles (which together form the Turkish Straits) demarcate the boundary between Thrace and Anatolia; they also separate Europe and Asia. Turkey's location at the crossroads of Europe and Asia makes it a country of significant geostrategic importance.

As of 1 January 2017, the population of Turkey was estimated to be 80 747 189 people.

The government type of the country is a republican parliamentary democracy and the official language is Turkish with the major religion Islam.

Figure 2 below shows two countries placement in the world map, while Turkey has a position of "bridge" between Europe and Asia, Portugal takes place in Europe:

Figure 2: World Map: Portugal and Turkey

Justification of the choice

There are several reasons for choosing this topic. Firstly, I am a Turkish student in Portugal and I had opportunity to observe both countries educational system. I participated Erasmus+ program in two categories: Erasmus Exchange Program and Comenius Assistantship which's aim is explained in Key Action 2 (KA2) as in the following; make it possible for organisations from different participating countries to work together, to develop, share and transfer best practices and *innovative* approaches in the fields of education, training and youth. As a result, I had great opportunity to enhance my knowledge on curriculum studies practically and theoretically by studying in a Portuguese university and also by working in cooperation with Portuguese teachers as their assistant in Agrupamento de Escolas de Póvoa de Lanhoso (Portuguese Secondary public school). It was interesting for me to compare both countries' education systems and with their pros and cons and the ongoing innovations. Like the definition of KA2: Cooperation for innovation and the exchange of good practices, my master study also can assume as a cooperation between me and University of Minho and my study may provide exchange of good practices and innovation to find out what can be done in order to raise education quality in these countries.

Secondly, even though there are few researches on comparison of Turkey and European countries' education systems, there is no previous research that directly compares educational systems and innovations between Turkey and Portugal and being first as a master student excited me. Thirdly, my study may stimulate the Turkish and Portuguese researchers for further research in the area of education. Finally, the choice of this topic also relates to the author's personal and professional interests in this field both as a teacher educator and as a researcher.

Research questions and main goals

Owing to a good research is guided by specific questions, the issue of *Innovations in Education Curriculum and Teaching Innovation in secondary school* has led to the following research questions:

- How do teachers innovate?

- What do teachers think about innovation?

- Do students innovate in their classes?

- Which problems do the teachers facing while implementing innovations?

As such, the goals of this study are:

1. To analyze the ways in which the teachers look at innovations in secondary school science education

2. To identify the capability of teachers in educational innovations in their classrooms

3. To get to know ongoing innovations in education conducting by science teachers in their science classes

4. To clarify how innovations, affect students' achievement and motivation in a science class

5. To analyse the problems which the teachers are having in their science classes in the terms of innovation.

The Organization of the Thesis

This thesis is organized into three main chapters, the introduction and the conclusion and discussion sections.

Chapter I

Review of the literature

CHAPTER I

INTRODUCTION

The literature review starts with a brief description of education and innovation in education, which is followed by the topics focused on why innovation needed in education and how they can be realized. Next, learning environments to make innovations possible in education presented. Finally, a thorough analysis of skills which are aimed to gain students in an innovative education are presented which are called "21st-century skills" with the frame of The Partnership for 21st Century Learning.

1.1   INNOVATION: SCOPE AND THE MEANING

1.1.1   Definition of Education

We are living in the era which the existing knowledge is varying rapidly with the developments in especially science and technology. The change is enormous and it is not easy to keep up with the improvements. With the globalization, there is no limit in this change, and it is compulsory to prepare students for the knowledge and the skills needed with education considering those alterations.

Education has defined differently by educators through their focus point. The most accepted definition of education in Turkish literature comes from Ertürk (1979) which defines education as "process of creating deliberate and desired behavioral change via the subjective experiences of an individual." (Soydan and Abalı, 2015, p.12). From a similar perspective, according to Tyler (1950) education is a period of change in behavior. For Tezcan (1985), education is the sum of the processes that an individual has developed his skills, attitudes and his behaviors positively in his society. Durkheim approaches education more functionally that in his book Education and Sociology he describes education as a fundamental social institution and he defines education as "socialization of the young generation in a methodical way" (Avcı, 2012, p.26). Likewise, British philosopher Russell (1976) mentions about functions of education in three categories which are; providing educational facilities to individuals and removing inhibitory effects, developing individuals' skills and transferring

culture, and making citizens worthwhile for the society (Soydan and Abalı, 2015). Finally, economists and politicians define education as "investment for human capital" (Kurtuluş, 2012, p.18).

1.1.2   Innovation in Education

While the roots of non-formal education rely long times ago on; formal education has two hundred century history considering human being history, and noticing the importance of education's vital role in a country development, origins only some decade ago (Kurtulus, 2012).

Over 50 years, international organizations trying hard to improve the development in education. As a result, these efforts have become a real challenge between developing countries. "The United Nations, UNESCO, UNICEF, the International Labour Office and the World Bank define education as a basic human right and growth engine" (p.8) and they promote for improvement of education (Patrinos and Psacharapoulos, 2011).

For OECD countries, education is an important element for rising productivity and competitiveness, for meeting citizens' expectations, and for keeping social cohesion. Moreover, in the developing countries, education is essential for achieving health outcomes, population stability, stable governance and economic growth. Therefore, the expectation from education has been raised in order to improve their existing performance and to meet new needs, for the economic competition and social dislocation (Bentley, 2008).

The key factors needed for a country development and to keep up with the rapid changes have become the significant features of knowledge era which are mainly: scientific and technological development, globalization, increasing knowledge, innovation and the changes came with innovation. Thereby, countries regard innovation as inseparable part of development

and improvement for their countries and they include innovation to their national strategies (Kurtuluş, 2012).

The term of "innovation" has a broad concept which encompasses different sectors and contexts.

The Etymology Dictionary explains that the word of "innovation" comes from Late Latin roots, from the 1540s which are innovationem, noun of action from innovare. And the word innovare stems from the Latin innovatus which means "to renew, restore;" also "to change," from *in-* "into" + *novus* "new". (Retrieved February 2, 2017, from the World Wide Web: http://www.etymonline.com/index.php?allowed_in_frame=0&search=innovation)

Although innovation commonly understood as something new and useful (Vidicki, Vrgović, Maksimović, 2011), we cannot say that it is something new at all. Creating something entirely new would be an invention; in contrast, innovation is changing something that already exists for better. The outcome may be something new or not, therefore the classic definition of innovation shouldn't be something new (Jay Fraser, 2014). Along similar lines, Fagerberg, Mowery, and Nelson (2005) explain that "Invention is the first occurrence of an idea for a new product or process, while innovation is the first attempt to carry it out into practice." (Fagerberg, 2004, p.4).

In the same way, Schumpeter (1942), defines innovation as "creative destruction" which means destroying something already exists and realize/create something new.

Yet mostly accepted the definition of innovation comes from so-called Oslo Manual published by the OECD and adopted by Eurostat, which is regarded as "improvements". In this definition innovation is; "Implementation of a new or significantly improved product (good, service) or process, a new marketing method, or a new organizational method in

business practices, workplace organization or external relations." (OECD, 2009, p.5)

Although this definition seems like it is related to economics, it can be applied to education as well. Through the definition above, we can expand this definition as following considering for education;

> Implementation of a new or significantly improved product (e.g new curriculum, new system etc.)) or process (e.g. using different methods, tools like ICT), a new marketing method (e.g. pricing of postgraduate course), or a new organizational method (e.g ICT to communicate with students or parents) in business (education) practices, workplace organization or external relations (OECD, 2009, p.5).

The perception of improvement can be understood as "a better way of something". Innovation in education should have the equal amounts of time and resources but, at the same time, it should have greater learning outcomes than standard practices (Murphy, Redding, Twyman, 2013, p.3).

OECD (2015, p.4) innovation definition is the "outcome of how we mobilise, share and link the knowledge."

1.2   WHY INNOVATION?

"Europe needs to boost its capacity for innovation both for economic and for social reasons." (Shapiro, Haahr, Bayer, 2007, p.3)

One of the important lessons of the past two decades has been the pivotal role of innovation in economic development (OECD, 2012).

The Lisbon strategy was a lesson for EU to be taken into account in the terms of economic growth with innovations. It was conducted by EU, between 200 and 2010 to make Europe's economy better with the aim of the most competitive and dynamic knowledge-based economy. But unfortunately, it ended with failure, mostly because of the coordination problems. Following to the Lisbon Strategy, the European Commission proposed the Europe 2020 Strategy for ten years. With the Europe 2020 Strategy, five targets are identified for better Europe and Innovations/R&D and Education is the two main targets of them. Encouraging and stimulating innovation is one of the main objectives of Europe 2020 goals.

Also, a lot of empirical studies (e.g. OECD 2001, 2004) showed that innovations are the key role of economic development in both regional and the national, and the European level (Shapiro, Haahr, Bayer, 2007).

OECD correlates innovations and education quality of a country directly with its welfare level by virtue of a well-educated country will have more successful economists, engineers, politicians, doctors and so on that will carry their country to the highest level of development (OECD, 2012).

Similarly, UNESCO (2017) explains the importance of educational change as in the following (UNESCO, 2017, p.7):

A fundamental change is needed in the way we think about education's role in global development, because it has a catalytic impact on the well-being of individuals and the future of our planet. … Now, more than ever, education has a responsibility to be in gear with 21st century challenges and aspirations, and foster the right types of values and skills that will lead to sustainable and inclusive growth, and peaceful living together.

Shapiro (2007) discusses about the prominent change in understandings of innovation over time from technological notion to a broader notion. Until the 1990s the main focus of debates about innovation was mainly technological innovation, whereas now the current thinking innovation is more than it. Innovation is a complex national and regional process for economic prosperity with non-technological and user driven. Thereby, same as the OECD reports, the potential role of education and training innovation has increasingly emphasizing for economic developments.

In the same way, Lekhi (2007) explains why innovation is considered essential for economic development and organizational survive in the following five points:

- To keep up with the competitiveness in globalisation,
- To adapt changing environments,
- To rise profits and strengthen organization,
- To encourage culture of creativity,
- To activate market life and make easy entry into new markets.

Considering that different education systems have tested for many years, it will not be wrong to say that the concept of innovation in education started with the education history. As a key to economic and social growth, without innovation, the countries stop developing, and they become stable in economy and society (Kurtuluş, 2012). Moreover, globalization has triggered the competition among developed countries towards on increased

importance of innovation consequently the value of *knowledge-based* economy increased in order not to fall behind the era (Audretsch, 1998).

Looney (2009) states that successful innovation depends on human creativity, knowledge, skills and talents and in a wide perspective these facts nurture and develop through education. Furthermore, he points out the trend behind the drive for innovation in education and learning as in the following (Looney, 2009, p.4):

- Social and economic pressures to raise achievement levels and to ensure greater equity of outcomes for all students;
- Changes in work, social and family life;
- Rapidly advancing technologies;
- The need to motivate and engage students.

Moreover, OECD (2014) clarifies why innovation matters in education under four subjects;

- Improving education quality and learning outcomes,
- Enhancing equity and equality (education for all),
- Benefits for public organisations with rising efficiency while minimizing costs
- Introducing necessary changes for society needs and encourage skills for innovation.

Continuously, the essential requirement for innovation in education is to prepare students for the unforeseen challenges of tomorrow. A generation ago what the students have been taught was enough for a lifetime, whereas, today, students have to be prepared for fast changing world. Nowadays, the economy and the society is changing rapidly while the new jobs have been appearing, new technologies have been discovered and all these things are happening faster than a person's life period. As a result,

today's education requires skills for the way of thinking to overcome with those challenges in the future (OECD, 2015).

Briefly, the widespread consensus that innovations have significant impacts for a country's not only welfare but also for its social cohesion. Innovative countries don't fall behind of globalisation and they are able to compete with their economic and social power. Economic power because innovations will provide better conditions in labour market, new technologies, as a result high efficiency in products with less workforce and social cohesion because it provides equity and equality with lively democracy and qualified citizens. Finally, although several conceptual frameworks have been proposed in the dynamics of innovation, most of them focused on education and training. Only with contribution of education and training we can make innovations possible. Here the key question is *how we can educate for innovation?* and *how can we adapt education to innovations?*

1.3   HOW TO INNOVATE?

1.3.1   Lifelong Learning and Erasmus+

"Education and learning are some key factors for innovation." (Raghupathi, 2017, p.3) Developing new practices and translating this knowledge into something valuable requires innovation which comes from the educational center (Hobcraft, 2012).

Comparative studies about the innovative country profiles prove the fact that education does have the power to provide innovative knowledge and skills because those country profiles characterized by high level of education (Bassani, Andrea, Scarpetto, Stefano, 2001).

As it was mentioned above the results of Lisbon Strategy has shown that Europe needs to focus on innovation more, and through this goal, Europe 2020 goals created for their education and training systems. Guideline 8 of the Europe 2020 strategy mentions about developing workforce through the needs of the labor market, improving job quality and *lifelong learning*. For this aim, from 2014 - 2020 Erasmus+ Programme developed by European Commission for the Lifelong Learning Programme (European Commission, 2017).

As it mentioned in Erasmus+ Guide (European Commission, 2017), Erasmus+ is the program developed for EU in different fields such as education, training, youth and sports in order to make positive socio-economic changes and it includes several programs and highlights *innovation* at different levels by specifying the following objectives:

• Fighting against unemployment of especially young people by improving the 21st-century skills and innovation in education, which is the

main task for European governments thereby it can help the competition in labor market.

- Doing international strategic partnerships in order to encourage innovations, exchange of experience between organizations and provide knowledge-exchange, creativity, employability by developing initiatives in different fields of the lifelong learning program. (Key Action 2)

- Supporting scientific and technological innovation and ICT platforms such as; e-Twinning, The Education Gateway, European Youth Portal for developing collaboration, databases of opportunities and online service for teachers/learners from different countries. (Key Action 2)

- Stimulating innovative policy reforms for Europe 2020 goals among stakeholders and testing effectiveness with public authorities. (Key Action 3)

The point of the program is not only creating the possibility of enhancing the capabilities of innovation in society but also fostering innovations in education and training systems. The Europe notices that their education system should undergo changes to become more innovative for both social and economic benefits. So as to catch up with the requirements of the 21st century, Europe should go with the flow and start implementing innovations. To this end, The Erasmus+ Programme takes into the account the important factors for innovation like learning environment, culture, teaching method and methodologies and it focuses on accomplishing these goals by learning from real life and experience.

Moreover, Bollington (2015) questions "Why isn't everyone lifelong learning?" in his report for OECD with the following explanation;

Many employers reported that the gap between what we taught in schools and what we need to know in real life has been getting bigger. The certain skills which have been demanded in labor market have been

changing rapidly in the age of information technology age. The importance is how to access information with skills and motivation whenever we need rather than how much we know. As a result, lifelong learning became no longer option, but absolutely essential. It is time to encourage students for skills such as questioning to access knowledge, collaborating with other students (across cultures), critically analyzing and evaluating, creating new ideas and solutions etc. and making this possible with learning environments (Bollington, 2015).

1.3.2 Learning Environments

The more changes in education system, requires the more need to change education environments. In order to make learning and teaching more attractive and effective, the place and the tools for education process should be well adjusted through the new era's needs. Education environments should be adopted through the innovations in order to increase motivation of students.

Dewey (1916) defines environment's active role on education in his book "Democracy and Education" as in the following (Schwartzberg and Dvir, 2014):

"We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference. And any environment is a chance environment so far as its educative influence is concerned unless it has been deliberately regulated with reference to its educative effect."

1.3.2.1 "7+3" Framework for Innovative Learning Environments (ILE) by OECD (2015)

Innovations in learning environments enhance attractiveness of teaching compared to classic environments. For this purpose, OECD (2015) has developed "7+3" framework which has seven design principles and three dimensions overlying them in order to be most effective and innovative schools or learning environments of 21st century which has shown in the table below:

Table 1. "7+3" Framework for Innovative Learning Environments (ILE)

7 Learning Principles of Innovative Organisations
1- Make learning central, encourage engagement, be where learners come to understand as learners.
2- Ensure that learning is social and often collaborative.
3- Be highly attuned to learners' motivations and importance of emotions.
4- Be acutely sensitive to individual differences including in prior knowledge.
5- Be demanding for each learner but without excessive overload.
6- Use assessments consistent with these aims, with strong emphasis on formative feedback.
7- Promote horizontal connectedness across learning activities and subjects' in-and-out school.
3 Dimensions of Innovative Organisations
1- Innovative pedagogical core.
2- Become "formative" organisations with strong leadership.

3- Open up to partnerships.

With the inexorable advance of technology and change in society, the school models of knowledge era are no longer limited with 4 walls; it is the world itself. Nowadays, access to information is not difficult anymore; in contrary, it is very easy (like Google), there is unlimited information ready in front of us, what is difficult is to know how to refine information, make it useful and transfer to real life. It is important for today's education environments to be aware of the rapid changes inside and outside of the school and adapt their selves to this flow. For this purpose, "7+3" framework has developed in order to guide learning environments.

More specifically, what mentioned above in the table is that; the knowledge is enormous and always updating as a result is impossible to fill the students with the wide range of knowledge inside of the classrooms. Instead of that, the goal of the innovative organisations to teach students how to seek for information, make their own analyse and find solutions in order to prepare them for the challenges of future world that we don't know. More important than filling a student with information is to provide them an environment that they can improve important skills which is needed for 21st century workforce. Those skills only can be nurtured through learning environments that students are encouraged for active engagement and empowered to be self-directed.

Moreover, schools are not factories that every student has the same properties and after education process, the outcome is same for all. We should consider that all students are different than each other in terms of their capacities, skills, preparedness, learning and cognitive styles, motivations and the like. These differences, doesn't mean that only some students can learn. In contrary, all students can learn with the right method which motivates to learn. As there is no "one size fits all", it is important to determine individual differences and prior knowledge of each student and

use different approaches to give them opportunities. For this purpose, technological tools, group works, activities in and outside of the school would be useful to promote positive emotions that will make learning more attractive (OECD, 2015).

Picture 1. Differentiation
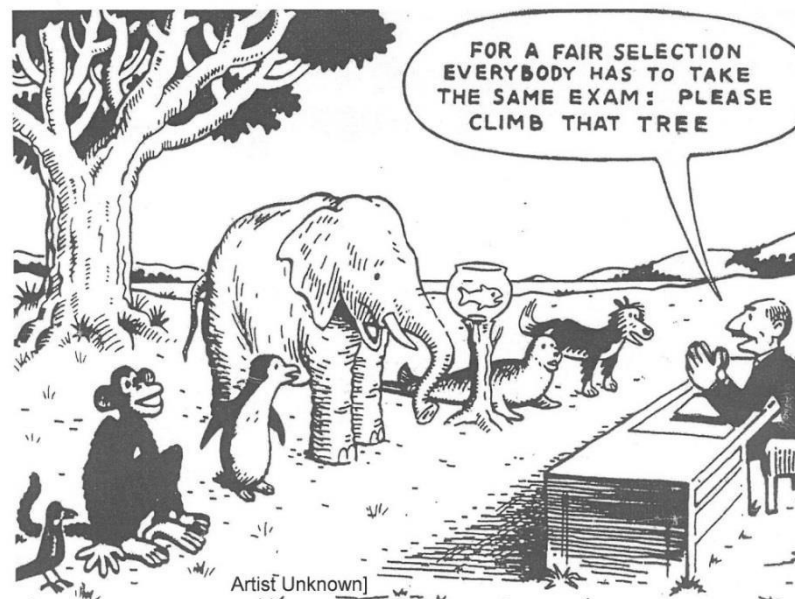
Picture 1 above metaphors the individual differences, as it is mentioned before, every student has different competencies. The assessment and evaluations must be well clarified with the expectations through considering that every student's development alters. Rather than simple pass/fail or right/wrong judgements, it is important to measure deep learning; 21st century skills, engagement, foundations for lifelong learning, and the like. Finally, what is mentioned on the second part; 3 dimensions of innovative organisations is that the cornerstone of innovative education environments is the starting innovation in pedagogical cores which implies how educators and learners work together, collaboration of different educators and inter-disciplines, using technology and curriculum which is mainly focused 21st century skills and sustainability. To design and implement this process teachers should be engaged with the formative feedbacks and be aware that they are the leaderships of this process. More than teacher's engagement; the collaboration must extend boundaries through school, parents, other schools, community bodies, cultural institutions and through networks for effective and innovative learning environments

In summary, to promote innovative learning environments the following conductive conditions and policies listed by OECD (2015, p. 34-35):

- Reducing standardisation, fostering innovation, broadening institutions.
- Appropriate accountability and metrics for 21st century learning.
- Fostering learning leadership, trust and learner agency.
- Widespread collaborative expert professionalism.
- Ubiquitous professional learning.
- Connectivity and extensive digital infrastructure.
- Flourishing cultures of networks and partnership.
- Powerful knowledge systems and cultures of evaluation.

1.3.2.2 Education City

"Education City" is another concept, focuses on the importance of learning environments on education and suggests innovations from a wider perspective; by the city. The school system in Education City, accepts the entire city as one large school instead of usual school boundaries.

This concept assumes the city as the key fact to innovations in education because the city is the where 70% of world population lives and functions, as a result it has a vital role in education. As its shown in the Diagram 1, city is the third place where people build relationships and social experiences between work/school and home, where social interactions and daily life routines happens and it is where we learn unconsciously from these experiences. Thereby, the city not only "educates" by means of its formal and informal educational sources but also by its companies, its environment, its industry, its social life etc. As a result, every city is significant educating source for its residents (Schwartzberg and Dvir, 2014). Diagram 1 below

illustrates the factors in a city which creates the environment of education
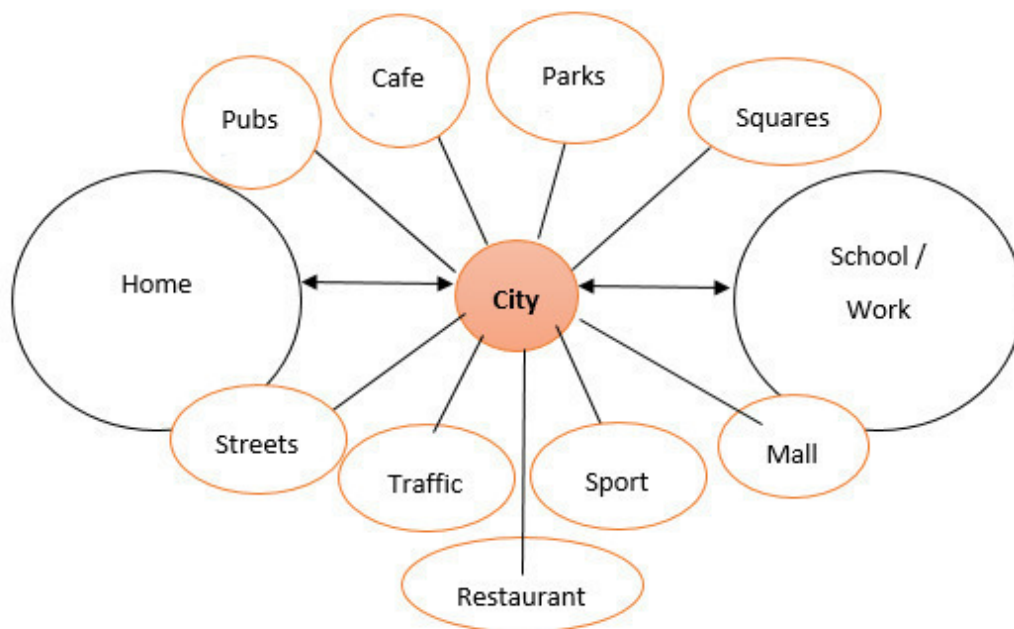
itself:

Diagram 1. The City

Moreover, The Figure 3 below presents the developed version of diagram of Malaguzzi who is an Italian teacher and psychologist, and developed a concept on education and the various interactions that affects education. He classifies three main interactions that individual experiences during his/her life and each interaction contains a teacher; The first teacher; is the group includes significant adults primarily parents and teachers, or advisors of youth activities, army etc. The second teacher; is the group of peers that usually from school, neighbourhood, sportive activities and the like. The third teacher; is the environment that we mentioned above, streets, cafes, the park, the town centre, etc. Finally, Education city adds a "Forth Teacher" to the model of Malaguzzi which is called "I myself". In this group, the individual develops himself through 21st century opportunities by means of virtual environment and he accesses unlimited knowledge and information.

As a result, 21st century teachers constitute the forth teacher (Schwartzberg, 2014, p.12):
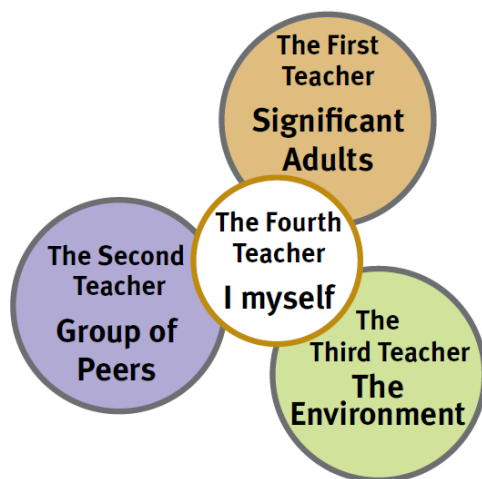
Figure 3: The Three (Four) Teacher Model

As it's mentioned before, the Education City's vision is first shaping the environment and consequently shaping the education. For this purpose, what aimed is to create a proper city which has influence on individuals.

The characteristics of the proper city which is called "The City of 2030", have been described in Table 2 below. The purpose of those principles in the table is building a democratic city with a future vision for all its residents without any kind of discrimination. The city of 2030 is where that everyone has right to city; which means it provides services, transportation, residence, business opportunities which is adapted for future needs, leisure activities etc. for all the members. It is where; the residents have active role and involvement in safety (especially female members) and are based on human rights. Moreover, it targets a greener and cleaner city where residents are conscious about effective use of energy and green technologies, and negative effects of climate-change (Schwartzberg, 2014).

In November 2010, 3000 leaders and mayors, regional and local council heads from all over the world gathered together in Mexico, to improve cities for everyone and for a better future. The conference organised by UCLG (United Cities and Local Governments) under the focus; "cities for everyone". The product of the conference was a document with principles of the proper democratic city in 2030, which characteristics are shown in the Table 2 (Schwartzberg, 2014, p.5):

Table 2. The City of 2030

The City of 2030 – Guiding Principles (by Mexico City Conference)
Democratic leadership in the city
A city for all its residents
A city with a vision for the future
A living city
A creative city, a city of culture
A safe city
Urban mobility
A city adapted for business development
A city with awareness of public service
A city without poverty-stricken areas
A cleaner, greener city

In terms of education, the city of 2030 aims (Schwartzberg, 2014, p.5):

A creative city, a city of culture; promoting a culture of creativity and innovation along with respect for the city's traditions and history, out of recognition for its spiritual value; the ability to connect people from different worlds as a tool for the city's economic development; developing a lifestyle based on excellence in all aspects of culture, placing special emphasis on the city's artists, lifelong learning, and the imparting of vital knowledge, tools and skills to each resident regardless of his age.

Moreover, one of the dimensions that importantly stressed in Education City concept is: Democracy in Education. As it's mentioned above, the City of 2030 is where everyone has same opportunities including in terms of education. Similarly, "to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" is the fourth goal of UNESCO (2015) for the implementation of Sustainable Development.

To sum up, Education City is a wide range of activities and products that we could only mention the main goals here. Its vision is to advance a democratic society which is based on democratic environment and culture that intends educational, social and therefore economic development by its values that navigate a city life. It provides individuals various opportunities to fulfil their selves, reach their goals, develop their skills and it promotes and encourages individuals to have the future that they wish to achieve. For this purpose, the action doesn't start with only one school, it starts with "the city" and Education city goes through the changes in the city in order to meet the 21st century – the Knowledge and Ideas era needs.

1.3.3 Promoting 21st Century Skills

"I am calling on our nation's governors and state education chiefs to develop standards and assessments that don't simply measure whether students can fill in a bubble on a test, but whether they possess 21st century

skills like problem-solving and critical thinking, entrepreneurship and creativity"

-President Barack Obama

In all over the world, innovative approaches to the education at present time have shifted some of the stress from subject knowledge to the acquisition of "21st century skills" and "personalisation" which are an essential both for individuals' personal success in learning and adult life for national economic development.

The awareness of the need to change started in 1991, when the first-time expenditures on Industrial Age goods (engines, machines etc.) exceeded for the first time by the amount spent on information and communication technologies (computers, servers, phones, networking etc.) "In 1991, "Knowledge Age" expenditures exceeded Industrial Age spending by $5 billion ($112 billion versus $107 billion). That year marked year one of a new age of information, knowledge, and innovation." (Trilling & Fadel, p.3). With the transition from Industrial age to Knowledge Age, it was not difficult to notice that skills from 20th century were not enough for 21st century anymore. (Kivunja, 2015, p.30) Today every country needs to produce workers qualified with the 21st century skills, which is only possible with education, as a result "education becomes the key economic survival in the 21st century." (Trilling, 2009, p.6)

This new age is the century of globalisation, information, media, complexity, flexible society structure, finally century of change and transformation. There is a big race between the global world countries and to be able to have a place in this race, countries need to raise qualified individuals who can fulfil the demands of 21st century and cope with the issues of this era, which is only possible with education. (Tutkun, 2010).

While, before, the knowledge a student learnt in the school was enough for whole life period of a student, whereas, today with the changing world, teachers must prepare students to face with unknown technologies, facts, issues that may happen in unknown future (OECD, 2015). Such as, digital media literacy skills which were not imagined fifty years ago and there are still more new skills to master likewise, there are still jobs of the future that don't even exist today. (Trilling, 2009).

Today, the core value has transferred from "knowing knowledge" to "using knowledge" (Tutkun, 2010), which requires 21st century skills.

The widest known definition of 21st century skills is conceptualized by P21 as "the skills, knowledge and expertise, which need to be effectively taught, and which students must master to be well prepared for success in the Digital Economy." (Kivunja, 2014b, p. 40)

The Glossary of Education Reform describes 21st century skills as "a broad set of knowledges, skills, work habits, and character traits that are believed – by educators, school reformers, college professors, employers, and others – to be critically important to success in today 's world, particularly in collegiate programs and contemporary careers and workplaces." (Abbott, 2016, retweeted from http://edglossary.org/21st-century-skills/ 2017, May 8)

For Wagner (2011), 21st century skills are the survival skills that today's students need to improve their self in the new world of work and in order to be beneficial citizens who will help to solve issues that we face in 21st century.

Likewise, Trilling and Fadel's (2009) definition is "the skills that young people need to succeed as individuals, citizens and workers in the 21st century" (Kivunja, 2014a, p. 85).

According to Griffinn, McGaw, and Care 21st century skills are "any skills that are essential for navigating the 21st century." (Aabla, 2017, p.255)

To sum up 21st century skills are the skills that students need to improve to succeed in the global modern world. Here the question is specifically what are those 21st century skills that are so important for students for their future? Although the skills are defined similar in some points, they are categorized differently, by different scholars or organisations.

The most common 21st century skills model was developed by the Partnership for 21st Century Learning, illustrated in the Figure 4 below shows the structure and the components of the rainbow that students need to develop to be successful in the 21st century:
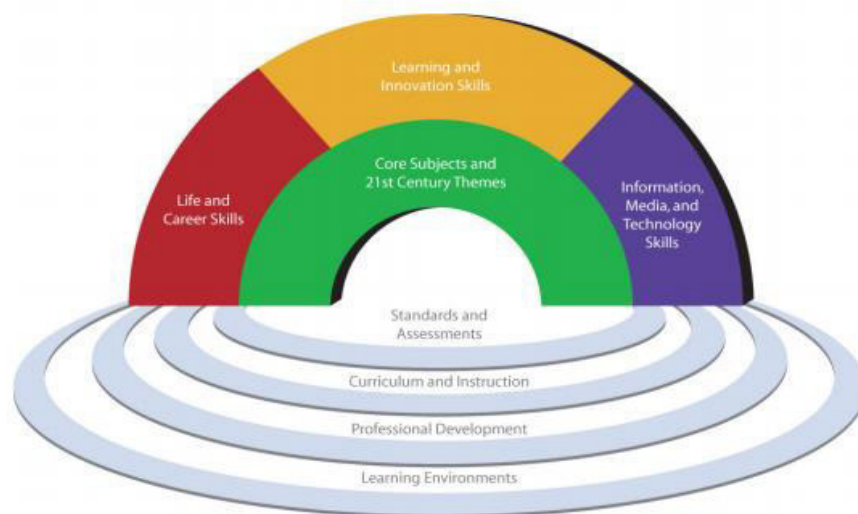
Figure 4:

21st Century Student Outcomes and Support Systems

P21 Framework illustrates 21st century student outcomes (as represented by the arches of the rainbow) and support systems (as represented by the pools at the bottom) and to produce students qualified with 21st century skills, arches of the rainbow must be aligned with the pools

at the bottom because these components are all interdependent (Aabla, 2017).

> Moreover, the framework adds to the traditional subjects interdisciplinary 21st century themes relevant to some of the key issues and problems of our times, such as global awareness (multicultural awareness and understanding); environmental literacy (ecological awareness and understanding of energy and resource sustainability); financial literacy (economic, business, and entrepreneurial knowledge); health literacy (health care, nutrition, and preventive medicine); and civic literacy (civic engagement, community service, ethics and social justice) (Thrilling, 2009, p.47-48).

If we consider the education in primary and secondary school as a building, the foundation of the building is the key academic knowledge and understanding and within the skills for success in 21st century, after it is combined by the necessary support systems- standards, assessments, curriculum and instruction, professional development and learning environments. 21st century skills are the most essential materials for the foundation of education. As with a lack of material, if a foundation of a building cannot be laid; with lack of 21st century skills, it is impossible to build an education system durable for 21st century conditions which means producing individuals without essential skills for today's world. As a result, the core subjects should be supported with those skills to build a qualified education for future.   As a result, 21st century skills are categorised in three sets by the P21 as its shown in the Figure 5 below:
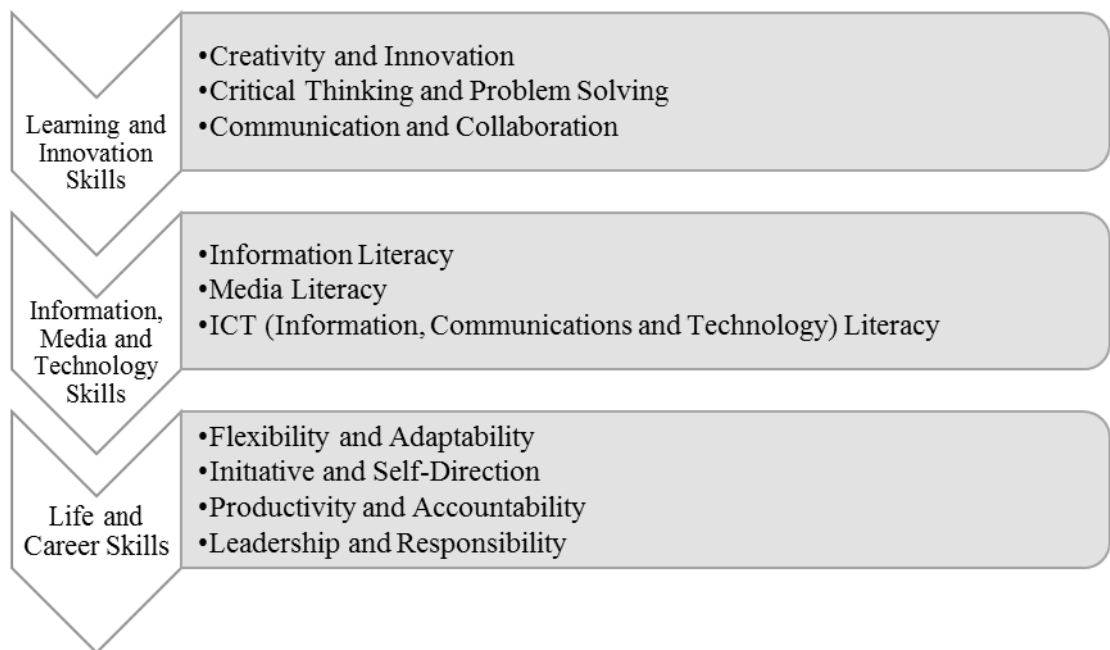
Figure 5:

21st Century Skills by P21

1.3.3.1 Learning and Innovation Skills

"You will recall how you were inspired to **think critically** and to question without fear, to seek out radically different solutions and to voice them without reprisal, to read widely and deeply, and to examine without end and grow intellectually. What I ask is this: pass it on."

Navy Admiral (Ret.). Mike Mullen, 11 June 2009

The first set of 21st Century Skills focuses on Learning and Innovation Skills which are represented as **4C**s as in the following:

- **Creativity** and Innovation

- **Critical** Thinking and Problem Solving

- **Communication** and **Collaboration**

These skills are the keys of unlocking the 21ˢᵗ century life and its work demands. Firstly, in the age of information, one of the biggest problem is to interpretation of information. Because nowadays it is very easy to access information (on the Web, in the media, in homes, school, streets, workplace) however, the problem is to critically review whether a knowledge is true or not from our own perspective of view which is only possible with critical thinking skills. Furthermore, as its mentioned many times before, to be able to solve new problems of the changing global world in unknown future, creativity and innovation skills are the prerequisites. Finally, communication and collaboration skills are highly distinctive to be able work with different people, countries, groups which is the necessity of global economy. Those are the main components to help build a better world also they are the cores of learning.

1.3.3.1.1 Critical Thinking and Problem Solving

Critical thinking is defined as "a judgement that is based on purpose and self-regulation and that goes through systematic stages to reach that judgement." by Facione. (Aabla, 2017, p.256) Another perspective of critical thinking from Halpern (2002);

Critical thinking is the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed—the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task. (Halpern, 2002, p.24)

Scriven and Paul (1987) pointed out that "Critical thinking is the intellectually disciplined process of actively and skilfully conceptualizing, applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by,

observation, experience, reflection, reasoning, or communication, as a guide to belief and action. (Saadati, Tarmizi, and Bayat, 2010, p.543)

Finally, Russell (cited in d'Angelo, 1971, p. 6) defines critical thinking as "Critical thinking is the process of evaluation or categorization in terms of some previously accepted standards ... this seems to involve attitude plus knowledge of facts plus some thinking skills" in the equation: Attitude + Knowledge + Thinking Skills = Critical Thinking (Halpern, 2002, p.8):

Table 3.

Partnership for 21st Century Skills – Critical Thinking and Problem Solving

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CRITICAL THINKING AND PROBLEM SOLVING

Reason Effectively

• Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

Use Systems Thinking

• Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

Make Judgments and Decisions

• Effectively analyze and evaluate evidence, arguments, claims and beliefs • Analyze and evaluate major alternative points of view • Synthesize and make connections between information and arguments • Interpret information and draw conclusions based on the best analysis • Reflect critically on learning experiences and processes

Solve Problems

• Solve different kinds of non-familiar problems in both conventional and innovative ways • Identify and ask significant questions that clarify various points of view and lead to better solutions

Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 20th May 2017

As it is shown in the above (Table 3), P21 mainly correlates the learners' ability to reason effectively, use system thinking, make judgements and decisions, and solve problems directly with their creativity and innovation skills.

Critical thinking and problem-solving skills can be provided through inquiry and problem-solving activities and complex projects challenges. Also, they can be developed with technologies that gives opportunities to students to reach and connect with experts via internet. (Thrilling, 2009)

1.3.3.1.2 Communication and Collaboration Skills

The knowledge based and the networked world demands people who can think and learn both individually and collaboratively. It is important to have critical and self-directed individuals with the ability to be reflective and collaborative to success in the 21st century (Garrison,2011). Because being able to listen and consider each other's viewpoints, is the key to being an effective team, thereby the key to success in the 21st century, where organizations shift the value on fostering team based works. As it is cited in P21 Research Series - Collaboration (2015):

> The nature of collaboration is shifting to a more sophisticated skillset. In addition to collaborating face-to-face with colleagues across a conference table, 21st century workers increasingly accomplish tasks through mediated interactions with peers halfway across the world whom they may never meet face-to-face….Collaboration is worthy of inclusion as a 21st century skill because the importance of cooperative interpersonal capabilities is higher and the skills involved are more sophisticated than in the prior industrial era (Dede, 2010, p.2).

Finally, we can sum up collaboration as "the activity of working together towards a common goal" (Hesse, Care, Buder, Sassenberg, and Griffin (2015, p.38). Table 4 below shows these collaboration and communication skills which are needed for an innovative environment:

Table 4.

Partnership for 21st Century Skills - Collaboration and Communication Skills

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COMMUNICATION AND COLLABORATION SKILLS

Communicate Clearly

• Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts

• Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions

• Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade)

 • Utilize multiple media and technologies, and know how to judge their effectiveness a priori as well as assess their impact

• Communicate effectively in diverse environments (including multi-lingual)

 Collaborate with Others

• Demonstrate ability to work effectively and respectfully with diverse teams

 • Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

• Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 20th May 2017

To sum up, communication and collaboration is a fact that provides students to understand each other in new ways, innovate and produce something together more meaningful. Also in the end, they are motivated for learning. These skills can be learned by team learning projects, or socially and technologically.

1.3.3.1.3 Creativity and Innovation Skills

"We do not grow into creativity, we grow out of it. Or rather, we are educated out of it."

Robinson, Ken. (2006)
- TED Ideas Worth Spreading Conference

Creativity and innovation have become a high desired priority in education in the 21st century, in order to have high-quality jobs, successful business, powerful economy, and better products and services. It is the key to being able to take place in the global world dynamic economies competition. Moreover, finding solutions, creating new technologies, invent new procedures for the unknown problems or needs of unknown future, only possible with innovation and creativity. (e.g. environmental challenges of future). As a result, we need to prepare our children from now for the future that we have no clue and we can only achieve with education.

For this purpose, we need to change the traditional education by transferring the focus from knowledge-based education to creativity and innovation based education. The biggest problem here is the fear of changing in the usual system. As Robison (2006), a leading thinker on creativity said: "We do not grow into creativity, we grow out of it. Or rather, we are educated out of it." Today's world has realized that we are losing the ability to be creative and innovative when we become adults, and they also realized that it is critically essential for success in the 21st-century world, thereby they start fostering innovation and creativity in education systems to adapt rapid changes in the 21st century.

Innovation involves experimentation and risk taking. Some attempts to innovate will fail, but across the economy the successes outweigh the failures. And the failures themselves generate new knowledge, which if evaluated correctly, can improve the chances for future success. The risk of failure justifies the potentially high returns from successes, which provide the incentive to innovate in the first place. **(Robinson, 2003, p.19)**

We can adapt this explanation to education as well. The failures in learning will generate new knowledge which will bring success. Thereby, instead of being afraid of failures, we should learn how to convert them for better results. To quote from Mary Kay Ash: "People fall forward to success."

Thrilling and Fadel (2009) assert that creativity and innovation skills can be provided through learning environments that maintain idea exchange, fosters questioning, does practice and encourages to do mistakes and failures to learn. Also, they can be learned through activities such as design challenge projects in which students should find solutions for real world problems. Table 5 below illustrates the creativity and innovation skills by P21 for these purposes:

Table 5.

Partnership for 21st Century Skills – Creativity and Innovation Skills

CREATIVITY AND INNOVATION SKILLS
Think Creatively   • Use a wide range of idea creation techniques (such as brainstorming)   • Create new and worthwhile ideas (both incremental and radical concepts)   • Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts

Work Creatively with Others

• Develop, implement and communicate new ideas to others effectively

• Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work

 • Demonstrate originality and inventiveness in work and understand the real world limits to adopting new ideas

 • View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 20th May 2017

To sum up, critical thinking and problem solving, communication and collaboration, creativity and innovation are the three principal themes of learning, working, and success for our times. While those skills provide us new knowledge and technologies for the 21st century, at the same time they require another skill: Digital Literacy Skills.

1.3.3.2 Digital Literacy Skills

"The convergence of media and technology in a global culture is changing the way we learn about the world and challenging the very foundations of education. No longer is it enough to be able to read the printed word; children, youth, and adults, too, need the ability to both critically interpret the powerful images of a multimedia culture and express themselves in multiple media forms. Media literacy education provides a framework and a pedagogy for the new literacy needed for living, working and citizenship in the 21st century. Moreover, it paves the way to mastering the skills required for lifelong learning in a constantly changing world."

As we mentioned before, 21st century brought new digital technologies along with new knowledges. The knowledge has become limitless and unrestricted, as a result here the need for a new skill appeared: digital literacy skills. Digital literacy skills are the skills for how to distinguish, analyse, evaluate the information that gathered from digital sources.

Wagner (2010) discussed about information age as in the following:

"In a very short period of time, with the advent of the Internet and the increasing availability of fast connections, we have evolved from a society where only a few people had limited information to one where all of us experience information flux and glut – and can look up almost anything imaginable on our computer in a search that takes nanoseconds" (p. 37).

While it has become so easy to access the information, just by a simple click in nanoseconds; the importance has moved to how to use make this information meaningful which is only possible with digital literacy skills.

The Partnership of 21st Century Skills focuses on three sets of digital literacy skills that will be explained next:

- **Information Literacy**
- **Media Literacy**
- **Information and Communication Technology (ICT) Literacy**

1.3.3.2.1 Information Literacy

In the information age, we are meeting limitless information through our school, work, social life, media briefly daily life, and now the problem is having too much information and sources. To be able to access right source,

interpret and evaluate the information gathered information literacy skills are needed along with other cognitive skills which mentioned before such as critical thinking, problem solving, communication.

In the same way, Aabla (2017) asserts that in order to manage the influx of foreign information that provided from a wide range of sources, we need to have information literacy skills.

UNESCO (2005) discusses about information literacy as: "Information literacy empowers people in all walks of life to seek, evaluate, use and create information effectively to achieve their personal, social, occupational and educational goals."

Likewise, Ala (2000, p.2) defines information literacy as: "Information literacy is a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." Table 6 below shows information literacy skills presented by P21:

Table 6.

Partnership for 21st Century Skills –Information Literacy

INFORMATION LITERACY
Access and Evaluate Information   • Access information efficiently (time) and effectively (sources)   • Evaluate information critically and competently   **Use and Manage Information**   • Use information accurately and creatively for the issue or problem at

hand

• Manage the flow of information from a wide variety of sources

• Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information

Source: Partnership for 21st Century Skills,

http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf ,

accessed 20th May 2017

Finally, be able to interpret a knowledge and make judgements on it, we need information literacy skills. Many online resources can be find to build information literacy skills, such as American Association of School Librarians (AASL), who are the "digital directors", leading to use effectively information technologies in schools. (Thrilling, 2009)

1.3.3.2.2 Media Literacy

We can define media as written or not written all communication tools such as: newspapers, internet, radio, television etc. that are the main part of our daily life. Nowadays, it is very easy to see the posts, videos, pictures, news from all over the world directly with social media. And those messages we receive critically influence our social life, which can be very dangerous. As a result, we need to have skills to distinguish the border between real life and media, and criticize the information if it is true or not, if it is imposed by someone or not, if it is bias or not in order to be protected from harmful sides of media.

> According to The Center for Media Literacy, media literacy skills provide "a framework to access, analyze, evaluate and create messages in a variety of forms, build an understanding of the role of media in society, as well as

[develop] the essential skills of inquiry and self-expression." (Thrilling, 2009, p.68)

Furthermore, as its mentioned below on Table 7, media literacy requires the awareness of ethical/legal issues, to access and use of any other's material which can be any document, photo, video or audio in proper way. For example, plagiarism which is copying some others works or ideas, and showing them as one's, is the most common issue among students, and teachers need to make students feel empathy and see that it is morally wrong:

Table 7.

Partnership for 21st Century Skills –Media Literacy

MEDIA LITERACY
Analyze Media   • Understand both how and why media messages are constructed, and for what purposes   • Examine how individuals interpret messages differently, how values and points of view are included or excluded, and how media can influence beliefs and behaviors   • Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of media   **Create Media Products**   • Understand and utilize the most appropriate media creation tools, characteristics and conventions   • Understand and effectively utilize the most appropriate expressions and interpretations in diverse, multi-cultural environments

1.3.3.2.3 ICT Literacy

The developments in technology is changing our lifestyles. While the adults are not so fluent in the use of technology, today from early age, children are growing with technology tools like computers, cell phones, tablets etc. but what consider is how useful they are using the technology for learning? On that purpose, students need guidance to be able to use ICT for their learning and developing their selves.

Thereby, all over the world, a lot of organisations dedicated to put international standards of use of ICT and they help integrate of ICT into schools and education systems, primarily UNESCO and ISTE (International Society for Technology in Education) (Thrilling, 2009).

In 2015, UNESCO convened World Education Forum 2015 (WEF 2015) in Incheon, Republic of Korea to debate the vision and goals of education for the next 15 years, in 2030. The Incheon Declaration (2015) was the product of the meeting with the aim of "'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (p.8) and the following statement made by the declaration in order to show the potential of ICT on Education 2030 goals (Fengchun and Nanaieva, 2016):

"ICTs must be harnessed to strengthen education systems, knowledge dissemination, information access, quality and effective learning, and more effective service provision" (Incheon Declaration, 2015, Paragraph 10).

Table 8 below represents ICT literacy skills developed by P21:

Table 8.

Partnership for 21st Century Skills –ICT Literacy

ICT (Information, Communications and Technology) LITERACY
Apply Technology Effectively   • Use technology as a tool to research, organize, evaluate and communicate information   • Use digital technologies (computers, PDAs, media players, GPS, etc.), communication/networking tools and social networks appropriately to access, manage, integrate, evaluate and create information to successfully function in a knowledge economy   • Apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies   Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 20th May 2017

In summary, ICT has an important role in improving the quality of education, teachers' and students' developments in learning and teaching, communication, accessing information and the like. When we look at the all picture, these three skills – information, media, ICT are continuously dependent to each other, and they form one of the chain which is connected to other 21st century skills illustrated in P21 rainbow. Finally, in collaboration with Learning and Innovation skills and Information, Media and Technology skills, there is one last skill in order to be successful and

effective citizens in 21st century: The Life and Career skills, that will be expressed in the next part.

1.3.3.3 The Life and Career Skills

"Abilities for adaptive and positive behaviour that enable individuals to deal effectively with the demands and challenges of everyday life."

- World Health Organization

The need for life and career skills, is because for today's world it is not enough to have only thinking skills and content knowledge. To be able to cope with the complex life and work environments in the information age, students need to improve their life and career skills (P21, 2004). Life and career skills are some important skills that are most often reviewed on employee evaluations (Trilling, 2009), which are listed in the following:

- **Flexibility and Adaptability**

- **Initiative and Self Direction**

- **Social and Cross-Cultural Skills**

- **Productivity and Accountability**

- **Leadership and Responsibility**

1.3.3.3.1 Flexibility and Adaptability

Everyone thinks of changing the world, but no one thinks of changing himself.

-Tolstoy

Since now, only mentioned many times that we are living in the 21st century; the age of information, changing, innovations, globalisation etc., as a result the need for change and adapt in the education system and

environments, but here it is more important to that first we need to adapt ourselves to those changing environments.

Trilling (2009) describes flexibility as "flex-ability" which is adjusting and adapting strategies for unexpected circumstances. Moreover, he stresses that with flexibility and adaptability, when we face with an unexpected turn that requires change in whole a new way, we can turn this circumstance to the advantage by creating solutions and true innovations which helps to meet the 21st century demands for new ideas and approaches for problems.

Thereby, today's labour market, flexibility and adaptability skills are priority for dealing with new situations or turning disadvantages into advantages for success in global world, as it is mentioned in the following:

91% of HR directors think that by 2018, people will be recruited on their ability to deal with change and uncertainty says The Flux Report by Right Management. Also 60% of HR directors identified employee wellness and resilience as key to enabling organisations to achieve their strategic objectives. 53% said that employees' ability to deal with unanticipated problems is THE key attribute for future business success. (retweeted from https://www.kent.ac.uk/careers/sk/adaptability.htm, 27th May 2017)

Moreover, Table 9 below presents Flexibility and Adaptability skills by P21:

Table 9.

Partnership for 21st Century Skills –Flexibility and Adaptability

FLEXIBILITY AND ADAPTABILITY
Adapt to Change   • Adapt to varied roles, jobs responsibilities, schedules and contexts   • Work effectively in a climate of ambiguity and changing priorities **Be Flexible** • Incorporate feedback effectively   • Deal positively with praise, setbacks and criticism   • Understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multi-cultural environments   Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 27th May 2017

These skills can provide to students by progressive complex projects that students work as a team when the things are not going good, they can change the course and adapt to new project developments with his team and new team friends. Also, they can help their teachers as "tech support" to solve quickly their technology problems when the problem appears (Trilling, 2009).

1.3.3.3.2 Initiative and Self-Direction

"If you don't take a chance, you don't stand a chance."

-Unknown

The meaning of the initiative is defined as "to assess and initiate things independently." or "the power or opportunity to act or take charge before others do." in Oxford Dictionary. We can say that initiative is the mental push that enables us to solve problems or take actions before being told for it. Also, it is a motivational incentive that feeds hope for winning something. With initiative comes independence which is related to self- direction. Self-directed person defined as "(of a person) showing initiative and the ability to organize oneself." In Oxford Dictionary, again. As a result, self-direction and initiative are the skills that cannot exist without each other.

In today's wound up the world, students should be able to self-manage their own time, goals, project plans. Initiative and self-direction skills can be provided through the progress of the school, music, dance, theatre performances, internships, community service projects, student-developed projects and hobbies in terms of developing a passion for a subject, exercising self-motivation, initiative and self-direction (Trilling, 2009). Table 10 below illustrates Initiative and Self Direction skills by P21:

Table 10.

Partnership for 21st Century Skills –Initiative and Self Direction

INITIATIVE AND SELF-DIRECTION

Manage Goals and Time

• Set goals with tangible and intangible success criteria

• Balance tactical (short-term) and strategic (long-term) goals

• Utilize time and manage workload efficiently

Work Independently

• Monitor, define, prioritize and complete tasks without direct oversight

Be Self-directed Learners

• Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise

• Demonstrate initiative to advance skill levels towards a professional level

• Demonstrate commitment to learning as a lifelong process

• Reflect critically on past experiences in order to inform future progress

Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 27th May 2017

1.3.3.3.3 Social and Cross-Cultural Interaction

"Diversity in the world is a basic characteristic of human society, and also the key condition for a lively and dynamic world as we see today."

- Jintao Hu

In the 21st century, one of the most important component of being world citizen depends on understanding and being aware of other cultures (Eğinli, 2011). Increasing globalisation of organisations (we can think about education as well), made diversity in workforce in terms of race, ethnicity, nationality even in home country, and the highlight of importance for fostering individuals cross cultural skills increased value in order to perform well in the 21st century cross cultural environments (Dollwet and Reichard, 2014)

We can provide these skills by using technology or learning programs which is mentioned before (Erasmus+ Lifelong Learning), to create opportunities for students to adapt and adjust their self to cultural diverse. In their home country or in abroad, they can learn how to work effectively and creatively together. Regarding the differences in different life styles, respecting each other's values, avoiding discrimination are essential more than ever in the 21st century.

 The key of being successful in both economically and socially in this era is, as Trilling (2009) mentioned, giving the students the sense of "how we are all different and all the same" (p.81) A famous Turkish proverb says: "Union is strength.", when the world really understand the importance of being together doesn't matter our origins and giving more tolerance to each other, then we will be able to catch the real success and solve all the world problems that are happening today. As a result, social and cross-cultural skills are the most important skills for today's world both in the terms of

economically and socially. Table 11 below shows those Social and Cross-Cultural Skills which are developed by P21:

Table 11.

Partnership for 21st Century Skills –Social and Cross-Cultural Skills

SOCIAL AND CROSS-CULTURAL SKILLS
Interact Effectively with Others   • Know when it is appropriate to listen and when to speak   • Conduct themselves in a respectable, professional manner **Work Effectively in Diverse Teams** • Respect cultural differences and work effectively with people from a range of social and cultural backgrounds • Respond open-mindedly to different ideas and values   • Leverage social and cultural differences to create new ideas and increase both innovation and quality of work   Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 27th May 2017

1.3.3.3.4 Productivity and Accountability

Productivity and accountability are another couple of solid skills for 21st-century success. Productivity is setting and achieving goals in a certain quality of time, prioritising needs to achieve the goal, while Accountability is taking responsibility for one's own work/learning. These two skills are

interconnected. Accountability boosts productivity in terms of taking responsibility for the work or learning. Also, accountability is self-monitoring to do the one's best for the performance of the product.

In the 21st century good project management skills are crucial for learning and work projects, as a result students and teachers need to improve their accountability and productivity skills for their success in school, work and life (Trilling, 2009).

Table 12 below shows Productivity and Accountability skills which are developed by P21:

Table 12.

Partnership for 21st Century Skills –Productivity and Accountability

PRODUCTIVITY AND ACCOUNTABILITY
Manage Projects   • Set and meet goals, even in the face of obstacles and competing pressures   • Prioritize, plan and manage work to achieve the intended result   **Produce Results**   • Demonstrate additional attributes associated with producing high quality products including the abilities to: - Work positively and ethically   - Manage time and projects effectively   - Multi-task   - Participate actively, as well as be reliable and punctual

- Present oneself professionally and with proper etiquette

- Collaborate and cooperate effectively with teams

- Respect and appreciate team diversity

- Be accountable for results

Source: Partnership for 21st Century Skills,
http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf ,
accessed 27th May 2017

1.3.3.3.5 Leadership and Responsibility

"If we could change ourselves, the tendencies in the world would also change. As a man changes his own nature, so does the attitude of the world change towards him. … We need not wait to see what others do."

- Mahatma Gandhi

In today's competitive global world, the importance of teamwork is highlighted more than ever in order to realize and achieve something successful, as a result, leadership skills became even more important. With the globalisation, either organisations or individuals has become more dependent to each other, this situation increased the need for successful leaders with leadership and responsibility skills significantly.

Leadership is the ability to influence and guide a group of people in harmony to maximize their efforts for success. A leader with leadership and responsibility skills must be able to motivate, encourage and inspire team members, provide positive interactions between them (within the framework of respect), and navigate effectively to achieve the shared goal. A team's ability to accomplish a goal, critically depends on how effectively they are guided by their leader while a leader's success to guide, depends on his

leadership and responsibility skills. Table 13 below illustrates Leadership and Responsibility skills which are developed by P21:

Table 13.

Partnership for 21st Century Skills – Leadership and Responsibility

LEADERSHIP AND RESPONSIBILITY
Guide and Lead Others   • Use interpersonal and problem-solving skills to influence and guide others toward a goal   • Leverage strengths of others to accomplish a common goal • Inspire others to reach their very best via example and selflessness   • Demonstrate integrity and ethical behavior in using influence and power **Be Responsible to Others**   • Act responsibly with the interests of the larger community in mind Source: Partnership for 21st Century Skills, http://www.p21.org/storage/documents/P21_Framework_Definitions.pdf , accessed 27th May 2017

To sum up, life and career skills are essential to cope with the challenges of everyday life routine. The globalisation is affecting our education and workplace environments with rapid transformations. To be able to adapt new conditions and deal with stress and frustration, we need new skills. Thereby, the more we develop life and career skills, the more we have flexibility herewith success for 21st century global world.

1.4   Overview of Education System of Portugal and Turkey

Portugal

Portugal became a member of the European Economic Community (EEC) -now the European Union (EU) in 1986 and had educational reform in 14 October 1986, by The Basic Educational Law (Lei de Bases do Sistema Educativo), approved by the Assembly of the Republic in 1986 (Law no. 46/86, of 14 October, subsequently amended in respect of certain clauses by Law no. 115/97, of 19 September). By this law, the Ministry Education became responsible for general non-higher Education in Portugal, while for the vocational and professional schools the responsibility belongs to Ministry Education and Ministry of Labour, Solitary and Social Security. (Ünal and Çolak, 2005) Moreover, by this law minimum schooling determined as nine years, with a minimum school leave age of 15. Finally, this law was important to organize and structure of current education system and teacher training (Alexandro, Field, Mitchell, 2005). Moreover, this law was important for developments in curriculum studies:

> Com a aprovação da LBSE Lei de Bases do Sistema Educativo, em 1986, já numa fase de consolidação da normalidade democrática, uma nova configuração normativa tornou possível uma reforma ampla do sistema educativo, tendo-se tornado a reforma curricular num dos seus principais vetores (Pacheco, 2006), tal como seria consagrada pela reorganização dos planos curriculares dos ensinos básico e secundário (Pacheo and Souso, 2016, p.91)

This Lei law was amended by 1997 and then in 2005. And in 2006, with the Bologna structure, Lei law regulated the changes about new model of organisation of higher education into cycles (Nuffic, 2012).

In 2012, and under the social democratic and popular coalition government of Prime Minister Durão Barroso, a proposition of a new

Education System Act (Lei de Bases da Educação) approved by the Government Council. With this regulation, one of the most important measure was the establishment of 12 years of compulsory Education, instead of the 9 years.

Recently compulsory education starts at 6 and ends at 18 in the end of secondary education. Public education is free and universal. (Eurydice-Portugal, 2016)

Turkey

Educational changes and developments became more common after Second World War, all around the world, also in Turkey (Kurtuluş, 2012). The first major reform around this time was the adoption of the Law on the Unification of Education, No. 430 in 1924, for the purpose of democratization and secularism in education system (OECD, 2007). The following years, with the transformation of industrial age to knowledge age, changes and innovations in all around the world effected Turkish education system as well. By the 2004, after fulfilling the Copenhagen criteria, the European Commission adopted a framework for Turkey in order to access negotiations in 2005. In the end of the negotiations, an acquis with 35 chapters written for Turkey by EU member countries in order to be candidate for European Union. In Chapter 26 (Education and Culture), the focus was education, training, youth and culture (Akşit, 2007, p.130). After that by the support of World Bank and European Union, and OECD, to solve educational issues, rise the quality of education and performance of students aimed for Turkish education system (Çelik, 2012).

After that, various changes have been made in Turkish education system in order to catch up standards of Europe countries. One of the most recent and important reform was in March 2012 with "Primary Education Law no

6287". This law, which is known by public as 4+4+4 and made a sudden change in Turkish education system and one of the important change by the law was: the compulsory education started to last 12 years instead of 8 years (Gün and Başkan, 2014).

Stages of Education System in Turkey and in Portugal

The information about the stages of education system in Portugal and Turkey, in this part is provided by Eurydice (2017) as in the following:

Portuguese education system divided in four levels as; Pre-School Education (until the start of basic education), Basic Education (6-15 years), Secondary Education (15-18 years) and Higher Education, similarly Turkish education system divided in four levels as; Pre-School Education (until the start of basic education), Primary and Lower Secondary Education (66 months-10years old) and (10-14 years), Upper Secondary (14-18 years) and Higher Education.

Until 2012, compulsory schooling was 9 years in Portugal, while it was 8 years in Turkey. In 2012, in both countries, compulsory education increased to 12 years (6 years to 18 years).

In Portugal, the pre-school education covers children from 3 years old to age of basic school and it has formal and informal pre-schools. Formal pre-schools are under the responsibility of the Ministry of Education and the Ministry of Labour, Solidarity and Social Security; while in Turkey the pre-school age is between 36-66 months, and there are formal and informal pre-schools as well. The formal pre-schools in Turkey are under the responsibility of General Director of Basic Education.

The basic education and secondary school education structures makes difference between Portugal and Turkey in terms of cycles. In Portugal, basic education is divided in three sequential cycles, while in Turkey it is divided in two. (see below: Table 14 - Table 15) Primary education in Portugal

divided in 2 cycles (6-10 years old and 10-12 years old), and later following lower secondary education as 3rd cycle (12-15 years old), while in Turkey primary education is only one cycle (66 months – 10 years old) and lower secondary education (which corresponds religious schools and lower secondary schools) is 2nd cycle (10-14 years old) of basic education. As a result, the period of basic education in Turkey is 8 years, while it is 9 years in Portugal. Moreover, the basic education is under the responsibility of the Minister education in Portugal, meanwhile, in Turkey for the basic education is under the responsibility of General Directorate of Basic Education, Ministry of National Education, and in addition under the responsibility of General Directorate of Religious Education in the Ministry for religious schools. Table 14 and Table 15 below illustrates education stages in Turkey and Portugal by level and age of students:

Table 14. Turkish Education Stages

Level	Basic Education								Secondary Education (Upper Secondary Education)			
	1st Cycle (Primary Education)				2nd Cycle (Lower Secondary Education)							
Grade	1	2	3	4	5	6	7	8	9	10	11	12
Age	6	7	8	9	10	11	12	13	14	15	16	17

Table 15. Portuguese Education Stages

Level	Basic Education									Secondary Education (Upper Secondary Education)		
	1st Cycle (Primary Education)				2nd Cycle (Primary Education)		3rd Cycle (Lower Secondary Education)					
Grade	1	2	3	4	5	6	7	8	9	10	11	12
Age	6	7	8	9	10	11	12	13	14	15	16	17

Moreover, secondary education lasts for three years in Portugal (15-18 years old), while it lasts four years in Turkey (14-18). In both countries, this level of education and training includes different types of courses as it is illustrated in Table 16 below:

Table 16. Portuguese and Turkish Secondary Schools

PORTUGAL			TURKEY		
School Types	**Grade**	**Age**	**School Types**	**Grade**	**Age**
Scientific-Humanistic Schools	10-11-12	15-18	Anatolian High School	9-10-11-12	14-18
			Science High School		
			School of Fine Arts		
Professional			Sports High School		

Schools					
Specialised Artistic Schools			School of Social Sciences		
Vocational Schools			Anatolian Religious High Schools		
			High Schools Conducting Vocational and Technical Programs		

Finally, in Turkey, the responsibility of secondary schools belongs to General Directorate of Secondary Education, the General Directorate of Vocational and Technical Education and General Directorate of Religious Education, while in Portugal the responsibility is the Ministry of Education's and the Ministry of Labour, Solidarity and Social Security's.

1.5 Overview of Science Curriculum in Portugal and in Turkey

Although science curriculum content shows similarity between Portugal and Turkey, it has difference on the process.

In primary education level; science is the core subject of a specific field defined as Social and Natural Environments Study in the first cycle of education, in Portugal (Grades 1 to 4); while in Turkey, science content is more limited in primary school level (Grade 1 to 3) in a course which is called Knowledge of Life. In both countries, the purpose of science curriculum at this level is to promote children recognize the natural and social environment in where they live and to help them acquire skills to adapt these circles. Moreover, in Turkey, another course -Sciences- is compulsory and its taught by primary school teachers in the first cycle of

basic education (Grade 3 to 4), however in Portugal in the second cycle (Grade 5 to 6), an independent course, the Natural Sciences taught by specialist teachers (TIMMS, 2015). Here it is possible to make the conclusion that in primary school level, in both countries the core subjects are almost the same but the difference is the distribution of themes over years. In Turkey, the science curriculum is more intensive compared to Portugal which is the result of primary school period in Portugal lasts 6 years whereas, in Turkey it is only 4 years.

In lower secondary school level, science is taught as Natural Sciences with the addition of Physics and Chemistry in Portugal, in the third cycle of Basic Education (Grades 7 to 9), while in Turkey all natural sciences are taught under only one course, Science and Technology, by specialist teachers in the second cycle of basic education (Grades 5 to 8) (TIMMS, 2015). The transition to Physics, Chemistry and Biology independent classes only starts after Secondary School in Turkey. Table 17 and Table 18 illustrates basic education science curriculum in Portugal and in Turkey with the learning areas, core subjects by the level of the schools:

Table 17. Basic Education Science Curriculum in Portugal

PORTUGAL		
Cycle	**Grade**	**Learning Areas and Units**
2nd Cycle	5	Water Air and The Rocks Solo Terrestrial Materials • The importance of rocks and soil in maintaining life • The importance of water to living things • The importance of air to living things Diversity of Living Beings and Interactions with the

		Environment
		• Diversity in animals
		• Diversity in plants
		Unity in Diversity of Living Beings • Cell - basic unit of life • Diversity from the unit - levels of organization • Hierarchical
	6	Vital Process Common to Living Beings • Nutritional changes between the organism and the environment: in animals • Nutritional changes between the organism and the environment: in plants • Transmission of life: reproduction in humans • Transmission of life: reproduction in plants
		Integrity of the Organism • Microorganisms • Hygiene and social problems
3ʳᵈ Cycle	**7**	Earth in Transformation • Earth's external dynamics • Internal Dynamics of the Earth

		• Consequences of the Earth's internal dynamics
		• Earth tells its story
		• Geological science and sustainability of life on Earth
	8	Earth: One Planet with Life
		• Earth System: From Cell to Biodiversity
		Sustainability on Earth
		• Ecosystems
		• Sustainable management of resources
	9	Better Living on Earth
		• Individual and community health
		• Human organism in equilibrium
		• Transmission of life

Table 18. Basic Education Science Curriculum in Turkey

TURKEY		
Cycle	**Grade**	**Learning Areas and Units**
1st Cycle	**4**	Live and Living Beings • Solving the puzzle of the human body • Microscopic creatures and the environment

		Matter and Change • Learning about matter
		Physical Processes • Force and Motion • Light and Sound • Electricity in our lives
		The Earth and the Universe • Our Planet Earth • The motion of Earth
2nd Cycle	5	Life and Living Beings • Solving the puzzle of the human body • Let's walk in and explore the world of living things
		Matter and Change • Changes in matter and distinguishing change
		Physical Processes • Measurement of force • Propagation of light and sound • Electricity in our life
		The Earth and the Universe • The mystery of the composition of Earth's crust

	6	Life and Living Beings • Reproduction, growth, and development in animals and plants • The systems in the human body
		Matter and Change • The particulate structure of matter • Matter and heat
		Physical Processes • Force and motion • Electricity in our lives • Light and sound
		The Earth and the Universe • Earth, the Sun, and the Moon
	7	Life and Living Beings • The systems in the human body • Humans and the environment
		Matter and Change • The structure and features of matter
		Physical Processes

		• Force and energy
		• Electric power
		• Reflection in mirrors and light absorption
		The Earth and the Universe
		• The solar system and beyond
	8	Life and Living Beings
		• Cell division and heredity of human beings
		• The relationships between living things and energy
		Matter and Change
		• The structure and features of matter
		• Phases of matter and heat
		Physical Processes
		• Simple machines
		• Sound and light
		• Electricity in our lives
		The Earth and the Universe
		• Earthquakes and natural processes

Table 17 and 18 above indicates science learning areas and units from Grade 5 to the end of basic education in Turkey (Grade 8) and Portugal (Grade 9). The concept of science curriculum in Turkey after 5th grade, is

categorized under 4 main learning domains which are: Life and Living Beings, Matter and Change, Physical Processes, The Earth and the Universe. In Portugal, the concept categorized under selected grade level and course.

All these domains are connected and complementary to each other. First fundamental topics are taught to students and later more sophisticated topics are introduced. As a result, the connection among these learning domains and courses is vertical and horizontal in both countries.

On the other hand, environment is not an independent subject in both countries, but it is integrated into fundamental scientific concepts in the science curriculum.

To sum up, the main goal of science curriculum in Portugal is to encourage students to raise questions, develop ideas about the world they live in and to gain general understanding of science while developing important skills such as reasoning, critical thinking and communication (Akpan, 2013), similarly in Turkey the key goal is to increase scientific process skills of students with the awareness of environment they live in and in additionally, to integrate technology to the science dimension (Erdaoğan, Kostova and Marcinkowski, 2009).

Last but not the least, TIMS 2015 International Science Achievement compares 47 countries in science achievements at the fourth grades (Picture 2[3]). By the results of this study, Portugal is more successful in science at fourth grades than Turkey, with a score of 508 out of a scale 590, while Turkey's score is 483. Moreover, through the same report, between 2011-2015, Portugal shows decrease (522 to 508) in science achievement, while

Turkey increases (463 to 483) its science performance in this years. Here, we can make the conclusion that although Turkey has a lower score than Portugal, Turkey is more successful in adapting the science education to the 21st century needs as a result it is a developing country, whereas Portugal is not as successful as Turkey about improving their education system, which makes it stop being a developed country:

Picture 2. TIMS 2015 International Science Achievement

1.6 Recent Innovation Practices in Turkey and Portugal

All around the world, the strategic investments on technology has raised by the globalisation in 21st century This digital revolution affected education systems as well. To be able to adapt information age and compete successfully in global race, countries started to do innovations in their education systems. Nowadays so called "1-to-1 computing" is the new tendency of education systems where every student has access to portable computing devices.

Recently, one of the most ambitious national initiative developed by the Ministry of Education for innovation practices in Turkey is the project of FATİH which has started performing in 2012-2013 academic year. The name of the project has an acronym title: FATİH (which stands for Fırsatları Artırma ve Teknolojiyi İyileştirme Hareketi, or "Movement to Increase Opportunities and Technology").

Within the Fatih Project, the main goal is to provide equity and equality in education and amend the technology in schools by using the ICT tools effectively in teaching and learning process; in the levels of pre-schools, primary schools and lower secondary schools by providing laptops, Internet-LCD Interactive Boards, network web in all classrooms and schools (Kurtuluş, 2012).

Minister of Education, Nabi Avcı (2015) clarified the need of Fatih project as "We need to update and format education according to the needs of our time" in the "Educational Technologies Summit 2015" organised for the purpose of contributing to FATIH Project in Education.

Fatih Project is composed of 5 different components which can be listed as in the following (retweeted from http://fatihprojesi.meb.gov.tr/proje-hakkinda/, 2017, June 3):

- Setting up Fibber Internet Network

- Providing Equipment and Software Substructure

- Providing and Management of Educational e-content

- In-service Training of the Teachers

- Effective, Conscious, Reliable, Manageable and Measurable ICT Usage İn Education

In terms of providing equipment and software substructure, its aimed to supply LCD interactive board for each class, printers for each school, and tablets for students and teachers, in order to enable each student and teacher to use ICT tools effectively in education.

Furthermore, all students will have ICT classes (in curriculum) to learn how to use ICT tools effectively, while teachers will have training for learning components and content of the project.

Finally, within the scope of the Fatih project, students and teachers will have access to Educational Social Platform (EBA); which is a social educational platform where they can reach the reliable and revised learning digital materials categorised in accordance with the class level. As a result, Fatih project is a radical step for 21st century education in Turkey in terms of providing learner centred interactive education rather than traditional teacher centred lecture (Picture 3):

Picture 3. Learner-Centred Interactive Education by Fatih Project (2012)
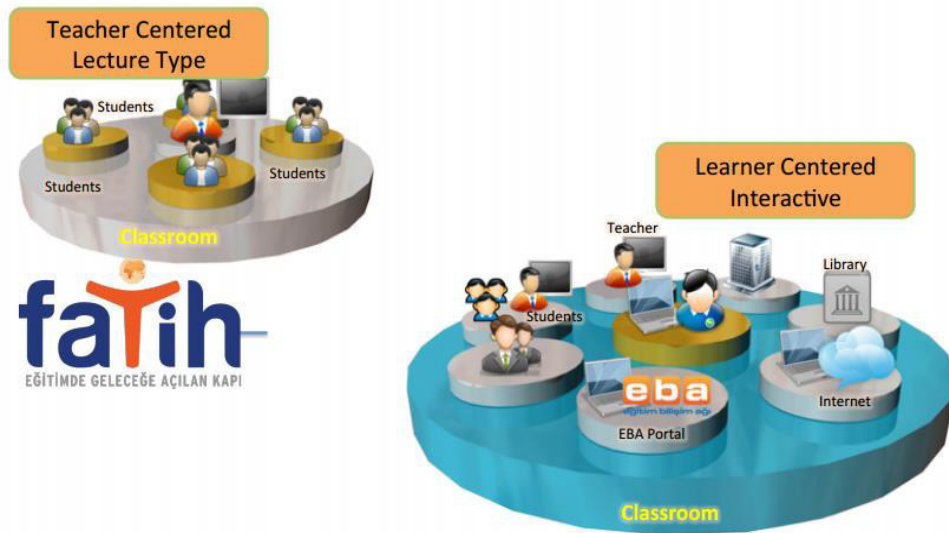
In order to evaluate developments in education technologies within the context of FATİH Project, academicians, policy makers, experts, teachers, students, NGO representatives and technology suppliers in private sector come together and share theoretical and practical information, in November 2017, Ankara, in the FATİH Project in Education, Education Technologies Summit which is held Ministry of National Education, General Directorate of Innovation and Education Technologies.(Picture 4) Fatih Project is an ongoing education project which is developing for 5 years, to reform Turkish educational system through 21st century needs (http://fatihprojesietz.meb.gov.tr/homepage-2/):

Picture 4. Fatih Project in Education Educational Technologies Summit 2017

Similarly, in 2007, Portugal started offering some initiatives in order to transform their education system through 21st century needs by "computerizing" their education systems with a project called "e-Escola and Magalhães Initiative" that took the name from famous Portuguese navigator Fernão de Magalhães. The program started with secondary schools and later it extended to lower secondary schools. On the other hand, as ICT tools, one computer for every five students; computer, printer, video projector for each classroom; and one interactive whiteboard in every three classrooms are granted to teachers and students with broadband internet connections with regard to innovation in education system and to give equal opportunities to all children (Pedreira, 2009):

Picture 5. e-Escola and Magellan Initiative

To sum up, Fatih project and e-Escola and Magalhães Initiative project share the same key goal which is to transform teaching and learning into interactive process for more productive and efficient education in order to prepare students for future workplace. For this purpose, both projects aim to provide ICT tools in order to acquire students 21st century skills especially critical thinking, problem solving, collaboration and creativity etc. The differences between Fatih project and e-Escola and Magalhães Initiative is that the technological tools and internet is free for everyone in Turkey within the Fatih project, in Portugal students on social aid have the laptop computer for free; while the others pay 50 € for it. Moreover, we can make the conclusion that Fatih project is more comprehensive in terms of providing ICT tools and internet. Fatih project targets all classrooms and each student, while e-Escola and Magalhães provides limited tools for students and classrooms.

Chapter II

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Methodology of the research

CHAPTER II

This chapter presents the key issues related to methodological procedures adopted for this research. First, the case study research method is explained in the design of the research. Following, description of the data collection instruments, the participants of the study and the data collection procedures used in the study explained. Finally, after details regarded data analyse procedure provided, the limitations of the study and ethical considerations are discussed.

2.1 Research Methodology

"The researcher will select the best method(s) based on his/her research question: will the researcher study individuals (narrative, phenomenology); explore processes, activities and events (case study, grounded theory); or learn about the broad cultural-sharing behaviour of individuals or groups (ethnography)?"

(Creswell 2009, p.177)

To be able to determine methodology of a research, we need the research questions under investigation. According to Yin (2014), a research question has two components; its *substance* (What is the topic or issue?) and its *form* ("Who, "What?", "Where?", "How?", "Why?" questions). Blatter and Haverland (2014), exemplifies the importance of case studies to understand the phenomenon as in the following:

Case studies are considered to be an excellent means by which to uncover and understand the processes or mechanisms that influence particular variables, why or how different variables are related to each other, for example what influences legislative change or policy formation on a given topic in a given country at a particular time why or how

79

different variables are related to each other, for example what influences legislative change or policy formation on a given topic in a given country at a particular time (Webley, 2016, p.8).

The reasons why this research is mostly supported by case study, have been guided by the following expressions and definitions of case study:

Case studies contain the close examination of experiences of people, topics, issues, or programs to illuminate and understand contemporary cases (Hays, 2004).

Yin (2003, p.13) defines case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; especially when the boundaries between phenomenon and context are not clearly evident."

Case studies enable researcher to "explore individuals or organizations, simple through complex interventions, relationships, communities, or programs" (Baxter and Jack, 2008, p.544).

Similarly, "Case study method enables a researcher to closely examine the data within a specific context. In most cases, a case study method selects a small geographical area or a very limited number of individuals as the subjects of study. Case studies, in their true essence, explore and case study as a research method to investigate contemporary real-life phenomenon through detailed contextual analysis of a limited number of events or conditions, and their relationships" (Zainal, 2007, p.1-2)

Creswell (2007, p.485) asserts that "a case study is an in-depth exploration of a bounded system (e.g., activity, event, process, or individuals) based on extensive data collection"

Case studies are the preferred strategy when "how or "why" questions are being posed, when the investigator has little control over events, and

when the focus is on a contemporary phenomenon within some real-life context (Yin, 2003, p.1)

Hartley (2004, p.323) explains aim of case study as "to provide an analysis of the context and processes which illuminate the theoretical issues being studied"

Case studies "concern with *process* (leading to the outcomes or 'results') can be key to understanding what needs to be done to change things" (Gillham, 2000, p. 7).

Through the definitions above, we can say that this research is supported by case study to understand phenomena of the innovations while exploring processes, activities, and events related to innovations in education in worldwide, Portugal and Turkey in a comparative way without no clear evaluation. In other words, it aims at describing the case of innovation in education, by analysing the ways in which innovations are planned to implement in schools and the ways in which innovations implementing successfully. Moreover, it purposes close examination of real-life context about innovations in education to explore how and why innovations are needed in 21st-century organizations including education, it concerns with the process of innovations, what needs to be done to change 21st-century education system rather than its results. Finally, the study is bounded by the time and by the place because of not having possibility to work with all schools in two different countries in a short period of time, as a result, as investigators we had little control over events, those made us prefer case study as an appropriate research method to reach the research goals.

Secondly, Qualitative research methodology is chosen to collect the data in order to describe the whole picture of the phenomena: innovations in education.

Richard (2013) asserts qualitative studies are superior because of their ability to contribute body of knowledge in terms of the meanings, traits, defining characteristics of people, events, interactions, settings, cultures, experiences. He stresses that "amount" or "quantity" of whatever studied does not exist in any definitions of qualitative research, like in the Berg's (2007, p. 3). definition on qualitative research:

"Quality refers to the what, how, when, and where of a thing – its essence and ambience. Qualitative research thus refers to the meanings, concepts, definitions, characteristics, metaphors, symbols, and descriptions of things."

Similarly, Denzin and Lincoln (2000, p.8) defines the word qualitative as in the following:

"The word qualitative implies an emphasis on the qualities of entities and on processes and meanings that are not experimentally examined or measured (if measured at all) in terms of quantity, amount, intensity, or frequency"

Those expressions do not mean that qualitative researches don't give importance to the results, but in these researches the focus is the reasons underlying to those results.

Finally, as can be understood from the literature review, the studies about innovations and education are largely dominated by quantitative and mixed-methods research studies. Thereby, using qualitative research on this topic will elucidate processes leading to results, rather than the importance of the results themselves (Gillham, 2000).

To sum up, in this research qualitative research methodology is used in order to describe the fact of innovations in education. Considering, in general the data collection is provided by qualitative research methodology, it is supported by quantitative research in terms of the instruments used in data collection that we will explain later. But still we cannot define this study

as a quantitative study because of the fact that it does not include a scale/quantity to be quantitative.

Last but not the least, although the specific methodology of the research is not case study at all because in a case study "researcher explores in depth a program, an event, an activity, a process, or one or more individuals" (Creswell, 2003, p.15) and the dimension of this study is not enough to be case study at all (the study only has one sample (one school) from each country); we can still say that research is mostly supported by case study approach aimed at shedding light into a deeper understanding and description of the perceptions of innovations in education, in Turkey and in Portugal, as it is described as "an in-depth study of a single person, event, community or group" by Kalof, Dan and Dietz (2008, p.194). In additionally, the case that explored in the current study was the perceptions and the experiences of innovations in education systems in the 21st-century world, and the use of innovations in Turkish and Portuguese science education systems.

2.2 Research Design

Case study research design categorized in different groups by different authors. For example; Stake (1995) classifies case studies as *the intrinsic case study, the instrumental case study* and *the collective or multiple case study.* The intrinsic case study focuses on a single case and this case provides a very detailed analysis of the experiences, while the instrumental case study focuses on issue (the research topic or the question), not the case. Finally, the collective or multiple case study, focuses on one issue but with more than one case to investigate that issue (Gültekin, 2016). We can say that this study is an instrumental case study because I will particularly analyse the effects of innovations on education systems in 21st century world, specifically the countries Turkey and Portugal.

On the other hand, Yin (1994) classified case studies as *the exploratory case study, the explanatory case study* and *the descriptive case study.* The exploratory case study focuses on a problem that has not been studied yet and formulates the problem. The explanatory case study focuses on "how" and "why" questions in order to investigate cause-effect relationships of variables. Finally, the descriptive case study focuses on characteristics of the facts usually in categories by using "what" questions. This study can be considered as explanatory because the goals of the research are mainly to find the answer "how" innovations effects education systems and "why" they are needed in 21st century, which means the research is more than the descriptions of the phenomenon.

2.3 Context of the Study

This research is conducted in Portugal and Turkey, in two public schools in secondary school level. From each school, one science teacher and their 20 students are participated. As a result, in total, the study is done with one Turkish science teacher and his 20 students who are at 8th grade; 1 Portuguese science teacher and her 20 students who are at 9th grade in secondary school. The study adopted both qualitative and quantitative approach and case study methodology to gain a deeper understanding of the goals of the research.

2.4   Participants

In this research, it was not possible to apply the method and generalize the system because there were only one secondary school from each country and few educators of science and secondary school students who were taken as the participants of the research.

There are four key participants in the study: the Portuguese Science teacher (PT) whose pseudonym is Teresa, the Turkish Science teacher (TT) whose pseudonym is Eray, Portuguese Secondary School students (PS) and

Turkish Secondary School students (TS). Table 19 and 20 presents the characteristics of the participants using code number for identifying them. Information for research presented in the informed consent process which is fundamental to protect participants' rights and confidentiality of the data as the main issues during the research:

Code	Gender	Age	Position	Academic Qualifications	Disciplines of Teaching	Years of Service
PT	Female	52	Lecturer	Licence in teaching Biology	Biology	23
TT	Male	26	Lecturer	Licence in teaching Science	Biology Physics Chemistry Mathematics	4

Table 19. Participants of the Study I

Code	Gender	Age	Position	Grade	School
PS	Female / Male	15-16	Students	9	Agrupamento de Escolas de Póvoa de Lanhoso
TS	Female /Male	14-15	Students	8	Tekneli İlköğretim Okulu

Table 20. Participants of the Study II

2.4.1 PT: Portuguese Teacher

Teresa was a 52-year-old Portuguese teacher of Science who had been working at the institution for 30 years at the time of the study. This teacher has a degree in Teaching Biology and Geology and a Master's degree in Education, with a specialization in ICT (Information and Communications Technology) for teaching of Minho University, a very high- rank stake university in Braga. She worked in Agrupamento de Escolas de Póvoa de Lanhoso for 23 years and has coordinated European projects under the Lifelong Learning Programme, with particular emphasis for the Comenius and eTwinning programmes. Currently coordinates projects integrated in the Erasmus +. Usually runs training sessions for teachers within the framework of the pedagogic use of ICT but have the competencies to develop training sessions in Biology and Geology methodology in classroom. Registered in eTwinning (www.etwinning.net) since 2005, she is the eTwinning Ambassador of the northern region of Portugal.

She is interested in innovative teaching and innovative projects between different schools. She always puts her students first and designs student-centred lessons which aim at increasing student autonomy. Moreover, she always encourages the teachers and students to participate in international innovative projects such as e-Twinning or Comenius and Erasmus+. She aims at growing students into autonomous, self-confident, creative and innovative, risk-taking individuals.

2.4.2 TT: Turkish Teacher

Eray is Science teacher from 4th grade to 8th grade, during the post-intervention period.

Compared to Teresa, Eray is a new teacher at the Science in Tekneli İlköğretim Okulu. He had been working at the institution for 2 years at the time of study. He graduated from Faculty of Education, Department of

Science Teaching from a high-rank university in Ankara. Upon graduation from university, he entered national exam to be a teacher in Turkey and he was appointed to Şanlıurfa, Turkey in 2014. He had been a science teacher for 4 years.

Likewise, Teresa, Eray gives importance to innovative way of teaching, and he fosters his students to benefit from technology for learning. He often uses ICT tools in his classroom to catch students' attention on subjects and to teach effectively. Last year he participated in STEM & Makers Fest/Expo 2016 TUBITAK projects, STEM Teachers Conference in Hacettepe University in order to encourage his students do innovative science projects.

2.4.3 Students

The students who has participated this research were pursuing their education at secondary school level in Tekneli İlköğretim Okulu, Şanlıurfa, Turkey and in Agrupamento de Escolas de Póvoa de Lanhoso, Portugal.

20 Turkish students (TS) from 8th Grade and 20 Portuguese students from 9th Grade were chosen for this study. The groups that are participated were both high achievers and low achievers because of their previous school experiences. Participants were aged between 13-16. Convenience sampling method of non-probability sampling strategy was used when choosing the participants of this study, because this study is not intended to be used to infer from the sample to general population in statistical terms.

2.5 Data Collection Instruments

Working with a small group is one of the advantage of case study research which enables the researcher to use several data collection instruments (Gültekin, 2016). In this study, the quantitative data collection instrument; *document analysis*; and the following qualitative data collection instruments; *individual interview* (with the teachers); and *questionnaires* (for the students) were chosen for data collection for the present study.

2.5.1 Document Analysis

Document analysis is used in literature review in order to interpret information and evaluate documents about the research topic and questions. It is a qualitative research method with systematic process for reviewing or evaluating documents and materials (Bowen, 2009).

To be able to analyse documents effectively, the researcher should have the skills and intuition to access and interpret the accurate data. Merriam (1998, p.112) defines the term document as; "the umbrella term has been chosen to refer to a wide range of written visual and physical material relevant to the study at hand.". In this study, the main documents that were reviewed were the articles, the books, the master and doctoral theses, the presentation papers, the publications, the agendas, and the journals. This step started from the beginning of the research and continued until the end of the study for documenting the scope and meaning of innovation in education and the innovations in education in Turkey and Portugal through several different sources.

2.5.2 Individual Interviews

Interviewing allows people to learn about the participants' ideas, thoughts, and memories in their own way of explaining their selves (Gubrium and Holstein, 2002). Interviews can be three type which are; structured, semi-structured or unstructured. Structured interviews are more controlled interviews with pre-planned questions, while semi-structure interviews are more flexible compared to structured interviews, it depends on participant's responses but still in semi-structure interviews there are questions planned before. Unstructured interviews are the most flexible interviews without pre-planning, it promotes open discussion (Schuh and Upcraft, 2001). In this study, unstructured interview method with open-ended questions used for the data collection.

The interview of about 30 minutes was held with the Portuguese teacher in the stuffs room of the school in order to gather some information about ongoing innovations in her current school and the challenges. It took around 30 minutes. I took some notes about key points of interview to memorise later. Also, I tried to avoid giving my opinion to not affect the teacher's opinions, while I was guiding the discussion with my questions.

Secondly, the Turkish teacher conducted interview by Skype because in the period of conducting this study, I was in Portugal. Similarly, it took 30 minutes and I took some notes of key points of the discussion through the teacher's words. Those interviews provided to get information by the teachers directly through their experiences and to comment on the profile obtained from their scientific literature.

2.5.3 Questionnaires

Questionnaire is a standardized survey instrument used in order to collect data from participants about themselves, a social unit or a school. For this purpose, each respondent is exposed to the same questions and same

system of coding responses. The most important thing ensured in a questionnaire is the differences in responses to the questions are because of the differences among the respondents, rather than differences in the processes of getting responses (Siniscalco and Auriat, 2005). As a result, we can make the conclusion that a questionnaire is a tool or an instrument which contains survey questions to collect data about a specific topic.

In this study, for understanding students' perspective to innovations in their science classes, students are asked to complete the questionnaire form (Appendix 3, Appendix 4), which contains instructions, open-ended and close-ended questions and spaces. The questionnaire applied to 31 Portuguese secondary school students in Portuguese by me, while it applied to 28 Turkish secondary school students in Turkish by the Turkish teacher. In both classes, it took between 20 and 30 minutes for students to complete the forms.

Finally, the reason why I chose those data collection instruments is because they cover geographically spread samples from Turkey and Portugal, and enable dispersed participants to be accessed and included in the sample for the goals of the study.

2.6   Procedures for Data Collection

To determine the Turkish and Portuguese students` and their science teachers` opinions, beliefs and attitudes on innovations in science education, firstly the secondary schools to be studied are chosen in both countries.

The Portuguese School is chosen through my Comenius Assistantship experience because I already did a project in that school before I study my master degree, it was easy to have connections to get permission from the headmaster of the school to conduct the study. The school in Turkey is chosen from my Turkish friend who we studied together, and after

graduation he started working as a teacher in government. As a result, in both countries getting permission process didn't have difficulties.

The school in Portugal is visited in the first weeks of the study and they are informed about the goals, concept and period of this research. For the teacher volunteer participant in the study, permission asked from headmaster of the school. Finally, the Portuguese school accepted to participate in this study and with the Portuguese science teacher an appropriate date arranged to conduct the study.

The managements for the school in Turkey is provided by the Turkish teacher because in the period of the study I was staying in Portugal. He informed me in every step and similarly, he asked permission from the headmaster of the school to conduct the study. The Turkish school accepted to participate in this study as well and the Turkish science teacher scheduled a day to collect data for the research.

In the study of Portuguese school, a questionnaire form which has multiple choice closed-ended questions and open-ended questions, is given to each student. The questionnaire sought information about the students' age, gender, grade and attitude toward innovations in their classes. The students are informed in cases where they are in a dilemma or where they don't understand. In this way, clearer answers to the questions are provided by the students. After the students completed the questionnaire, with the Portuguese teacher and unstructured interview held for 30 minutes with open-ended questions, and her answers are recorded as notes.

In the study for Turkish school, the questionnaire is applied and explained to the students by the Turkish teacher, and the forms are sent by internet to me. The unstructured interview with the Turkish teacher held by Skype approximately for 30 minutes, and the key points are recorded as notes for the data collection.

2.7   Procedures of Analyse

The qualitative and quantitative data collected for the research questions were analysed employing descriptive content analyses approach. Descriptive method, is used frequently in the analyses of qualitative data in order to describe the obtained data systematically and clearly and in the end to explain and interpret these descriptions' cause and effect relations (Yıldırım, Şimşek, 2011, p.224).

Data analysis is a systematic search for meaning. It is a way to process qualitative data so that what has been learned can be communicated to others. Analysis means organizing and interrogating data in ways that allow researchers to see patterns, identify themes, discover relationships, develop explanations, make interpretations, mount critiques, or generate theories. It often involves synthesis, evaluation, interpretation, categorization, hypothesizing, comparison, and pattern finding. It always involves what H. F. Wolcott calls "mind work" . . . Researchers always engage their own intellectual capacities to make sense of qualitative data (Hatch 2002, p. 148).

For this purpose, using the research questions as a guide, the interview and questionnaire data categorised after synthesis and evaluation. The categories, are identified carefully through a core theme and each theme had some direct citations from interviews and interprets. Moreover, graphics and percentages are created on Ms Excel from the data gathered from the questionnaires for statistical analyses under each theme. Finally, the relationships and differences in both countries are specified and in the end the data reassembled in order to tell the participants opinions and experiences on research questions.

2.8   Ethical Procedures

The scientific ethics and academic rules are met diligently in the process from the proposal phase of the work, Innovations in Education Curriculum and Teaching Innovation in secondary school - a comparative case study

between Turkey and Portugal which I prepared as a master's thesis. Also, all the information in the thesis obtained within the framework of scientific ethics and tradition in this work is prepared in accordance with the thesis writing rules, finally all indirect and direct citations in this work are shown with their sources in the references part.

2.9   Limitations

The limitations of this dissertation concern mainly the time constraints and the exploratory nature of the study. One year to collect the data in Portugal and Turkey and to analyse the data along with the writing up of the dissertation was not an easy task. The second limitation was the few numbers of participants and especially the language problems between participants. However, the various roles undertaken by the participants have made a good sample of key informants about innovations in secondary school science classes.

Chapter III

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Findings

CHAPTER III

Findings

In this chapter, findings are described. This is done according to the main emerging themes arising from the data, which were described in the previous chapter. Findings will be presented according to the following themes: views of the participants about the innovations itself; its positives and negatives; the changes and challenges in its implementation, and usage of ICT in terms of innovations.

3.1 Participants' enthusiasm to the Innovations

The participants presented their points of views about the pros and cons of their science classes, their methodology and technique of their teacher, and their needs for the better learning environment. In general, the participants are eager to innovations such as new methodologies; new technologies tools which will make them innovate and find new solutions to the problems in their classes. Moreover, innovations are seen as an incentive for students, due to the fact that it makes their classes more enjoyable and interesting.

High learning motivation levels are necessary for a better change. To be able to put innovations in practice, both students and teachers must be enthusiastic for new learning aims, methodologies, and metrics. If the motivation level is high, there will be measurably highly levels of engagement by students and participation will increase the efficiency of the

classes. Under this condition, the participants in the study took it seriously about the importance of innovations in science classes.

The teachers' and students' willingness for innovations is very important for implementing innovations in Science classes because sometimes even though the teachers want to try new things in the class, the classroom seems to be not ready or motivated for the new things. They just want the classes end soon. In order to apply innovations efficiently, we should see that the students are enthusiastic enough. (TT)

Figure 6 below shows through survey results (2.1) by and large, the participants are willing to see innovations in their classes. While 53% percentages of Portuguese students totally agree that they like innovations in the classes, 80% of Turkish students they agree on the same point:
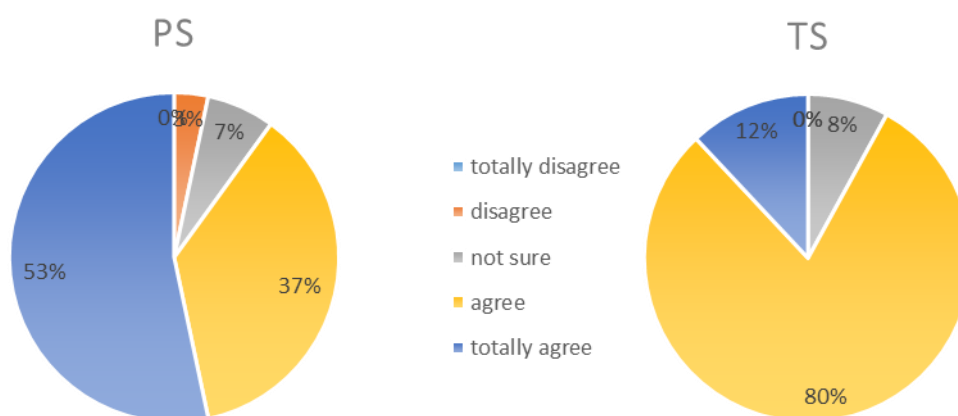
Figure 6: Interest to Innovations

As it can be seen in Figure 6, although the majority of students are interested in innovations, the minority are not thinking the same. TT explains the reason why some students are not willing to innovations as in the following:

Some students are not willing to innovations because they can prefer classical methods, or they may have difficulties when they meet with a new practice. Also, every student

96

has different personality and the ones who are less social and less active in classes, find innovative methods such as group works boring and not interesting (TT).

To sum up, it is difficult for teachers to fit one method or practice for all the students since they have different personalities but mostly students find innovations in their classes interesting, so, by trying different kind of innovative methods teachers can rise their students' motivation levels.

3.2 The Positive and Negative Aspects of Innovations

The teachers have identified both positive and negative aspects of the innovations according to their perceptions and their experiences of their science classes. Table 21 below shows the teachers aspects of innovation:

Table 21. Positive and negative aspects of innovations

Positives	Negatives
Making possible the impossible	**Education process problems:**
"Innovations bring closer the classroom of the reality of the society/student and open new doors for students; promote the learning to learn; have available, in real time, resources that, otherwise, would not be possible (examples: simulation of seismic waves propagation; perception of earthquakes that are occurring around the globe at every moment; several simulations in the range of sciences)" (PT)	"When we want to try new things in our classrooms, usually we have a timing problem with the curriculum plan. Because we are preparing our students for a national test, and in this competition the program force us to focus on *what* we teach instead of *how* we teach, as a result we have to hurry and unfortunately we don't have time to try new things." (TT)
"For example, ICT provides students	

have an easily accessible platform for sharing materials and ideas and connect with the world, without traveling. They can learn about cultures, ongoing innovations from all around the world and they can connect with the world. Or they can use online libraries to read some books without any access/financial problems." (TT)	
Students' Motivation: "Innovations increase students' motivation for learning." (PT) "New activities or new methods in classes makes attention of students rise, they follow the class more carefully and focus on more." (TT)	**Physical conditions:** "High dependence on technology and little investment in the development of skills related to handicrafts, creativity, among others." (PT) "Even though we want to use new tools in our classrooms we don't have enough physical conditions such as smart board, tablets or even computers for all students. Or for example, we want to use the laboratory for practical classes, but we don't have enough material for our crowded classrooms. The financial conditions of our school don't let us innovate." (TT)

Improving Skills:	Teachers' readiness:
"Innovations train necessary skills for the entrance/ingress into active life and/or at the university (example: search reliable information, treat this information, practice the presentation formats of the information)" (PT)

"Students gain a lot of skills through innovations, such as teamwork, creativity, critical thinking, problem-solving ability etc." (TT) | "As a teacher, I don't think we have enough knowledge about innovations in education. For example, most of the teachers don't know about ICT, as a result, they don't use it in their classes. In my opinion, the government should provide some courses for teachers in order to develop their skills and catch up new age's needs." (TT)

"Lack of teachers' formation to use properly all the resources, at this time, available, particularly for mobile devices (tablets and smartphones)." (PT) |
| Knowledge of Technology: | Students' readiness: |
| "Innovations potentiate/enhance the resources that students have easy access like smartphones (the can be an excellent way to monetize in the context of teaching and learning)." (PT) | "Little ability of (the) students to use the ICT to learn (the students use ICT to play, send messages, post on social networks but in most cases, they |

	don't know how to use these devices to learn issues
	related to different school subjects)" (PT)
	"Most of the students' lack of knowledge of how to use technological tools in terms of learning. Usually, it causes spending much more time than planned in the class." (TT)
Team Teaching:	**Difficulties on Evaluating:**
"In terms of innovations, we are conducting an e-Twinning project with seven schools from different countries for four years. We are working as a group of teachers from different areas in our school while we are working with international teachers. It is really important to have teamwork between teachers." (PT)	"The disadvantage of innovations, sometimes the method that applied is difficult to measure. For example, project-based learning is different from other teaching and learning methods. It is more observational and hard to evaluate quantitatively." (TT)
"We are gathering all together to follow updates of educational innovations in science education and we discuss what we can do more in our classes in order to raise students' achievement.	

Teamwork between teachers motivates us more for using innovations in our classes." (TT)	

3.3 Changes and Challenges of the Innovations

Through the participants' point of view, there is several changes and challenges in the implementation of the innovations.

3.3.1 Team teaching/collaboration

Team teaching/collaboration boasts many advantages in improving the teaching and learning skills. A number of articles related to innovation in education described innovative teachers as highly collaborative. It provides not only a dynamic and interactive learning atmosphere but also it helps teachers across different disciplines share their ideas and inspire new ideas among their classes. It encourages teachers for new activities, projects, and innovations.

Buckley describes the importance of team teaching in his book **(Team Teaching: What, Why, and How, 2000, p.4)** as the following; "Team teaching involves a group of instructors working purposefully, regularly, and cooperatively to help a group of students to learn. As a team, teachers work together in setting goals of a course, designing a syllabus, preparing individual lesson plans, actually teaching students together, and evaluating the results. The share insights, arguing with one another and perhaps even challenging students to decide which approach is correct. This experience is exciting. Everybody wins!"

If we talk about the team teaching in schools, it differs from Portugal to Turkey. In the Group of Schools of Póvoa de Lanhoso, teachers' awareness of team teaching/collaboration is higher than in Tekneli Secondary School, Turkey. One of the benefits of the e-Twinning project that the school is conducting for four years is while it provides collaboration between teachers of the school from different disciplines, it also gives the opportunity to make collaboration between international teachers. E-Twinning is an online platform which offers teachers from different countries to share their ideas, collaborate and develop projects together. It promotes school collaboration by using ICT.

"Through my experience with the e-Twinning project, we engage in professional discussion about leadership, innovation, and professional collaboration." (PT)

As Cumming and Owen (2001) states that innovative teachers are more likely to be collaborative and teachers who collaborate are more likely to be innovative.

In terms of collaboration, teachers in Tekneli Secondary School have meeting two times in a year (each semester) in order to review the aims of the curricular program, students' achievements, and evaluation methods, moreover to share their ideas about how to improve the success of the students with innovations in their classrooms. Beside that meetings, teachers have general meetings in the staff room but these meetings are not taken seriously. The main issue with teacher collaboration is teachers' reluctance to participate in these meetings:

We are facing with the unwillingness to cooperation issue at my school. Our issue is not a lack of time. Actually, our teachers just don't work together. One idea I thought of was asking other teachers if we can meet at least once a month (maybe even getting together after school) for planning, speaking about ongoing problems and finding solutions to the problems and finally making discussions about how to encourage students to innovate in our classrooms. Unfortunately, collaboration is

always a difficult thing especially when all participants involved are not willing. (TT)

It is possible to talk about the same issue in Group of Schools of Póvoa de Lanhoso, teachers' unwillingness to collaboration because of the teachers' relation with each other, furthermore another the reason under this reluctance is teachers' being a lack of time and the intensity of new curriculum subjects. Moreover, setting a common time to meet and collaborate for everyone is usually a problem:

> Not all the teachers are willing to collaborate in our school. While some teachers have good relationship with others, some don't. This makes separate the teachers into groups. While a group of teachers is working in collaboration together, searching and participating in innovative projects, other some other teachers don't want to participate because of personal reasons. Also, timing problem is another issue besides personal problems related to the situation. (PT)

Finally, most of the studies prove that collaboration encourages teachers to be innovative. When teachers see innovation in action by others around them such as using technology, they start to implement same things in their classes. We can accept that collaboration is a dynamic process between teachers in terms of innovation.

3.3.2 Innovative Classroom Environment

A classroom environment is an essential component to innovative learning. In an innovative classroom environment, the focus is on student learning. A study of seventeen exemplary technology-using teachers who are opposed to traditional teacher-directed environments, revealed that their practices focused on student-centered lessons (Ertmer, Ross and Gopalakrishnan, 2000).

Innovative classrooms rise students' motivation and interest to the subjects. When students are more interactive they are more likely to pay attention, and learn. Figure 7 below shows that 53% of Portuguese students

and 56% of Turkish students related new techniques/tools with their interest in the subjects:
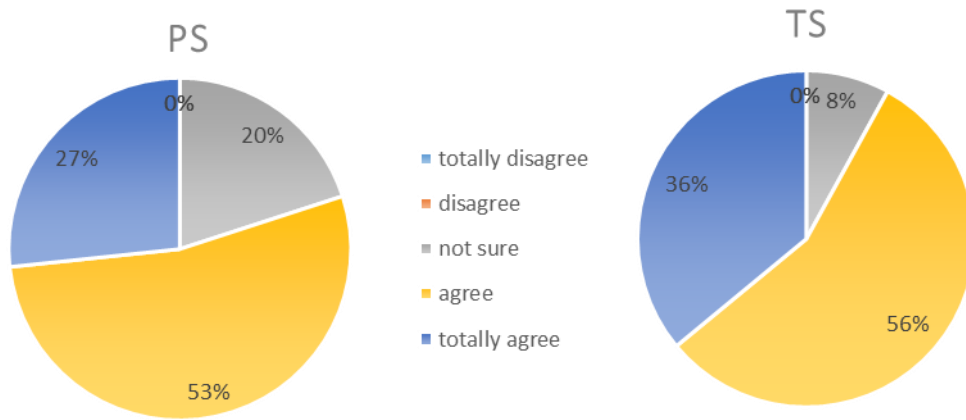
Figure 7:

New Techniques/Tools to Rising Interest

Also through questionnaire results, students stated that the time they enjoyed and motivated more was when the teacher used different/new activities or tools:

"When our teacher showed us Kahoot (Platform-collection of questions in real time) was the time that I enjoyed most from all classes." (PS30)

" In classes of Biology, I was pleased with the use of new technologies in different classes, such as the realization of group work." (PS9)

"The best time for me was when our teacher showed us a simulation with Algodoo about Archimedes' Principle." (TS2)

"It was really funny and informative when we played electric field game on Phet.colorado. I learned while I was playing. I will never forget this subject." (TS14)

As it can be seen from the Figure 8 below, the time that students are more interactive and enjoyed the class is when they use technologic tools.

This fact explains why the students want to use technologic tools more often in their classes. From the survey results, while 43% of Portuguese students want to use technologic tools more often, 64% of Turkish students agree with the same fact:
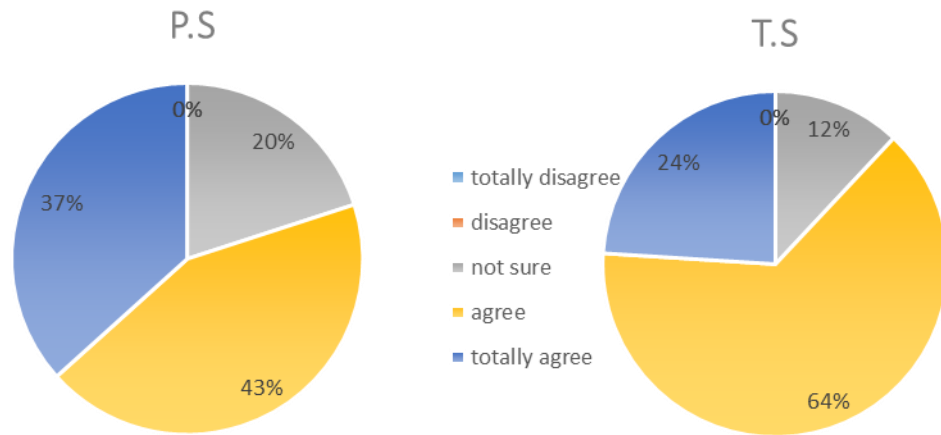
Figure 8:

Desire to Use Technologic Tools

When its asked to students what they like to see in their classes, they replied as in the following:

I particularly like the interaction that the teacher has with the students to teach the subject. I also like the technological learning that the teacher gives us. (PS19)

In my opinion, when our teacher uses technologies like a smart board, computer, projection our classes are more interesting and entertaining. (TS3)

On the other hand, technology allows student-centered classroom environment which is the most important element of innovations in education. According to Hartnell-Young (2003), instruction in an innovative classroom is teacher facilitated, rather than the teacher transferring knowledge to students. Collaborating and Communicating are two main goals of 21st-century skills for students. Students must be able to share their

thoughts, questions, ideas and solutions while they are working together to reach a goal. In that purpose, teachers lead group works for an innovative classroom environment:

> From my point of view, we should encourage students to innovate which is only possible with a creative lesson plan. In my classes, I prefer project-based works or group works rather than traditional teaching methods which are the teacher is the active one in classes while all the students are passive. I should be less speaking in order to give opportunities to students to share their ideas, and be more interactive. (TT)

Figure 9 below shows the results of students' evaluations of their teachers if they are leading group works or not are quite satisfied. 60% of Portuguese students and 76% of Turkish students thin their teacher is very effective on leading group works:

Figure 9:

Teacher's Leading Group Works

Students explained their opinions on group works as in the following:

> I like when we do group works at the end of the units. It gives us the opportunity to work together. We are more productive when we share our ideas and help each other. (TS21)

I like when the teacher asks questions to students, it is a way to interact with the students and also to attract more attention. (PS18)

In Tekneli Secondary School, the students are given assignments of group work usually outside the class more than in the class. The teacher asks students to do it outside the class and after that bring to the classroom for presentation, or for evaluation of the teacher, whereas in the Group schools of Póvoa de Lanhosa, the students are mostly given group works during the classes. The teacher gives the students the guide for the group work and gives the feedback to their works in that moment.

As a result, group works enables students to think creatively and find innovative solutions for existing and future problems. Working together help students to think of the problem with different perspectives and innovate better solutions and finally create a product.

3.3.3 ICT Tools for Better Learning

"Technology is endowed with an immense potential to innovate education" (Shivakumar and Manichander, 2014, p.803). There are various ICT tools for teachers that are easy to learn for innovative teaching.

The effective use of new technologies requires innovative teaching skills. When students are not provided with an adequate understanding of the capabilities of technologies, there is a high probability that they will replicate familiar forms and ideas using the new tools, as opposed to using the new tools to explore new connections and different ways of fashioning (Sultan and Al-Lail, 2015, p.11).

The teachers have listed the ICT tools which they have been using in their classes for innovative teaching as in the Table 22 below:

Table 22. ICT Tools for Innovative Teaching

Turkish Science Teacher	Portuguese Science Teacher
Algodoo: "I use Algodoo to create 2D simulation scenes. It designed in a playful, cartoony manner, as a result, it encourages students own creativity, ability, and motivation to construct knowledge while having fun. I used this tool for the subject Archimedes' Principle and my students loved it!"	**Kahoot:** "I use Kahoot (https://kahoot.it/#/). Sometimes I made the Kahoots use in a class. Sometimes the students made the Kahoots play with other. Kahoot is a game made to use at the end of a subject to assessment the learning. For this game, the students use smartphones."
Antropi: "With the Fatih Project, Antropi has been selected as a software for interactive whiteboards. I use Antropi to import my PDFs, presentations, videos, images and so on. It is easy to use and fast, helps me save time."	**Google Drive:** "I use a lot of collaborative tools. The most used are Google Drive to make collaborative presentations (PowerPoints), collaborative texts and forms. "Collaborative works" – 2, 3 or 4 students work in the same document. The students don't need work in some time. Example: During a lab class, the students take pictures about the experiences (with a smartphone), take notes and make some research on Internet. After, in groups, try organized the information in a collaborative presentation to show in a class."
Prezi: "We can consider Prezi as Power Point but it is with animations as a result, more fun for students. I prepare most of my presentations with Prezi and it affects	**QR codes:** "I use QR codes about some information important to students are motivate to search more about one subject."

students' motivation positively."	
Phet.Colorado: "Phet.colarodo is the tool that I use more frequently. It is an interactive simulations project at the University of Colorado Boulder. It encourages students to learn through exploration and discovery while they are enjoying."	**Google Scholar:** "I ask students to use Google Scholar to found credible information."
TED-ed: "I suggest my students check the videos on Ted-ed. They are in English but most of them have Turkish subtitles and the videos are really funny and interesting at the same time for students."	**e-Twinning Space:** "I involve students in European projects - Erasmus + and eTwinning - so, I use The eTwinning platform in www.etwinning.net. The last project was "Education for a sustainable consumption (ESC), a global challenge". You can see some products in https://twinspace.etwinning.net/1699/"

3.3.4 The Challenges in Innovations Implementations

Teachers explained the challenges that they usually face while implementing innovations in their classes as in the following:

The implementation of innovations in the classroom requires that the time spent for the preparation of materials and, such as the classes are so much bigger. It happens because the teacher has to explore the tools you will use, from a technical point of view like pedagogical interest. The professor has to do the analysis. He needs to have a reasonable control of the instruments that he will use in the classroom, so it requires a very long time of consumption, still, the use of methodologies more innovative that meet students' interests help to increase the motivation of the students for the learning. The truth is that it is not difficult to teach motivated students, the difficult part is to teach unmotivated students. If with the use of innovative methodologies, it is possible to motivate the students, then it can

already be considered that all the time last for the preparation of the classes was well spent. Often, teachers and to implement something more innovative and they can't do it because the school doesn't have the resources or because these are barriers to the use of some of the resources or because these are barriers to the use of some of the resources that the students use/have like for example, mobile phones. I have a chance to be in a school that is open to innovation and such barriers of this type don't set. This is, however, a problem that can't be neglected. (PT)

The biggest problem on implementing innovations is being lack of material and teachers' readiness. We don't have classes full equipped with technology or laboratory tools. Sometimes we want to do tests in laboratory for innovative teaching but there are usually some materials missing and the only solution is or teacher needs to provide the missing materials before, or we not doing that test which is sad. By 21st-century, everything has changed and if the classrooms are not changing by ages then it means there is a problem. As a result, in my opinion classrooms should redesign through the needs of century. Another thing, it takes a long process to organise a trip to outside of school like museums, galleries, universities etc. and unfortunately, we don't have enough time to do these types of activities because of our tight schedule and curriculum. For me, this is an issue we should not ignore since these trips provide students learning by living which is the most effective way of learning. (TT)

3.3.5 Support Received

Both teachers stated that they don't have any special support from school in terms of doing innovations:

There is no specific support for seeking to innovate, nor benefit in terms of the progression in the teaching career. Each teacher demand, or not, to innovate in terms of those that already are its characteristics in relation to the way he sees his profession, and also in function of the school context he is. In my case, I always loved to vary the strategies to make the process of teaching and learning more interesting for students and for me. I always considered that teaching is nor restricted to the contents of a discipline but it should enhance the integral formation of the young/student. In this sense, I loved to update myself, either through structured training classes/courses, either through self-learning. On the other hand, I find myself for many years in a school that focuses on innovation and openness to Europe and the world, which really facilitates the work of teachers. (PT)

Although school administration wants to support for innovative education especially by designing classrooms, the financial conditions don't let it. Or, the school is not providing an informal education or course for teachers to improve themselves in terms of using ICT tools or to update their knowledges. I don't think that we have enough support for innovations in education, the schools are still not ready for it. (TT)

CONCLUSIONS AND IMPLICATIONS

In this research, we studied on the perspectives of the students and the teachers; basically, the cornerstones of education, about innovations in a comparative way between two countries: Turkey and Portugal. The purpose of the study was to learn about the students' and the teachers' knowledges on innovations, the opportunities and the obstacles of the schools and classrooms through innovations, what can be done for encouraging more innovations or eliminating the obstacles through innovations, and to seek the innovation culture of teachers and the schools.

Through the goals of the study, firstly literature reviewed about scope and meaning of innovation and innovation in education, and the connection between them discussed in summary, and mainly focused on "why" and "how" innovations in 21st century. Finally, the science curriculums and ongoing innovation practices of the studied countries are examined. To learn teachers' and students' experiences and opinions on innovations a qualitative research which is supported by quantitative research tools conducted.

In this chapter, the results after interviews and surveys are evaluated under two titles; following the suggestions and possibilities in order to improve innovation in education are included.

We can evaluate the conclusions of this thesis under these two following titles:

• The opportunities and obstacles of innovation practices in the schools or in the classes

• Individual's innovative culture and their interest on innovations:

• **When we evaluate the opportunities and obstacles of innovation practices in the schools or in the classes:**

1. Teachers and the students don't think that classes are well equipped to do innovations, they relate it especially with technological tools like smart boards, tablets, computers etc. In both countries, students and teachers correlate directly concept of "innovation" and "technology".

2. In order to develop innovations, teachers and the students mainly focused on improving education environments like classes and laboratories. Also, it was interesting that Turkish teacher made direct connection between social activities outside of school and innovations.

3. In both countries, the teachers participated in the study were willing to do innovations in their classes whereas, their colleagues mostly avoid innovations and prefers classical education methods because of not being qualified enough to use new technologies in their classrooms, or because of being afraid of failing and wasting time.

4. In both countries, collaboration between teachers has a vital role for innovations in teachers' opinions. But both teachers find their colleagues are not enough in collaboration. With e-Twinning project, some Portuguese teachers doing collaboration but still it is not enough, while in Turkish school they don't participate these types of projects that teachers can collaborate because of the timing problem.

5. To implement innovations and try new things, in both countries teachers are having timing problem. Even if they want to collaborate, their busy schedule makes difficult everyone meets at the same time.

6. Students' and teachers' readiness to use ICT tools is another issue in terms of implementing innovations, teachers that not being qualified to use technological tools is a barrier in front of innovation practices. Also, schools

are not providing a course or informal education for improving ICT skills for teachers or for students in both countries.

7. Teachers think that the financial problems of the schools are the biggest problem in terms of providing innovative environment: classes, laboratories and schools don't have enough support from government to do changes.

- **When we evaluate individual's innovative culture and their interest on innovations:**

1. Both Turkish and Portuguese students think innovations as an incentive due to the fact that new methods or active participation to classes makes their classes more interesting and enjoyable. Through the results, students have the mentality of seeing innovations as a tool to get away from boredom.

2. The individual facts that pushes teachers to do innovations are their personal characteristics and their own interest in innovations.

Through the results obtained from this thesis study, to improve the vision of the teachers and students about innovations in science education, it's possible to make these following suggestions:

1. In order, the concept of innovation to be fully understood, all the teachers should be informed about the importance of the innovations all over the world and their contribution to the countries and they should explain it to the students. They can get this information through conferences, in-service training which are provided by administration of the school.

2. In addition to concept of innovations, teachers should be informed about 21st-century skills both for students and teachers. Later they can set their goals on students and themselves through 21-st century needs and they can guide their classes considering these goals.

3. School administration can organise mandatory ICT classes for students and for teachers in order to improve their ICT skills and to increase their awareness of media literacy.

4. The infrastructure of schools should be improved in terms of financially. For instance, Erasmus+ programmes which are provided and financially supported by European commission must be encouraged especially in Turkey in order to make innovations in education.

5. Curriculums should become more flexible in order teachers to have free time to try new methods, activities, projects in their classrooms. Also, for teachers to have time for collaboration and create innovative projects, plans together.

6. A school environment which allows students to explain themselves freely and gives them opportunities to innovate should be created with the collaboration of administration of school, teachers, parents of the students, and students.

7. The missing materials in a science laboratory should be presented as a report to the responsible parts of governments before every new semester.

8. Between teachers and administrators from different schools, or even different countries, each semester/year meetings should be organised in order to do brainstorm about innovations, and to share their opinions, experiences through innovative practices.

9. In order to evaluate education systems of each countries, and to compare their success levels, worldwide researches such as PISA must be followed carefully by teachers and according to the country levels, the deficiencies that need to be addressed and the precautions need to be taken must be determined and applied by the teachers for their classes.

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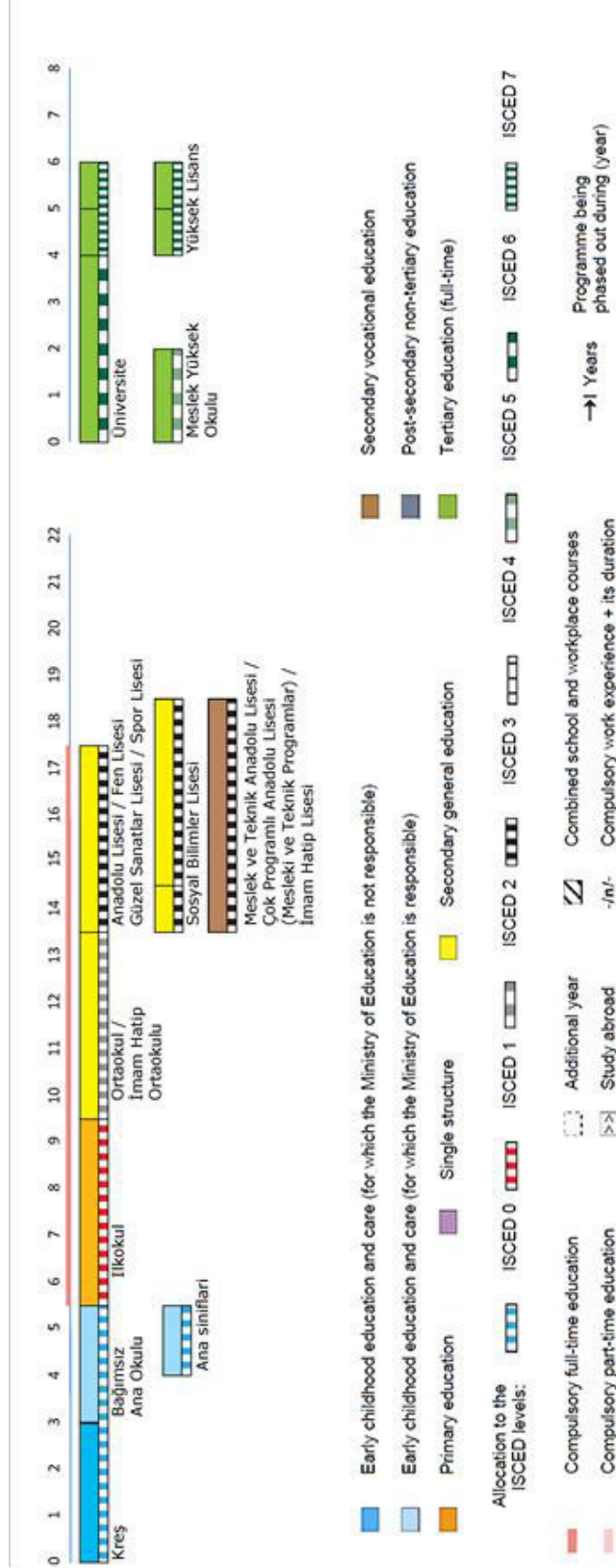

Picture 1:

http://kcelt.org/21st-century-learning/humanisitic-knowledge/cultural-
competence/revisiting-differentiated-instruction/

Picture 4:
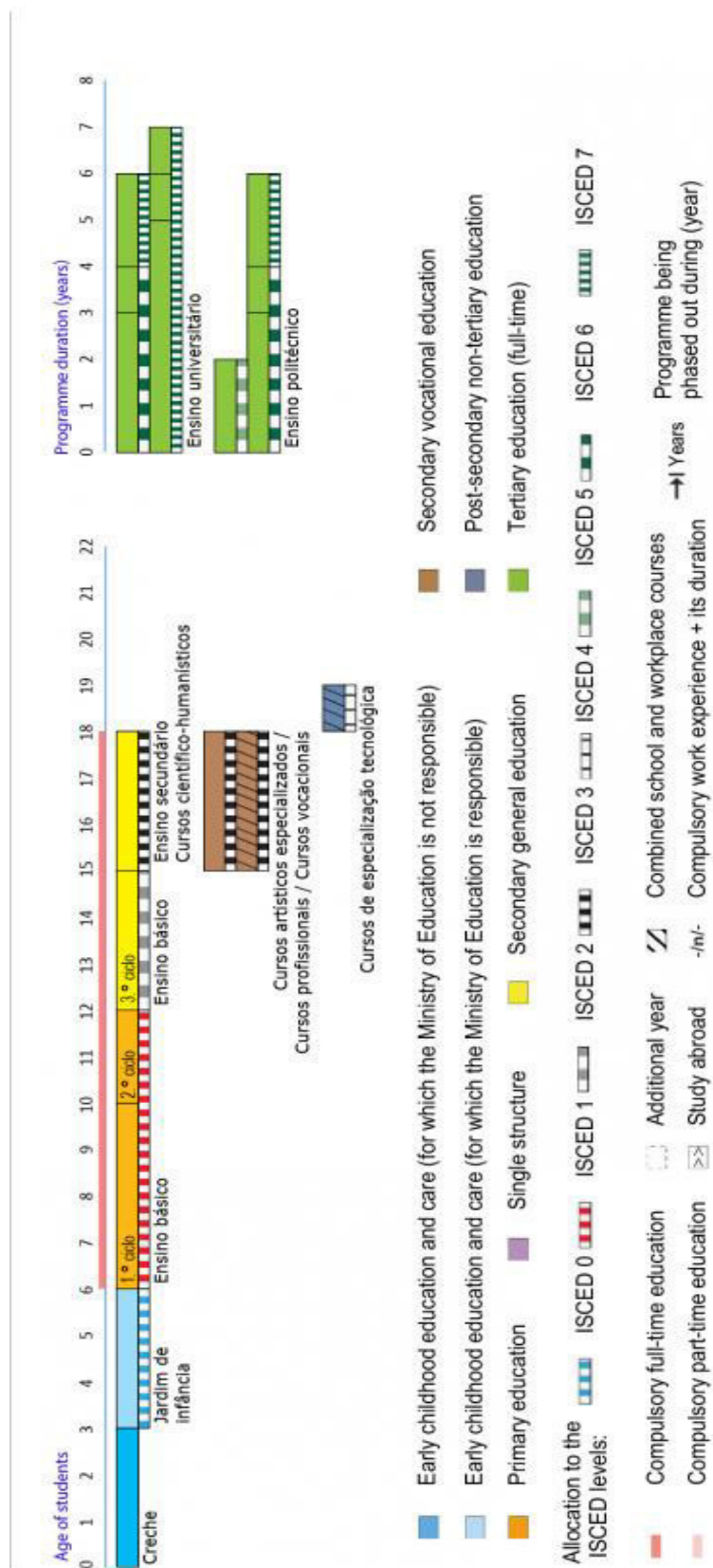
http://fatihprojesietz.meb.gov.tr/homepage-2/

Appendix 1. The Structure of The National Education System of Turkey

source: Eurydice 2016

Appendix 2. The Structure of The National Education System of Portugal

source: Eurydice 2016

Appendix 3. Questionnaire Form (Eng.)

Universidade do Minho
Instituto de Educação

Curriculum and Teaching Innovation in secondary school

a comparative case study between Turkey and Portugal

I'm Esra TETIK and I conduct a project in investigation which is incorporated within the framework of master in Science of Education, in the University of Minho, in the area of curriculum development and educational innovation, on curriculum innovation and innovation in education. It has as objective to analyze curriculum innovation and the effects on the quality of student learning and characterize innovative educational practices, in secondary school , comparing the Portuguese and Turkish educational system under the supervision of Isabel Carvalho Viana. That is why ask you a special favor to fill out the questionnaire and give it back to your teacher, in anonymous. I deeply appreciate the time and effort available for your collaboration.

1. PERSONAL DATA

1.1 Age: ___
1.2 Grade: ___
1.3 Gender: 1.Male ( )   2.Female ( )
1.4 Name of the Course: _____

1

130

MOTIVATION FOR INNOVATION - PERCEPTIONS OF IF
Circle the option that corresponds to your situation

	Perceptions if...	Strongly disagree	Disagree	I'm not sure	Agree	Totally agree
1	I like innovation in the class	1	2	3	4	5
2	It's hard for me to focus on the lessons that the proposed activities are always equal	1	2	3	4	5
3	I feel bored in the repetitive lessons	1	2	3	4	5
4	I'm not interested in innovative activities	1	2	3	4	5
5	I wish that the class finish fast, when the activities are not innovative	1	2	3	4	5
6	I don't understand the subjects	1	2	3	4	5
7	I think that the subjects are not interesting	1	2	3	4	5
8	It is difficult to understand, the teacher gives the lessons always in the same way	1	2	3	4	5
9	I don't like repetitive classes	1	2	3	4	5
10	Our teacher doesn't use new techniques in classes	1	2	3	4	5
11	I don't like the way that the professor teaches	1	2	3	4	5
12	I want to have different activities in the class	1	2	3	4	5
13	I don't think in new ways of solving problems	1	2	3	4	5
14	I feel that the class was a waste of time	1	2	3	4	5
15	Our teacher uses different techniques that increase my interest in class	1	2	3	4	5
16	Our teacher doesn't help me to be creative	1	2	3	4	5
17	I want to use technological tools in the classroom	1	2	3	4	5
18	When our teacher uses different techniques, I feel that makes me progress in my learning	1	2	3	4	5
19	I don't think that the activities are fun	1	2	3	4	5
20	I want my teachers to use new techniques in the class	1	2	3	4	5
21	I don't think that the things I learned in class will be useful in my future	1	2	3	4	5
22	I do not feel motivated to come next classes	1	2	3	4	5

2

EFFECTIVENESS OF THE TEACHER IN THE PERFORMANCE OF THEIR FUNCTIONS

Circle the option that corresponds to your perceptionum

	My teacher...	Not Effective	Slightly effective	Effective	Very Effective	Exceptionally effective
1	Teaches in clear way	1	2	3	4	5
2	Presents/shows the subjects in different way	1	2	3	4	5
3	Presents/shows creative activities	1	2	3	4	5
4	Leads works in group	1	2	3	4	5
5	Uses new technologies	1	2	3	4	5

Is there anything that you particularly enjoyed about how your teacher taught the course? If so, please explain in the text box below:

Is there any areas where you believe your teacher can improve this course? If so, how? Please provide your comments in the text box below:

3

Appendix 4. Questionnaire Form (Pt.)

Questionário Alunos, maio 2016

Universidade do Minho
Instituto de Educação

Curriculum and Teaching Innovation in secondary school

a comparative case study between Turkey and Portugal

Sou Esra TETİK e estou a desenvolver um projeto de investigação que se enquadra no curso de mestrado em Ciências da Educação, da Universidade do Minho, na área de Desenvolvimento Curricular e Inovação Educacional, sobre a inovação curricular e inovação no ensino. Tem como objetivos nucleares analisar a inovação curricular e os efeitos na qualidade das aprendizagens dos alunos e caraterizar práticas educativas inovadoras, no ensino secundário, comparando os Sistemas Educativos Português e Turco, sob a supervisão de Isabel Carvalho Viana. Venho, por isso, pedir-te o especial favor de preencheres este questionário e o devolveres ao teu/tua professor(a), em anonimato. Agradeço profundamente o tempo e o esforço disponibilizados com a tua colaboração.

1. DADOS PESSOAIS

1.1 Idade: ___
1.2 Nível de Escolaridade: ___
1.3 Sexo: 1.Masculino ( )   2.Feminino ( )
1.4 Nome da disciplina: _____

1

MOTIVAÇÃO PARA A INOVAÇÃO – PERCEÇÕES DE SI
Faz um círculo à volta da opção que corresponde à tua situação

	Perceções de si...	Discordo totalmente	Discordo	Não Tenho a Certeza	Concordo	Concordo Totalmente
1	Eu gosto de inovação na aula	1	2	3	4	5
2	E difícil para mim concentrar-me nas aulas em que as atividades propostas são sempre iguais	1	2	3	4	5
3	Eu sinto-me aborrecido(a) nas aulas repetitivas	1	2	3	4	5
4	Eu não estou interessado(a) em atividades inovadoras	1	2	3	4	5
5	Eu desejo que a aula acabe rápido, sempre que as atividades não são inovadoras	1	2	3	4	5
6	Eu não percebo a matéria	1	2	3	4	5
7	Eu não acho a matéria interessante	1	2	3	4	5
8	E difícil perceber, a professora dá a matéria sempre da mesma forma	1	2	3	4	5
9	Eu não gosto das aulas repetitivas	1	2	3	4	5
10	A nossa professora não usa técnicas novas na aula	1	2	3	4	5
11	Eu não gosto da maneira como a professora ensina	1	2	3	4	5
12	Eu quero ter atividades diferentes nas aulas	1	2	3	4	5
13	Eu não penso em novas formas de resolver problemas	1	2	3	4	5
14	Eu sinto que a aula foi uma perda de tempo	1	2	3	4	5
15	O nosso professor(a) usa técnicas diferentes que aumentam o meu interesse na aula	1	2	3	4	5
16	O nosso professor(a) não me ajude a ser criativa(o)	1	2	3	4	5
17	Eu quero usar ferramentas tecnológicas na aula	1	2	3	4	5
18	Eu sinto que, quando o nosso professor(a) usa técnicas diferentes, me faz progredir na minha aprendizagem	1	2	3	4	5
19	Eu não acho os atividades divertidas	1	2	3	4	5
20	Eu quero que os meus professores usem novas técnicas nas aulos	1	2	3	4	5
21	Eu não acho que as coisas que aprendi nas aulas venham a sen úteis no meu futuro	1	2	3	4	5
22	Eu não me sinto motivada a vir as próximas aulas	1	2	3	4	5

2

EFICÁCIA DO(A) PROFESSOR(A)NO DESEMPENHO DAS SUAS FUNÇÕES

Faz um círculo à volta da opção que corresponde à tua perceção

	O/A meu/minha professor(a) …	Nada eficaz	Pouco eficaz	Eficaz	Muito Eficaz	Excecionalmente eficaz
1	Ensina de Forma Clara	1	2	3	4	5
2	Apresenta as Matérias de forma diferente	1	2	3	4	5
3	Apresenta atividades criativas	1	2	3	4	5
4	Lidera Trabalhos de Grupo	1	2	3	4	5
5	Usa as novas Tecnologias	1	2	3	4	5

Há algo, em particular, que tenhas gostado acerca da maneira como o(a) teu(tua) professor(a) lecionou a disciplina. Se sim, explica dentro da caixa abaixo:

Há algum modo em que acredites que o teu/tua professor(a) pode melhorar as aulas da disciplina? Se sim, de que forma? Deixa os teus comentários na caixa abaixo:

3