

# JOURNAL OF **INCLUSIVE** EDUCATIONAL RESEARCH

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## Table of Contents

<b>Research Articles</b>	
An Overview of Quality Studies in Higher Education <i>Funda HATIPOĞLU</i>	26 - 35
An In-service Training about Developing Materials Including Critical Thinking Elements <i>Melih TIMUÇİN, Atilla ÇİMER</i>	36 - 48

## An Overview of Quality Studies in Higher Education

Funda HATİPOĞLU<sup>1</sup>

### Article History

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### Abstract

Having an innovative, contemporary, and modern education system in a country is very valuable. The value given to education is the most precious treasure that will enable the members of the society to guide future generations. The key point for universities to provide quality education depends on the quality system of the university. An increase is observed in the number of universities in the field of higher education in Turkey. The progress of the quality systems of universities in line with strategic plans will make a great contribution to education both socially and scientifically, and will also accelerate the transformation into qualified universities. In this study, researches on quality in higher education between the years 1996-2022 were discussed, and the studies were examined according to the concepts of quality, quality management, total quality, satisfaction and accreditation. Studies on quality are generally gathered under the titles of service quality and satisfaction, quality standards and total quality, the concept of quality and opinions on quality, needs and suggestions for quality, quality assurance, accreditation system, quality control and management. In the research, quality and studies in higher education, doctorate, master's theses, articles published in journals were examined. It is thought that the research will provide insight to researchers who will conduct research in the field of quality.

**Keywords:** Quality, higher education, satisfaction, accreditation, education

### 1. Introduction

Education can be defined as a life process that appeals to the entire society of a country and constantly updates itself as technology progresses. As time progresses, the plans and programs reflected in education show that the education system has a dynamic process. Since education covers the whole life of individuals, it can be suggested that studies on education should be increased. The idea of how education can be made more efficient in all educational institutions should always be on the agenda. Since higher education institutions are institutions that train educators, the quality in this field is important and should be examined. Continuously advancing technology requires having an innovative approach in education in order to bring a qualified education vision to the future. A nation that develops on the basis of a quality living standard can live without being tied to any country. In this study, the concept of quality is discussed. Although it is known that it dates back to the 2150s, the birth of quality coincides with the 19th century (Yalçın, 1998). Quality has been expressed as “perfect in education” (Madu, Aheto, Kuei and Winokur, 1996). According to Kutlu (2007), quality is high quality. It reveals many expressions such as goodness, perfection, competence and completeness. European Quality Control Association (EOQC) quality; it is a collection of statements that indicate the product or task's desire to meet a requirement (Kovancı, 1999). The quality of a good; It is understood with the external structure and usage situation and suitability (Türker, 2003). The important factors of quality and basic quality principles are as follows; quality is a happy citizen, a way to efficiency, meeting the expectations of citizens, a management style, a philosophy of life, a world of continuous improvement (Akgül, 1998). It may involve group work and also integrate each other (Akgül, 1998). Although quality is a field in itself, its management includes different elements for strategic planning. Quality process situations, parts, superiorities, personal, and social expressions should not be considered different from quality, they should all be gathered in the same expression (Ehlers, 2016). Progress in society is possible with the creation of a developed society and the delivery of qualified graduates (Merale, Adıgüzel, 2012). Quality must be integrated into the world of education and training. Ruben (1995) divided quality into three relationship quality, academic quality, and management quality. Academic quality appeals to the higher education section of society. It can be predicted that the society has an important expectation from the higher education level. An important step that will meet the needs of the society can be universities, which are one of the basic steps of education. The aim of higher education should be to raise

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individuals who research, question, offer solutions to the problems they encounter, try to realize themselves, and respond to the expectations of society.

### 1.1. Quality in Education

The Ministry of National Education (MEB) and the Council of Higher Education (YÖK) are responsible for the education and training process in Turkey. Investments to be made in education should be made in these two education levels. While Adıgüzel (2008) sees the quality of education and training as a result of this process and expresses that individuals who talk about the educational mission have characteristics or create certain standards; Bridge (2003) presents the individual as the strongest system that can prepare the individual for all conditions. It is known that the quality event is taken to the center and the quality is assumed to be related to the progress of the country under all circumstances (Özden, 1999; Karlı et al., 2001). The higher the degree of education in any place, the more programmatic the order of that country will be (Keskin and Keskin, 2005). Countries should allocate a large share of education. Efforts should be made to increase the attention required for educators, that is, teachers, who occupy a large place in the realization process of education.

The first reason why teacher training institutions in Turkey need to be revised is the new responsibilities brought by the developing and changing process (Higher Education Council, 1998). Various studies are carried out on teacher qualifications and teacher training that enable the structuring of education faculties, and there are still various problems that occur with the perception of quality in education faculties (Karaca, 2008). There are some applications that have been put forward to fix the problems. Courses such as "Educational Psychology", "Assessment and Evaluation", "General Teaching Methods and Principles" and "Introduction to Educational Sciences", which were abolished by YÖK in 1997 with the idea that they did not provide professional competence to the teacher and consisted of theoretical knowledge, were reintroduced in the programs within the scope of the teaching professional knowledge course, This is the most striking part of the arrangement. In the process of moving the information society to the next level, it is seen that institutions are the most basic structure in terms of production and distribution of information (Tonta, 1999).

### 1.2. Quality in Higher Education

The education institutions' following methods suitable for the advancing technology will improve the educational aspect of that institution and will make significant contributions to the universities both for the students and the city and country. The most important issue in demonstrating success as an institution is how to manage complex structures in a systematic way and how to motivate employees in terms of corporate goals and social benefit (URL-1).

In order for the understanding of quality in higher education to be successful today, it is necessary to have a strong and individual-centered order with its mission and vision. Quality in higher education is of great importance for the future of a country (Yokuş, Ayçiçek, and Yanpar Yelken, 2016).

One of the conditions for reaching the ideal university is the continuous implementation of the "Plan, Do, Check, Act" (PUKÖ) cycle in order to improve quality (URL-1). This model is one of the application models of total quality management (TQM) that aims to improve quality. The (PUKÖ) cycle seen in all implementation models can be described as the heart of TQM (Kalaycı, 2008). The quality problem in higher education has become a more discussed topic over time. This situation can be clarified with the following two social developments; on the one hand, the decrease in public resources, which are increasingly limited in developing and securing the expected competencies, on the other hand, the increasing complexity of social interactions and structures and the increase in demand for the competencies of individuals (Koyuncuoğlu, 2020). For the details of the quality in the higher education mechanism, the beneficiaries and producers of higher education services should be clearly revealed (Köksoy, 1998). Quality in higher education is defined in five different approaches: quality as excellence or consistency; quality as transformation; quality as an exceptional quality; quality as economic value and quality known as fitness for purpose (Harvey and Green, 1993). These definitions indicate in which areas quality demonstrates competence. According to Gencel (2001), it is desired to reach better levels continuously by setting various standards with total quality management in higher education institutions. Educational institutions covering the tasks of revealing knowledge and creating manpower; high-level science research with learning at its center that has produced a combination of education; It has taken its place in the literature as institutions that have qualified staff (UNESCO, 2000). In order to emphasize quality in higher education institutions, four important aspects should be possessed. These are the quality of the program, the quality of the teaching, the quality of the research, and the quality of the educational administration (Doğan et al., 2006).

Bakioğlu and Baltacı (2000) describe the quality in higher education in 8 sections as: instructor development and quality, teaching and learning, social services, supports trying to train students, educational products, graduate students, and educational outputs. According to Özcan (1997), quality is a multi-faceted concept and it

is explained by the expression of continuous renewal of methods that will increase the individual's commitment to the whole education life and nation, and improve all his psychological states, stating that it emphasizes social judgments, audience and continuous improvement (Özcan, 1997). Improving quality in higher education is considered very important. While there is British, American, French, and Japanese emphasis in shaping the understanding of quality in higher education, there are three approaches that reveal the basis of all these situations. These ways also play an important role in emphasizing quality in higher education (Hacıfazlıoğlu, 2006). Quality approaches have been revealed as Relativist, Developmental approaches and Objective approaches (Barnett, 1992). According to Ekong, quality is It refers to the regular continuity of all systemic phenomena within the institution (Bakioğlu & Baltacı, 2010). Bogue (1998) argues that the quality assurance system consists of four methods. These methods are; Total Quality Management, Accountability, Traditional Peer Review, Performance Indicator Reporting Evaluation, and Results Action. The existing system consists of accreditation, certification, and standardization models in order to strengthen quality assurance (Aktan & Gencil, 2010). The importance given to quality in higher education has increased in recent years. It is seen that more importance is given to quality in different countries and there are studies that ensure the spread of quality in our country. With the Bologna situation that emerged in 1999, the Higher Education Quality Assurance Board (ENQA) was structured with the intention of ensuring the continuity of eliminating the deficiencies in higher education, and at the same time the quality assurance standards (ESG) were revealed (European Commission, 2020). shows a situation that is not very sufficient in terms of creating an employment environment (Eriçok, 2020; Yalı, 2017; Yıldırım and Aslan, 2021). The effects of this low performance are visible. Our country, which took part in the Bologna event in 2001, has put forward some formations in order to be integrated into this event. Methods and guidelines suitable for ESG that every country should have are compatible with the country's past and customs (Alzafari and Ursin, 2019; Stensaker and Leiber, 2015). In this context, an international agency, "Higher Education Quality Board-YÖKAK" was established in 2017 and it conducts research with its education-training structure, corporate management system research, social benefit perspective and development capabilities (Higher Education Board, 2018). Institutional External Evaluation Criteria (CIAS) have been created to control the measurement. This issue, which has been put on the agenda, has been integrated into administrative resources (European Commission, 2020; YÖK, 2019). It includes creating the environment and atmosphere (<https://yokak.gov.tr/>). Bologna process has been very effective in increasing the quality of higher education in Turkey. Afterwards, many quality agencies related to quality were established. These quality agencies show themselves internationally all over the world and these agencies are HCERES (High Council for Research and Higher Education Evaluation), AKKR (Danish Accreditation Agency), ENQA (European Association for Higher Education Quality Assurance), ACQUIN (Accreditation, Certification and Quality Assurance Agency) , EQAR (Higher Education European Quality Assurance Registration), IUA (Irish University Quality Board), EUA (European University Association), AQ (Quality Assurance and Accreditation Agency - Austria), QAA (Higher Education Quality Assurance Agency), CHEA (Higher Education Accreditation Board- known as the USA). Each of these agencies is functionally separated from each other's and covers an important place. Having a culture of quality can show that it reveals the accumulated knowledge. In higher education, the Turkish system cannot comply with some aspects such as having a single administrative system, stakeholder participation, and accountable structure (Yıldırım and Şenpınar, 2022). Considering the examples in higher education, to give an example of the studies carried out in different countries for quality assurance in higher education, quality education in African higher education (Burgess, 1989); Examination of the quality of higher education in the USA and England (Moodie, 1988); work qualification in Australian higher education (Brown and Nunn, 1981); Research on quality assurance in all education systems in Ethiopia (Adamu & Addamu, 2012); quality and intelligibility in Sweden (Tuijnman, 1990); Following a system to improve higher education in South Korea (Shin, 2017); the concept of quality assurance in other countries in the Bologna process (Keçetep and Özkan, 2014); Total higher education and quality management in Malaysia (Kanji and Tambi, 1998) can be examined as the interpretation of quality assurance in higher education in the Turkish Republic of Northern Cyprus (Sarı, Firat and Karaduman, 2016). It is seen that quality assurance is examined in different ways in other countries. Comparison of quality standards in Europe and Romania (Prisacariu, 2015); Examining some courses in Romania in terms of quality control in engineering faculties (Popescu-Mitroi, Todorescu, & Greculescu, 2015); Examining higher education in Romania (Gorea & Saharov, 2015); Examining vocational schools in Romania (Todorescu, Greculescu & Lampă, 2014) have been found in such studies. Again, it has been observed that some universities have conducted studies on the subjects that include the sub-fields of quality. For example, in the field of total quality management, surveys were conducted in a vocational school for quality reviews (Karahan and Mete, 2014). In another study, it was stated that six sigma quality management application was used (Adina-Petruta and Roxana, 2014). A study was found on the advancement of quality culture (Barbulescu, 2015). One study has been identified (Eryılmaz, Kara, Aydoğan, Bektaş, & Erdur, 2016). It has been observed that Canada, which has a high level of education, carries out intensive studies in the field of quality (Bakioğlu, Gürbüzler and Argun, 2015). In order to improve higher education, the principles in the field of total quality should be systematically applied. There are studies on how to deal with it in a way that is handled

in a way (Todorut, 2013), the integration of the existing plan into quality by following the guidelines (Rezeanu, 2011), and the use of concept maps during the implementation of such managerial plans in Brazil (Pereira, Araujo, and Machado-Taylor, 2018). It is understood that the quality of teachers is tried to be identified with the situations in the system approaches organized due to the development of teacher training and teacher quality in the context of keeping up with social change and the path and responsibility that teachers should adopt, and one of the efforts to identify is "accreditation" (Doğan, 1999). This system is being tried to be implemented due to being able to catch up (Özen, 2022).

### **1.3. Accreditation**

Accreditation is initially a source of trust. It is the quality order system that eliminates the compliance problem. It is a set of systems that reveal certain qualities and comply with the standards of an institution within the framework of a certain order. These performances are the efficiency of practice and activity. The accreditation system is the most important trust formation in higher authorities of a higher education system. Although it is not an accreditation control mechanism, it is a whole that questions and directs the system it is in, and looks from the outside (Hesapçioğlu, 2003). The practices of increasing the quality in higher education are defined as the accreditation criteria expression of the directive principles of the institutions that emerged for this purpose (Bıyık, 2002). In our country, it is seen that the implementation and accreditation studies for quality are not determined by the universities, they are put forward politically (as cited in Özer et al., 2011).

In this study, it is aimed to examine the results related to quality studies in higher education, higher education quality and satisfaction, quality standards and total quality, quality concept and opinions about quality, needs and suggestions for quality, quality assurance, accreditation system, quality control and management.

## **2. Method**

In this study, studies on quality in higher education, higher education quality and satisfaction, quality standards and total quality, the concept of quality and opinions on quality, needs and suggestions for quality, quality assurance, accreditation system, quality control and management were examined and these issues were examined. In this context, the quality and satisfaction of the studies related to quality, quality standards and total quality, the concept of quality and opinions about quality, needs and suggestions for quality, quality assurance, accreditation system, quality control and management are gathered under the headings grouped by.

## **3. Findings**

As a result of this study, increasing studies on quality in higher education can be given as a suggestion.

It can be presented as a suggestion based on the results of the study that projects related to quality should be done and that the quality studies should be arranged in line with student opinions.

Table 1. Quality studies in higher education

Studies	Data collection tool	Sample	Research Subject
Topsakal(2013)	Survey method	Tourism students	Satisfaction and service quality perceptions and recommendation status
Yokuş vd. (2017)	Survey method	University students	Their corporate selves and their service quality views
Owlia&Aspinwall (1996)	Survey method	Gazi University students	Quality concept
Bektaş &Akman (2013)	Survey method	University students	Developing a scale of service quality based on the HEdPERF scale
Şimşek &Öztürk(2019)	Valid and reliable scale creation study	University students	Satisfaction level of university students with the quality of their university
Bayrak(2007)	Survey method	University students	Needs to increase academic knowledge levels of academicians, development of a scale for quality service documents
Deveci(2012)	Survey method	State and foundation staff and students	Quality levels in higher education
Hussein(2021)	Survey method	Foreign students at public and private universities	Comparison of image satisfaction and loyalty of students in education faculties
Mohammed(2022)	Survey method	University staff	The effect of corporate social responsibility practices on employee engagement, commitment and perceived service quality in higher education institutions in Iraq
Polat(2022)	Qualitative research method	University students	Research on the service quality of the institution
Uysal(2011)	Scan method	Literature	Quality standards for America
Göçen &Aslan(2021)	Scan method	Higher education institution employees	Perception scanning from different aspects of total quality management
Kalaycı(2008)	Survey method	Higher education lecturers	Total quality
Ceylan(1998).	Survey method	Academical personal	Opinions of academic staff about quality
Tarıı(2015)	Case study method	Teachers	Total quality Management
Omar(2017)	Survey method	University students in Iraq	Relationship between competitive situations and quality order
Mahmood(2017)	Survey method	Higher education students	Creating a quality-enhancing resource for quality
Molla(2022)	Survey method	Higher education students	Interior quality
Meraler & Adıgüzel (2012)	Relational screening model	University students	Establishing a Scale for Determining the Views of Faculty of Education Students on Quality in Higher Education
Hacıfazlıođlu (2006)	General scanning model	University students	Experimentally determining the level of achievement of quality studies in universities in Turkey
Ataman(2019)	General scanning model	University students	The relationship between different variables of quality views in higher education
Melek (2003)	General scanning model	University students	Quality concept
Sami (2020)	Analytical method	Academics	Revealing Libyan education sector performances
Işık &Beykoz (2018)	Qualitative research method	Literature	Quality assurance system
Yıldırım& Yenipınar (2022)	Qualitative as well as quantitative method	Higher Education Evaluation and Quality Assurance Status Reports	Describe and evaluate in terms of Quality Assurance Standards (ESG)
Özçiçek & Karaca (2019)	General scanning model	Literature	Historical development of quality and accreditation studies in Turkish higher education institutions
Sipahi Mencet(2019)	Descriptive case study	Quality actors at administrative, academic and administrative levels in medical and tourism faculties	Themes of education-training, research-development and management and administrative processes for quality in higher education
Özdađođlu vd,(2020)	Scientometric method	All studies in the Science (WoS) internet application resource	Researching the studies conducted between 1980-2018
Koyuncuođlu (2020)	Basic research	Literature	Quality culture
Taştan &Yılmaz(2021)	Basic research	Literature	Management of quality
Kotora(2019)	Case assessment method	Literature	Administrative status of the concept of quality in Libya

### 3.1. Results on Service Quality and Satisfaction

The results of the study on service quality and satisfaction were examined. In a study, satisfaction and service quality perceptions and proposition status were examined. This application was made in tourism students. The relationship between the investigated concepts was examined. The research was carried out in a Tourism Faculty in Turkey and data were obtained by survey method. As a result, it has been understood that there is a significant relationship between the researched titles. In addition, it was observed that the study revealed a gender difference in terms of satisfaction, administrative staff and internationalization sub-variables (Topsakal, 2013). Yokuş et al. (2017) selected university students studying at the faculty of education in higher education as a sample in their study. In this study, they examined their corporate selves and their service quality views. Scales were used for this purpose. As a result, it has been determined that the situation in service quality is close to high, and service quality views vary according to absenteeism, department, level and success. It was revealed that this change showed a significant relationship. In addition, it has been revealed that students adopt their universities, have a sense of belonging, and feel that their universities are at a qualified level, therefore they have made the right choice. It is seen that the institutional self is one of the results of the research, which depends on the department, level, absenteeism and success of the student. In another study, Owlia and Aspinwall (1996) basically examined the concept of quality and students at Gazi University were selected as a sample and a questionnaire about service quality was applied. Students were asked to comment as an observer. Quality elements were given to the students and they were asked to evaluate accordingly. The researcher emphasized the reason for the application of the study on students as seeing the student as a customer. (Owlia and Aspinwall, 1996). Bektaş and Akman (2013) created a scale for service quality based on the HEdPERF scale. According to the results, it has been seen that the scale can be applied in our country. Again, in a study conducted in an education faculty, a valid and reliable scale was created. The level of satisfaction of university students with the quality of their university was measured. Its aim is to prepare a scale to increase the quality of the university's cultural activities, research direction, social, educational and different aspects. A high level of reliability was provided by the researcher (Şimşek & Öztürk, 2019). In a study, Bayrak (2007) first identified the academicians and their needs to increase their academic knowledge levels. Necessary research was carried out in line with the identified needs and a scale was created for all quality service documents required for higher education. In this direction, perception statements about the quality levels of the students in their universities, their needs and opinions about quality were revealed. The interaction between quality and opinions in terms of different variables was investigated. In a study conducted by Deveci (2012), quality levels in higher education were examined and the status of these quality levels in education/training was examined. In the research, the opinions of the staff and students of private and public universities about the system were compared. According to the results, students do not find the quality levels of their universities sufficient. However, it has been revealed that senior managers are of the opinion that their universities are at a better level, regardless of state or foundation. Again, it was concluded that the opinions of the researched population, individuals and their prediction levels were not related. It was observed that these characteristics differed in terms of variables such as gender and age. In addition, it has been revealed that the perspective on the Bologna process differs by the universities researched. According to the results of the research, it has been determined that state universities have lower evaluations than foundation universities. In another study on service quality and perceptions, this time foreign students were included in the sample. Variables such as the satisfaction images of foreign students in public and private universities and how this image can be improved were investigated, it was wanted to be measured, and detailed research was carried out. In other words, it is aimed to examine the framework of the plans followed by the universities and to compare the satisfaction and commitment of the students in the faculties towards the image. In the study, it was determined that the images of public and private universities have an effect on student satisfaction and perceptions. In particular, the images of private universities are more important than the image created by public universities, customer interest and perceptions, and reveal meaningful results (Hussein, 2021). According to the results of the questionnaire applied, it was seen that the service quality did not show a significant result in student satisfaction, and student engagement showed a significant difference. In a study by Mohammed (2022), he revealed the effect of corporate social responsibility practices on employee engagement, commitment and perceived service quality in higher education institutions in Iraq. Questionnaire method was used to test the relationship between the variables of the study. The results indicate that corporate social responsibility practices have a desired effect from many places on the loyalty and commitment of employees and service quality at Iraqi state universities in Kirkuk. In addition, there is a significant relationship between the commitment and loyalty of the employees on the quality of service provided by Iraqi state universities in Kirkuk. Aiming to measure the institutional capacity of Karamanoğlu Mehmetbey University, Polat (2022) carried out a study in higher education institutions. The research on the service quality of the institution is included in the study.

### 3.2. Results on Quality Standards and Total Quality

Studies in the literature on quality standards and total quality were examined. As a result, studies related to quality standards and including total quality were encountered. Uysal (2011) discussed the quality standards for

America in a study he conducted. The method plans developed by the consortia and councils, which took the first place in the literature, were examined and it was aimed to make theoretical information explanations for this. These quality standards are based on America's online education. Göçen and Aslan (2021), in their study, discussed total quality management between the years 2020-2021 and selected the sample on a voluntary basis in a higher education institution and applied it. The study is based on the principle of scanning and interpreting perceptions of total quality management from different aspects and revealing a result. Since a general assessment of the situation was desired, the general screening method was used. The results of the research were obtained with the total quality management scale and personal information form. As in other studies, not only the administrators were taken as a sample, but also the views of the student body were taken into account, and it was seen that the knowledge about the understanding, perspective, interpretation styles, criteria that ensure the emergence of total quality is important for the continuity of quality.

When the studies are examined, it is seen that the elements that make up the total quality management, the problems that constantly arise, what the total quality is, their explanations, the perceptions of quality among university students, and the customer-quality relationship are discussed. In addition, different recommendations have been made so that the total quality method in higher education can respond in the desired direction (Serin and Aytekin, 2009). It aims to bring up the most common problems in total quality management. He tried to find a solution to these problems. It examined the applications of total quality based and total quality method system. It is aimed to try to eliminate the problems related to quality in higher education, to make applicable suggestions and determinations, and to reveal ideas about the subject. In another study, the views of academic staff on quality were examined. This study was carried out at Abant İzzet Baysal University (Ceylan, 1998). In another study dealing with total quality management, the application was made in higher education. He carried out the TAAI(2015) application at Fatih University. The case study method was used to analyze a situation through an example. The data of the employee was sent to the teachers via e-mail with the survey method and collected back again. When the results of the research were evaluated, it was seen that there was no significant difference. In addition, the research has been examined both individually and institutionally. Omar (2017) selected university students in Iraq as a sample in a study. It is aimed to reveal the relationship between competitive situations and quality order. Quality standards were chosen as the changed variable in the research, and the effect to be observed was expected to be competitive advantage. Results were measured by questionnaire. There was a significant difference in the expected direction between the measured variables. It is stated how the researched expressions affect the total quality and how they can improve the total quality. Mahmood (2017) took the higher education level as a basis in his research and directed towards the education/training field at this level. As a result of this research carried out at Süleymaniye University, he stated that he aimed to create a quality-enhancing resource for quality. Molla (2022) emphasized the quality of interior space in his work. Understanding and controlling the sources of indoor environmental pollutants will contribute to students' learning in healthier environments. Planning of spatial elements is very important for the quality of services offered by universities, especially education, and for the effective use of public resources. This research also showed that there is a direct relationship between the quality of education and the quality of the space, and that student performance increases in a quality space.

### **3.3. The Concept of Quality and Conclusions on Quality-Related Opinions**

When the literature on the concept of quality and views on quality is examined, meaningful studies have been revealed. The aim of Meraler and Adıgüzel(2012) is to reveal the quality views on education. For this reason, the researcher developed a scale for his study and obtained his data with this scale. This scale is stated as "The Scale for Determining the Views of the Faculty of Education Students on Quality in Higher Education". Data were collected from students studying at Harran, Adıyaman, Dicle and Universities. According to the findings, among the qualities that increase the quality; providing the opportunity to study abroad, the scholarships provided by the university, the ease of accessing the information requested from the library, the provision of different opportunities for students with disabilities, the quality of the university being studied among other universities in the world, the easy access to any course material and plus the fact that the university can earn pocket money, if not full time. Also, job creation qualities were considered valuable.

Özdağoğlu et al., (2020) determined the researches carried out to objectively determine the existing situation in the literature using the sociometric method and revealed a result. Studies conducted between 1980-2018 were researched and analyzed. All studies in the Web of Science (WoS) internet application resource were reviewed. It has been seen to be a comprehensive research because the registered researches of the countries with the highest number of publications are discussed. The concepts discussed by the researcher are given in the network structure and community. In a study conducted by Karaca (2008), it was revealed that the issue of quality should be on the agenda in education faculties as well as in all education levels, it should be functional and there should be improvement practices in all faculties. In the same way, countries that try to train teachers, research, question and produce teachers with the teacher profile required by the age will again emerge in countries that attach

importance to the pursuit of quality. Therefore, the aim of this research is to determine the reasons for the revision of teacher training institutions in our country.

In his study, Hacıfazlıoğlu (2006) aimed to experimentally determine the level of quality studies in universities in Turkey. In addition, it is foreseen by the researcher that it will benefit the literature in the field of European Union higher education institutions. One of the sub-dimensions of the special research result of the study is the recognition of student ideas. At the same time, some of the demand reasons and study sub-dimensions of the faculties are given as teaching processes, academic achievement services, student affairs, library services, communication with teaching staff and administrative staff, physical learning conditions, campus life, research activities. In his research, Ataman (2019) examined the relationship between different variables of quality views in higher education. In order to make generalizations, the scanning method was used. As an important contribution of the study, it can be shown that all individuals participating in the study care about quality. Melek (2003) examined the quality in terms of the body of information in her study and used the feedback from the sample by creating a determination questionnaire with the aim of creating a foresight. By observing the order of the desired features in terms of different variables, they were combined under the comprehensive expectation title with different methods. A study was conducted to evaluate the situation of Tripoli University academicians. The research focused on the Libyan education sector and an analytical method was followed to reveal the performances. All academics at Tripoli University were selected as a sample in the study and a wide audience was reached. As a result, beneficial effects have been observed regarding performance evaluation in the field of quality education, and a number of recommendations have been put forward, consisting of the opinions of the instructors about quality (Sami, 2020).

### **3.4. Results on Quality Assurance and Accreditation System**

Studies on quality assurance and accreditation have been examined in the literature and gathered under this title. Işık and Beykoz (2018) examined the quality assurance system theoretically in their study. Quality standards in Turkish higher education have been taken into account. One of the research results is that the quality in higher education is still not fully developed at the desired level. In addition, it has been stated that the criteria of ESG standards, which have an important place in quality, are not fully met. In the research aiming to explain and define higher education by the European Quality Assurance Standards (ESG), improvement management processes, system creation, goal setting, support service, guidance and interpretation were given importance. One of the most remarkable results of the research is that while a sufficient level is determined in establishing targets and systems in institutions in the general framework, it is seen that it is insufficient in the interpretation and improvement phase in terms of the policy followed during the implementation phase of the decisions.

According to the results of the research, the fact that most of the institutions cannot center the student causes the system to have a centralized understanding in terms of administration. This understanding draws a restrictive framework in quality management (Yıldırım and Yenipınar, 2022). In a study investigating the impressions of quality assurance on open and distance education, the concept of accreditation was also discussed and interpreted around the selected guidelines Emin(2022). is indicated. Yiğit (2017) highlighted the accreditation work in social services in his study. Systems have been produced for the necessary factors for the concept of accreditation, such as the education/training plan, infrastructure, teaching team, the objectives of the program, the products of the process, and the situation of reaching consensus. In addition, the characteristics of accreditation have been revealed by different variables (Aktan and Gencel, 2010). Özçiçek and Karaca (2019) emphasized the benefits of the concept of quality for all individuals as a result of their research. In the study, accreditation was shown in detail and the progress from past to present was investigated. In his research, Sipahi Mencet (2019) drew attention to the sustainability of quality in an educational institution in our country and aimed to reveal quality perceptions. The interview method was applied in order to obtain opinions and to reveal a more detailed result. In the research, research-improvement, administrative processes, management, education-training subjects were considered important. It has been stated that the opinions of the individuals participating in the research are also important in the evaluation. In addition, suggestions have been put forward to increase such studies. It is seen that the national progress of the countries is related to the commitment of the institutions to the quality systems. Koyuncuoğlu (2020) examined quality culture in higher education institutions and stated that more research on quality culture is needed to raise awareness on this issue.

### **3.5. Results on Quality Control, Management, Needs and Suggestions**

Literature studies on quality control, management, needs and suggestions were examined. Worldwide developments and research have been revealed. Doğan (1999) examined organizational patterns and quality situations in his study. In this context, the members of the system and their competencies are considered very important. Education faculties need to be constantly checked and efforts should be made not to go below the critical level. In our country, YÖK makes important contributions in quality control, but it also brings to light negative situations. These negative situations turn into a problem trap due to the involvement of YÖK in the

situation and the inability to understand the developing and constantly structured difference. Taştan and Yılmaz (2021), in their study, aimed to set an example theoretically by considering quality as managerial. The extent to which higher education contributes to the decision-making processes of individuals has been reviewed. Another study addressed the quality status. In order to reach the results in more detail, a case study was conducted and the analyzes were determined according to this application (Kotora, 2019). As a result, it is understood that in order to increase the quality, students' opinions, wishes and satisfaction should be included by showing quality standards rather than theoretically.

#### 4. Conclusions

When the literature was reviewed, it was understood that more studies are required for the improvement of quality in higher education institutions in Turkey. When examined in terms of European standards, it can be said that the policy followed by Turkey has problems in terms of usefulness.

As time progresses, the increase in population, economic conditions, some problems caused by the need for education come to the fore with the spread of universities. The importance of quality and accreditation in higher education should be increased.

Studies have proven that the increase in the quality of education is related to the quality of the educational institution. There is a need for dissemination and restructuring of the quality assurance system in higher education. Dissemination of research, especially in the field of quality, is one of the important suggestions of the study.

Students' opinions should be given importance in higher education institutions and scientific and social activities should be expanded in this direction. Different accreditation practices should be carried out in order to expand the quality in the countries and to turn into a more qualified structure. According to the results of the research, the quality studies revealed that a quality education institutional quality is important, the accreditation process should be carried out in a systematic way, the concepts of satisfaction and compliance should be considered, and the planned execution of the quality management system.

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# An In-service Training about Developing Materials Including Critical Thinking Elements<sup>1</sup>

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## Abstract

This study aims to evaluate the effects of the in-service training called ‘Developing Materials Including Critical Thinking Elements’ by evaluating the knowledge, opinions and implementations of in-service biology teachers before and after the implementation. The study adopted convergent mixed method design which applies qualitative and quantitative research synchronously. In the training, fundamentals of critical thinking-based instruction, critical thinking-based activities and a sample biology unit were presented and discussed. The in-service training was delivered to 27 volunteer teachers as a formal, local in-service training of the Ministry of National Education, in twelve hours. The data were collected by teacher portfolios, pre and post “Critical Thinking Concept Test” and participant teacher semi-structured interviews. The participants evaluated the in-service training as useful. After the training, the teachers reported that their perceptions about students’ critical thinking attainment were changed, the activities presented during the in-service training had positive effects on their classroom instructions and they felt themselves more confident about developing and applying critical thinking activities. The concept test showed that the conceptual knowledge of the participants did not improve significantly. However, interviews and observations indicated that the procedural knowledge of the participants improved better than their declarative knowledge on how to support student critical thinking.

**Keywords:** Biology, critical thinking activities, higher order thinking, in-service training, procedural knowledge

## 1. Introduction

Variety of different ideas come out while concepts of the thinking process are tried to be defined (Stein, Haynes, and Unterstein, 2003). So, it is necessary to define and differentiate the terms before starting a study in this field. Members of the contemporary societies should be equipped with critical thinking and other higher order thinking skills (Low, Hui and Cai, 2017; Paul, Binker, Jensen, and Kreklau, 1990; Schleicher, 2008; Sector, 2004). Critical thinking-based activities have potential to influence students’ critical thinking competence and comprehension. There have been studies showing critical thinking-based educational innovations positively affected; critical thinking skills and dispositions (Collier, 2017; Sundararajan, Adesope and Cavagnetto, 2018; Ulger, 2018; Wartono, Batlolona, and Mahapoonyanont, 2019; Prayogi and Yuanita, 2018) and course achievement (Tomaç, 2012; Yoldaş, 2009). The definition, borders and sub-components of Higher Order Thinking Skills (HOTS) and critical thinking are considered within the framework defined by (Timucin and Cimer, 2022).

### 1.1. The Aim of the Study

Critical thinking skills can help teachers meet future demands in teaching like forming a habit of thinking carefully and thoroughly about pedagogical alternatives and strategies (Low, Hui, and Cai, 2017). Moreover, teachers should be well versed in teaching critical thinking and designing the learning environment for students to apply critical thinking in learning so that the desired pedagogical shift could be managed (Tan, Koh, Lee, Ponnusamy, and Tan, 2017). Therefore, supporting students’ critical thinking skills and possessing these skills themselves are essential for contemporary teachers (Facione, 1990; Paul and Elder, 2005; Thompson, 2011; Wei, Lin, Chen and Chen, 2020).

The Ministry of National Education, which is the institution hiring teachers in Turkey and Higher Education Council, which is responsible for teacher education declared that teachers’ needs for preservice and in-service training diversify continuously, thus, teacher competencies and accordingly teacher training curricula are being

<sup>1</sup> This paper is based on Doctoral Dissertation called “Eleştirel düşünmeyi esas alan biyoloji dersi modelinin öğrenci başarısına etkisi / The effect of critical thinking based biology instruction model on student achievement” submitted to Trabzon University The Institute of Graduate Education by Melih TİMUCİN (Corresponding Author)

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renewed continuously. (MEB, 2017; YÖK, 2018). However, there are not sufficient courses and content under individual courses targeting critical thinking in the curricula of education faculties (YÖK, 2018).

Critical thinking instruction of teachers can be improved via proper in-service training (Yeşilpınar, 2011). There have been sample practices of such trainings (Dolapçı, 2009). There have been only a few in-service studies targeting science or biology teachers' critical thinking supporting knowledge and skills (Zohar, Weinberger and Tamir, 1994).

The literature review presented implies that providing teachers with further critical thinking knowledge and critical thinking-based activities have potential to improve the quality of their instruction. Within this framework, the aim of the present study is to develop and implement in-service training to support biology teachers in terms of critical thinking concepts and activities, assessing the effects of the training. Along with this aim an in-service training called "Developing Materials Including Critical Thinking Elements" was developed and the effects of the training on critical thinking knowledge, awareness, and applications of the participant biology teachers were investigated. In order to put forward comprehensive outputs of this inquiry, answers to the following questions were pursued:

1. How was the in-service training evaluated by the participants?
2. How did the in-service training affect the critical thinking related classroom implementations of the participants?
3. How did the in-service training affect the critical thinking knowledge and awareness of the participants?

## 2. Methodology

In this study mixed method was used. In the course of in-service training quantitative and qualitative data collecting tools were used separately but simultaneously. The data from the tools separately analysed, related to each other and collectively interpreted to develop conclusions (Clark, 2019).

### 2.1. Research Group

The in-service training was formal, local training by the Ministry of National Education with reference number 2011610302. The main implementation was conducted with 27 volunteer in-service biology teachers (Table 1). Since all the participants are biology teachers working in the same city and they voluntarily followed the formal in-service application steps sampling was purposive and can be named as criterion sampling (Etikan, Musa and Alkassim, 2016).

Table 1. Profile of the participant teachers

Code	Gender	School Type (Secondary)	Education (Degree)	Experience (years)
T1	F	Anatolian	MBA	10
T2	M	Anatolian	Bachelor's	9
T3	F	Anatolian	Bachelor's	4
T4	M	Anatolian Teacher	Bachelor's	8
T5	M	Fine Arts and Sports	Bachelor's	9
T6	M	Science	Bachelor's	17
T7	F	Anatolian Teacher	Bachelor's	9
T8	M	General	Bachelor's	12
T9	M	VTTC	Bachelor's	14
T10	M	VTTC	Bachelor's	8
T11	M	Anatolian Vocational	Bachelor's	8
T12	M	Vocational	Bachelor's	11
T13	M	Fine Arts and Sports	Bachelor's	13
T14	M	Anatolian	MBA	9
T15	M	Multi Program	Bachelor's	10
T16	F	Anatolian	PhD	20
T17	M	Anatolian	MBA	18
T18	M	General	Bachelor's	21
T19	M	Anatolian	Bachelor's	10
T20	M	Anatolian	Bachelor's	9
T21	M	General	Bachelor's	14
T22	M	Science	Bachelor's	13
T23	F	Vocational	Bachelor's	4
T24	M	Vocational	Bachelor's	20
T25	M	General	Bachelor's	25

Table 1 (continued)

T26	M	General	Bachelor's	18
T27	M	General	Bachelor's	10

In Table 1 science secondary schools can be referred as having the highest achievement profile. Anatolian secondary schools also accept students with central examinations. The schools called “general” are mainstream upper secondary schools. Vocational and Technical Training Centres (VTTC) mainly offer module certificates for working learners.

## 2.2. Content of the Training

The content included basic critical thinking concepts, skills dispositions, supporting strategies, activities, and assessment. A sample critical thinking-based lesson plan for environmental problems and sustainability unit from the actual 9<sup>th</sup> grade biology course curriculum was supplemented with the training. Critical thinking supporting strategies presented in the training were; enrichment of lesson and environment (Potts, 1994), associating it with daily life (Bustami, Syafruddin and Afriani 2018; Carvalho *et al.*, 2015; Zohar and Dori, 2003), including ethical elements in problem scenarios (Ritchhart, 2002), supporting students' thinking skills and encouraging them to think systematically (Marzano, 1992), being a role model in terms of thinking systematically, focusing the core of the topic and adjusting the content as students can understand best (Low, Hui and Cai, 2017; Schrag, 1992), defining fundamental problems well, learning by setting up categories, sharing the aims with students (Paul *et al.*, 1990; Potts, 1994) and applying proper assessment (Black and William, 1998).

The way the literature review shaped the activities presented in the training can be summarized as follows: Active learning strategies have positive effects on cognitive processes and critical thinking skills. Student portfolios, diaries, reflective student reports, group presentations, case problems from daily life, examination analysis, and cooperative learning activities are some examples of active learning activities (Youngblood and Beitz, 2001). Zohar and Nemet (2002) posed daily life cases to their students in the biology course and monitored the argument development process of them. Similar activities including decision making based on ethical issues were applied in the science course by Tonus (2012) and proved effective. Potts (1994) noted that problems should be expressed in daily life language and students should decide which data are irrelevant or which led to the result. Such ill-structured problems may include missing information or assumptions; solutions may be based on moral evaluations and personal choices (Akay, Soybaş and Argün, 2006; Kohlberg, 1971). Examples of the argumentation process extracted from daily life can be used to explain the process of critical thinking (Bowell and Kemp, 2014). Finally, critical thinking text activities similar to the texts in certain critical thinking tests can contribute to the critical thinking skills of students (Table 2).

Table 2. Sample critical thinking activities

Activity Type	Name of the Activity	Resources	Used in
Critical thinking texts	Deduction	Watson, 1980	Activity 15
	Recognizing hypothesis	Watson, 1980	Activity 16
	Interpretation	Watson, 1980	Activity 14, Sample Unit
	Critical reading and text analysis	Paul, <i>et al.</i> , 1990	Activities 5, 6, 7 and 8
Real life problems	Ill-structured real life problems	Akay, <i>et al.</i> , 2006	Activity 1, Sample Unit
Six thinking hats	Six thinking hats	De Bono, 1985	Sample Unit
Reflective thinking activities	Know, Want to know, Learned (KWL) schemes	Ogle, 1986	Sample Unit
Critical debates	Corner debate	“Four corners,” n.d.	Activity 3
	Debate and write activity	“VCU CTE,” n.d.	Activity 2, Sample Unit
	Debate and role-playing	“VCU CTE,” n.d.	Activity 4
Activities towards learning basic critical thinking concepts	Propositions and argument definition, correctness of propositions, validity of arguments, fallacies	Bowell and Kemp, 2014	Activities 9, 10, 11 and 12

Activities in Table 2 had been subjected to a continuous feedback loop process by evaluation of field experts and teachers and implementation in different school types.

### 2.3. Implementation of the Training

The training was performed in Trabzon, Turkey, in the pre Covid-19 pandemic setting. The training was planned based on working groups in-service training model (Saban, 2000) by which teachers from different professional development stages with various perspectives actively and collectively evaluate an educational innovation. Both the pilot and main implementation were conducted in three days and twelve hours within a week. The theoretical knowledge was provided by the researcher with six different presentations via lecturing. The content supported with real-life examples and issues were discussed and exemplified by teachers' own experiences when it is needed. All of the participants were given a content book by which they can follow the instruction or self-study afterward. The participant teachers were provided with the portfolio sheets within the in-service content booklet. They included individual and group activities to help the participants think reflectively and assess their learning. There was also an activity for teachers to classify the thinking styles in the given real-life cases. The portfolios were collected and analysed after the training.

### 2.4. Data Collecting Tools

Interviews and "Critical Thinking Concept Test" were supported by the researcher's observations and the participants' portfolios. Critical Thinking Concept Test was composed of open ended questions asking teachers to define all the critical thinking concepts presented within the content of the training. The items were one-to-one corresponding to the concepts covered. For the validity, two field experts evaluated it and the test was finalized along with the feedback by the experts. The participants of the pilot study were interviewed with unstructured focus group interviews for their opinions to improve in-service training. Before and after implementation the participants were interviewed with semi-structured open-ended questions, and they were asked about their knowledge and implementations about critical thinking. In the post-interviews, they were also asked to assess the in-service training. The post-interviews were applied after a week to a month after the training which gave opportunity to participants to implement what they gained from the training (Figure 1).

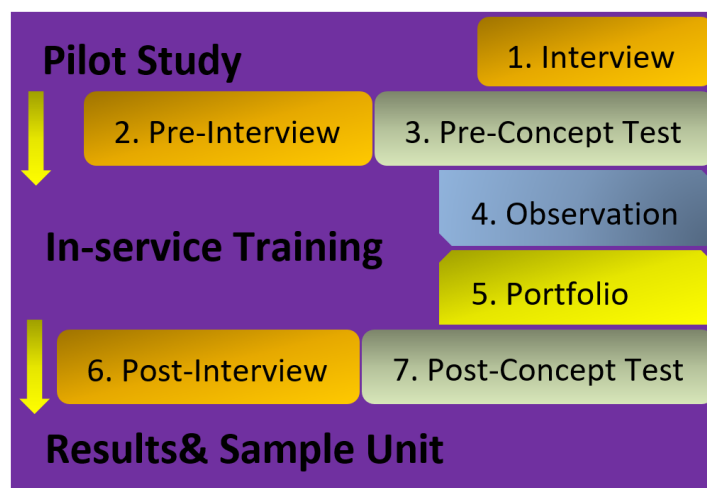


Figure 1. Data collecting tools

In the concept test, the teachers were asked to define: Higher order thinking, Critical thinking, Creative thinking, Reflective thinking, Performance assessment, Metacognition, Proposition, Argument, Fallacy, Socratic questioning, Critical thinking skills and dispositions. Each definition was graded as 5 points; total score was 60 max. The test was repeated before and after the training with the same questions. The relevance between test questions and content of the in-service training and research questions were approved by two field experts.

### 2.5. Data Analysis

Assessment of critical thinking is hard. Whether they are quantitative or qualitative, all assessment tools bring about certain advantages and disadvantages. Thus, rubrics prepared specifically for the particular case are one of the best solutions of assessment (Stein, Haynes and Unterstein, 2003; Willingham, 2007). Definitions of the critical thinking concepts can also be similar, confusing and overlapping. Therefore sticking a single correct definition for each question was not a productive evaluation way. Eventually, a rubric evaluating the participant responses with respect to general borderlines and by comparing with other responses was developed. The concept test was evaluated with the rubric presented in Table 3.

Table 3. In-service training concept test scaling rubric

Grade	Explanation	Sample Answer
5	Adequate and right information without false examples and details.	Higher Order Thinking: “Ability to perceive events with another point of view. Ability to think about the events deeper in a reason-result relationship.” (T12)
4	Right information including wrong parts and examples. Incomplete but mainly correct information.	Higher Order Thinking: “Debate, mainly coming up with a different view from everybody else’s point of view.” (T4)
3	Right but considerably incomplete information including errors / false examples.	Critical Thinking: “Being productive... But only after talking about the real value of the knowledge, real and true syntheses can be done.” (T15)
2	Information with a narrow relation with reality, including major mistakes or false examples.	Reflective Thinking: “Thinking skill towards presenting data, forming an idea or a product etc. Painting an authentic picture, for example.” (T5)
1	Wrong information, false example, obvious mistake.	Creative Thinking: “We call it empathy.” (T9)
0	No response	-

The data from the interviews were subjected to content analysis by assigning codes for common expressions and determining their frequency (Table 4). Topics that go together such as methods the teachers use in their lessons were grouped and tabulated with frequencies.

Table 4. Sample coding

T17: Words you frequently used like “algorithm” were words we were accustomed to but unable to define. I believe, we have understood them. I shared this experience with my friend day by day.	Comp+ Con
T11: Things I have learned were useful. But we may have some problems in implementation related to school and infrastructure.	Comp+ -CT-inf
T11: Even if I cannot fully define the concepts, my knowledge was extended. I have seen that naming the process and following certain steps can be more useful. I try to apply on my students...	Imp Chan+
T24: Improved. I applied “Six Thinking Hats.”	CTimpl

The statements by T17, indicate his competence has improved. Hence “Comp+” code was used. “Con” (Concept) refers to expressions like: “We have learned the definitions of the concepts we previously used.” “-CT-inf” refers to infrastructure originated problems adversely affecting critical thinking interventions. “Imp” explains the cases that the participant teachers’ awareness improved, and they found critical thinking more important after the training. “Chan+” shows that there have been changes in classroom implementations of the teachers after the in-service training. “CTimpl” is the code to group and count the critical thinking implementations used by the teachers (Table 4).

### 3. Findings

Findings were presented to reveal data about teacher opinions about the training, changes in their classroom applications, their conceptual and methodical knowledge.

#### 3.1. Teacher Opinions about the Training

The content book of the in-service training was positively evaluated (Table 5). Three teachers gave answers expressing their negative thoughts. One of these teachers discoursed his general discontent about the in-service training due to not being practical. Majority of the teachers answering the related question, positively evaluated the lesson presentations of the training. The presentations were also criticized for being far from practical. The presentations about types of thinking, critical thinking concepts and critical thinking supporting strategies (T8) and the barriers of critical thinking (T5, T7, T8, T11 and T16) were mentioned as particularly useful.

Table 5. Opinions of the participants about the training

Opinions of the Participants	f	Teachers
The content book was sufficient.	18	
The participants should have taken more part in shaping the content and activities.	14	T1, T3, T5, T6, T7, T8, T9, T10, T13, T14, T16, T20, T21 and T27
The time period was short for the training.	11	T4, T5, T6, T8, T16, T17, T18, T20, T22, T23 and T26

Table 5 (continued)

The lesson presentations were sufficient.	8	T4, T8, T10, T11, T13, T14, T16 and T27
The teacher portfolios were helpful.	8	T4, T8, T10, T11, T13, T14, T16 and T27
The sample unit can be improved	6	T3, T6, T7, T21, T26 and T14
The presentations were informative.	2	T4 and T11
The training was improvable.	2	

T14 and T21 argued that defining critical thinking by comparing with Bloom’s taxonomy (Bloom *et al.*, 1956) was helpful in terms of making the critical thinking concept memorable. The teachers noted that, more hand-on activities towards biology classrooms should be added, sample lessons supporting critical thinking should be demonstrated as if they were in the classroom in order to improve the in-service training. The participant teachers also noted that they should have taken more part in shaping the content and the delivery of the in-service training. Moreover, some of the teachers asserted that in-service training should be fully practical without any theoretical presentations (T3, T20 and T21). Similarly, T5, T6 and T16 said that the concepts presented in the training were excessive, condensed, and hard to understand. T8 put forward the idea that practical activities and real-life examples were useful in understanding abstract concepts such as types of thinking and they should be used more. Determining hypothesis activity (Activity16) included in the first lesson presentation was found ambiguous. T8, T17 and T25 described the questions in the activity as complex and conflicting to apply in their classrooms. The teachers submitted a wide range of different ideas about the activities on basic critical thinking concepts (proposition, argument, and fallacy: Activities 9, 10, 11, and 12). Some of the teachers reporting negative ideas about these activities changed their minds during the training process.

T11 and T14 discoursed they would like to apply critical thinking activities in different units. T6 said that it was not possible to instruct as the sample unit offers with the existing curriculum load. T21 stated that sample unit could be associated with the formal intended learning outcomes of the unit more rigorously. T7 mentioned the importance of selecting questions in Activity 15. T1, T5, T7, T14, and T17 stated that the activity can be improved by matching these questions with the learning outcomes better.

### 3.2. Changes in the Classroom Applications

In the pre-interviews, only four participants responded to the question about what type of critical thinking activities they use. T1 said “I applied Six Thinking Hats. I assign video performance tasks and short role-plays.” Rest of the answers were rather superficial: T8 mentioned activities in resource books; T14 said he used such questions in multiple choice and other tests and T20 said that he tried to use interpretations in exams, but he had to use multiple choice questions in general.

The instructional methods, techniques, and activities that the participant teachers reported they use during the pre-interview are presented in Table 6. Particularly strategies such as group work, performance assignments, laboratory activities, debates, drama, conceptual change texts, games, and inventory learning can bring about support of higher order skills. However, apart from T1, none of the teachers could articulate the direct relation between these strategies and supporting critical thinking. Moreover, mentioned items such as student centred instruction, proper activities for scientific development and brainstorming were unclear or too general to explain what was exactly done in the classroom.

Table 6. Instructional methods, techniques and activities used pre-implementation

Method/Technique/Activity	f
Questioning	12
Demonstration, animation, presentation <i>etc.</i>	11
Lecturing	9
Group work	4
Project, performance or research assignments	3
Student centred instruction	3
Debate	2
Laboratory activities	2
Taking notes	2
Brainstorming	1
Drama	1
Concept maps	1
Conceptual change texts	1
Proper activities for scientific development	1
Games	1
Inventory learning	1

After the in-service training 20 teachers reported that their classroom applications had changed /were going to change (T3, T4, T5, T6, T7, T8, T9, T10, T11, T12, T16, T17, T18, T20, T21, T23, T24, T25, T26 and T27) and explained their applications with examples (Figure 2).

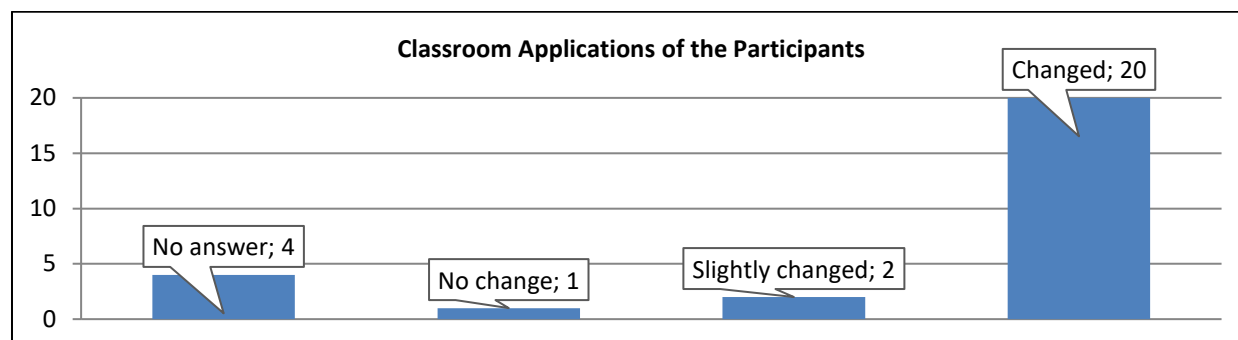


Figure 2. Status of participant teachers' classroom applications after the training.

Four teachers thought that the training had not affected their classroom applications. T22, saying he was waiting for suitable conditions to apply and T14, who was thinking he could not precisely decide which applications to use to support students' critical thinking, were classified as "slightly changed." In Table 7 critical thinking activities the teachers used after the training are presented.

Table 7. Critical thinking activities and strategies used by the participant teachers after the training

Activities/Strategies	f	Teachers
Sample Unit	6	T5, T9, T11, T14, T20 and T27
Encouraging / Motivating Questions	5	T3, T8, T11, T23 and T25
Portfolio	5	T4, T5, T8, T10 and T14
Critical Thinking Supporting Strategies	5	T4, T11, T16, T18 and T24
Six Thinking Hats	4	T9, T10, T17 and T24
Real Life Problems	3	T6, T7 and T25
Supporting Lesson with Visuals	3	T7, T16 and T18
Student Centred Learning	3	T6, T11 and T17
Socratic Questions	2	T9 and 27
Reflective Thinking	2	T10 and 24
Argumentation	1	T20

6 teachers indicated the sample unit. T27 explained his approach as "Not, much but I have made little tries based on it." T9 indicated his intention by saying "Since it was going to be time and effort consuming to plan activities fully based on the sample unit, I plan to scatter the things we have learned to more available times." Additionally, four teachers (T3, T13, T14 and T25) noted that they would apply the sample unit and activities depending on other factors such as availability of time and previously prepared materials.

Ten teachers (T8, T9, T10, T11, T17, T18, T21, T24, T25 and T26) said that the training increased their competence to develop activities with potential to support students' critical thinking. Eight teachers (T4, T5, T6, T7, T20, T23 and T27) were thinking that their competence was improved but they had some problems with implementation or they think activities should be prepared by professionals.

Certain teachers provided rather detailed snapshots from their post-training classroom environments which can account for change in implementations with a critical thinking perspective. Although T16 implied that she was not interested in conceptual dimension, her explanations indicated that she carried out critical thinking-based lessons after the training with a certain system and awareness and that she discussed with her students on how to think.

*T16: I used to make them talk. But now I try to reach different points starting from their rights and wrongs. By this way they learn things like that their thoughts can sometimes be wrong and how to think. I said something and asked "Is it right or not?" and I collected their opinions. Then the other students tried to explain the reasons. There was chaos in the classroom but everybody spoke about their ideas and learned what is right or wrong eventually.*

Another teacher with similar reaction towards supporting higher order thinking skills, T11 noted the difficulties he had faced:

T11: *We used to say things like “this activity is going to be done and these are the materials.” Now we are not doing so. We even sometimes go out of the topic and have the lesson in a way that students can question the subject matter and contribute with their own experiences. Some of them had serious difficulties in that. There were critics such as “What is that? What is it good for?”*

T18 shared his observations towards the activities increased student interest and learning in groups with moderate achievement level:

T18: (Interviewer: Had not you applied critical thinking activities before?) *Not on this scale. I would play little games in short periods but I used to feel guilty. I had worries like: I wasted time, I had lots to explain and I couldn't catch up with etc. However, this activity (student group presentation, students' decision making with debate and writing poems in the biological classification unit) took 20 minutes and I felt that the children grasped the core of the 90-minute-lesson in 20 minutes.*

As an example of applying real life problems: T11 encouraged his students to talk about “a self-sufficient aquarium child living in her/his own ecosystem.” He evaluated the activity as useful with certain drawbacks. T17 narrated the observations from implementation of Activity 1 in which students were asked to decide how to allocate an imaginary land for housing and farming, what to grow, whether hormones or GMO seeds would be used *etc.*

T17: *I asked students whether they would use hormones. Some of them said yes: it makes more profit. But one of my students came up with a considerable point of view and said: “If my crop is organic, it costs three-fold.” It was a really good point. I felt happy. We caught such things.*

After the training T9 noted that he believes when critical thinking is considered in instruction students can gain life-long necessary skills like; preparing for real life, organization and self-expression skills. T7 mentioned that after the training he realized with a different perspective that students can think critically, propagate and question different ideas.

### 3.3. Conceptual Knowledge of the Participants

Table 8 summarises average pre and post-test scores of the concepts and presents sample answers and scoring. Low answering rates in the concept test (63% pre-test, 58% post-test, 61% total) impaired the reliability of the statistics. T-test showed that there was no significant difference between average pre and post-test scores ( $p > 0,1$ . From 14,3 to 18,4 average). This tells that conceptual knowledge of the participant teachers on critical thinking concepts did not improve significantly.

Table 8. Average pre and post concept test scores and sample responses

Concept	Pre-test mean	Post-test mean	Sample Responses
Higher order thinking	3,53	4,31	Thinking by considering properties and all the probable outcomes. T20(Post-test) Scored 5
Critical thinking	3,29	4,33	Thinking towards a specific aim. T12(Pre-test) Scored 3 We will draw a reason-result relationship. We should be aware that our ideas can be wrong. We will sieve the ideas of others. Then we will have a judgement. T12(Post-test) Scored 5
Creative thinking	4,44	4,0	Reaching new outcomes from existing knowledge. T11(Pre-test) Scored 5
Reflective thinking	3,11	3,09	Sharing the gained knowledge with others instead of keeping it for oneself. T23(Pre-test) Scored 3
Performance assessment	3,8	3,69	Explaining subject related knowledge with your own original ideas. Putting forward a product. T25(Pre-test) Scored 4
Meta-cognition	2,4	3,29	To know what we know or not know. T10(Post-test) Scored 5
Proposition	2,0	3,0	An idea we keep about a situation. T5(Pre-test) Scored 3
Argument	1,2	1,56	I can't define concretely. T14 (Post-test) Scored 1
Fallacy	2,55	3,54	A result that not to be concluded. T17(Post-test) Scored 4
Socratic questioning	2,6	4,36	To direct children to an intended point; starting from the way they know and asking the reasons and the bases of an issue. T16 (Post-test) Scored 5
Critical thinking skills	3,33	4,17	The talent of questioning, presenting cognitive skills and reasoning. T24(Pre-test) Scored 5

The greatest improvement was in Socratic questioning which was given concrete examples and found applicable by the participants. Creative thinking, reflective thinking, performance assessment, and critical thinking dispositions concepts could hardly be defined even in the post-test. On teacher-wise; T10 showed improvement in defining 10 concepts. T3, T12, T9 followed him with 8, 7 and 6 concepts respectively. Table 8 presents the concepts defined, sample answers and average scores. 16 teachers in metacognition, 15 in proposition, 12 in argument, 10 in Socratic questioning, 17 in critical thinking skills gave answers neither in pre nor in the post-tests. However, the participants' opinions about their own critical thinking concept knowledge, collected by the interviews, were different (Table 9).

Table 9. Opinions of the participants about their critical thinking concept knowledge

Expressions / Common Thoughts	f
The training increased my conceptual knowledge about critical thinking.	19
We have learned the concepts that we had already been applying in the classroom.	13
The training did not increase my conceptual knowledge about critical thinking.	5

Nineteen participants thought that the training increased their concept knowledge. Only five teachers (T4, T9, T10, T14 and T17) evaluated their conceptual improvement insufficient.

#### 4. Results and Discussion

As a whole, the training was evaluated as informative by the participants. Based on the data obtained by the interviews there were certain changes in critical thinking awareness and classroom implementations of the participants as a result of the training.

The content was evaluated as related and useful by the participants. Although the content had been diluted and practical dimension supported after the feedback from the field experts and pilot study, still it was found too theoretical. The participants demanded that the training should be fully structured with the participants at the beginning.

The training was also criticised in terms of having a short duration compared to its content. Although it was a registered in-service training in the calendar of the Ministry of National Education, it was conducted within the educational term with teachers from all over the city, which brought forward time constrictions for personal and institutional reasons.

Having to plan shorter time periods due to concerns such as workload or participant attendance have also been a problem for previous critical thinking related in-service studies (Yeşilpınar, 2011; Zohar and Nemet, 2002). Akar (2010) suggested school centred structures enable continuity of activities and performing follow up studies to solve similar time problems.

Interpreting Table 6, it can be concluded that the majority of the participant teachers did not have specific methods, targeted effort, related materials and awareness towards improving their students' critical thinking skills before the training. This situation had projections on their applications. They mainly pointed that they preferred methods and techniques like questioning and lecturing in their instruction with the aim of "controlling classroom more easily." Particularly the teachers working for the school types with moderate academic achievement profile thought that their students were not ready for activities demanding critical thinking and they frequently lower the level even to making students take teacher-directed notes. They would try to increase attention and objectify student learning by demonstration, animations and presentations. The teachers who dared higher level activities would use group-work, project, performance or research assignments, laboratory activities and debates. Moreover, some participants, sometimes tried techniques that can be accepted as higher order such as; drama, concept maps, conceptual change texts, activities fitting scientific development, games and inventory learning.

When the data collected after the training with different tools compared, the interviews showed that the participants applied different critical thinking strategies and activities in their biology classes, they realized the importance of supporting instruction with critical thinking elements. Altered classroom implementations of the participants after the training and their observations over students further supported their positive thoughts about critical thinking activities. The interviews also indicated that the participants felt confident about critical thinking terminology. However, their concept test scores did not approve the participant teachers' ideas. There was no significant change between pre and post concept test scores. There were studies citing similar under-scoring of teachers while defining critical thinking concepts. Kanık (2010) reported only a few trainee teachers could explain the dimensions of critical thinking by giving examples from their classroom applications and the rest demonstrated very little improvement in terms of knowledge on critical thinking terms. In a series of in-service training (Zohar, 1999), the teachers were quite successful at solving problems requiring thinking skills related to procedural knowledge (knowledge about how to do a certain task) while they frequently had difficulty in describing their thinking ways of solving the problems (declarative knowledge). In the present study, we can also say that

declarative knowledge of the participant teachers about critical thinking concepts did not increase at an expected level.

There was very little data to compare obtained by the teacher portfolios. Since they preferred to discuss verbally, the reflections written by the participants on the teacher portfolios were much less than expected. The participants mainly took short notes for their group-works.

Before the training the teachers could not state elaborate explanations for their critical thinking implementations. In post interviews, some of the participants reported that they improved their knowledge about critical thinking, they broadened their point of view in terms of implementation and that their instruction improved so as to make more connections with real life. Some of the teachers exhibited deeper insight for critical thinking related concepts by using the terminology compared to the pre-test. After the in-service training the participants started self-questioning in terms of certain aspects of higher order thinking such as “there may not be an absolutely true answer”, “questions with more than one true answer” and “somebody’s thinking on their own thinking processes.”

Most of the participants felt confident about developing critical thinking based activities. Some teachers thought that their competence was improved but not enough to develop their own critical thinking materials. Although the activities used by the teachers after the training did not one-to-one fit the content, teachers took and interpreted the training holistically similar to Dolapçı (2009) reported after his critical thinking seminar with teachers from different majors. The participant teachers of the present study attempted to create a critical thinking based classroom environment, applied critical thinking based trials, utilized the sample unit and activities. They also used ill-structured questions with more than one correct answer or with no clear answers even for teachers. They tried to direct students to think about their thinking processes by using the concepts like argument and proposition. One teacher applied the activity inquiring the ethical elements and he noted that he could observe the intended, “different thinking” of students. A teacher from a low-academic achievement profile school gave his students responsibilities, letting them do peer instructions and activities in different fields of intelligence. The participating teachers applying the gains of the training reported that their instructions were more efficient, took shorter time than usual, that they were impressed by the performances of their students and they regretted not trying it before. There were also teachers saying that they had made these trials occasionally on suitable units or they would apply them in the future.

However, similar to İrez and Yavuz (2009) reported, the teachers in the present study noted that they do not have the opportunity to perform their instruction full time critical thinking based as offered by the training because of the reasons like inadequacy of lesson hours, condensed curriculum and the pressure caused by central examinations (Baştürk and Doğan, 2010; Dindar and Demir 2006).

Another point to be taken into consideration is critical thinking skills, competences and dispositions do not change instantly (Kuhn, 1991; Tiruneh, De Cock and Elen, 2018; Zohar and Nemet, 2002). It needs a certain period to settle a critical thinking culture in the classroom. Therefore, the participant teachers can be expected to improve their critical thinking implementations by time. The critical thinking culture, which will possibly form in their classrooms, will help them achieve more in terms of critical thinking.

## **5. Conclusions**

This study highlights the potential of critical thinking inducing in-service training in shaping instruction of teachers. Some of the participant teachers adopted the provided samples and agreed on their benefits. Some others interpreted the training and exhibited a holistic tendency towards critical thinking. Both those who develop this awareness and the rest, the teachers mentioned factors made them hesitant in applying full time critical thinking based instruction like curriculum load and pressure by central examinations. “Only curricula that are rigorously designed to foster critical thinking competencies can reap the intended student outcome” (Tan, Koh, Lee, Ponnusamy, & Tan, 2017). Thus, the long term achievement of similar critical thinking innovations is largely bound to the constrictions of the context, which should be referred for prospective studies.

Similar to the previous studies (Kanık, 2010; Zohar, 1999), the present study also showed that teachers’ orientation towards procedural knowledge, rather than declarative knowledge should be taken into consideration during planning of critical thinking based in-service training. Teachers, quite naturally, have a tendency towards applicables. Similar prospective training should fully focus on practical activities and the participants should take part in designing the content, selecting the activities.

Activities offered by the present study can be applied in classroom settings by teachers or studied more specifically by researchers. They can be examined in terms of different individual higher order thinking skills like creative thinking or higher order thinking as a whole.

Finally, based on the opinions and classroom implementations of the participant teachers of the present study, it can be said that critical thinking based instruction should be insisted on in all educational levels and profiles. Persistent and comprehensive implementations can lead classroom and institution critical thinking culture, which promise better results in terms of higher order thinking.

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