

**DEVELOPMENT OF A MULTIDIMENSIONAL SCALE
FOR 21ST CENTURY SKILLS**



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**DEVELOPMENT OF A MULTIDIMENSIONAL SCALE
FOR 21ST CENTURY SKILLS**

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ABSTRACT

DEVELOPMENT OF A MULTIDIMENSIONAL SCALE FOR 21ST CENTURY SKILLS

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The purpose of this study is to develop a multidimensional scale to assess university students' current levels of 21st century skills. This scale, which is called 21CS Scale, intends to be in scope and originality to address the most common skills, namely communication, collaboration, creativity, critical thinking, information and communication technology literacy, problem solving, productivity, and sociocultural skills emphasized in six internationally acknowledged theoretical frameworks. For the development of the scale, an exploratory sequential mixed method design was adopted and the data was collected from 614 participants who were enrolled in English medium universities. The data analysis was completed in three steps including exploratory qualitative data analysis for item generation, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA). Upon careful review of the literature, eight skills were identified as construct domains for the scale, and a total of 61 items were developed in a 5-point Likert scale format. Upon expert review, two of the items were removed and the remaining items were tested to examine the psychometric properties of the scale. The results of the EFA showed that the data supported the proposed eight-factor structure for 28 of the original 61 items and CFA indicated a good fit of the model with the Cronbach's alpha coefficient of .91. As a measurement tool that encompasses different frameworks under a single structure and offers practical use, the 21CS scale serves as a reliable and valuable tool for educators and researchers aiming to assess the 21st century skills of students.

Keywords: 21st century skills, Integration of 21st century skills, Scale development

ÖZET

21. YÜZYIL BECERİLERİNE YÖNELİK ÇOK BOYUTLU BİR ÖLÇEK GELİŞTİRME ÇALIŞMASI

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Bu çalışmanın amacı, üniversite öğrencilerinin 21. yüzyıl becerilerinin mevcut düzeylerini değerlendirmek için çok boyutlu bir ölçek geliştirmektir. 21CS Ölçeği olarak adlandırılan bu ölçek, uluslararası alanda kabul görmüş kuramsal çerçevelerde vurgulanan en yaygın beceriler olan iletişim, işbirliği, yaratıcılık, eleştirel düşünme, bilgi ve iletişim teknolojileri okuryazarlığı, problem çözme, üretkenlik ve sosyokültürel becerilere yönelik geniş kapsamlı, özgün bir ölçme aracı olarak tasarlanmıştır. Ölçeğin geliştirilmesi için keşfedici sıralı karma yöntem (exploratory sequential mixed method design) kullanılmış ve veriler İngilizce eğitim veren üniversitelere kayıtlı 614 katılımcıdan toplanmıştır. Veri analizi, madde yazımı için açıklayıcı nitel veri analizi, açıklayıcı faktör analizi (AFA) ve doğrulayıcı faktör analizi (DFA) olmak üzere üç adımda tamamlanmıştır. Literatür detaylı bir şekilde tarandıktan sonra, ölçeğin boyutları olarak sekiz beceri belirlenmiş ve 5'li Likert ölçeği formatında toplam 61 madde geliştirilmiştir. Uzman incelemesi sonucunda iki madde çıkarılmış ve kalan maddeler ölçeğin psikometrik özelliklerini incelemek için test edilmiştir. DFA sonuçlarına göre, verilerin orijinal 61 maddenin 28'i için önerilen sekiz faktörlü yapıyı desteklediği, fit indekslerin modele uyum gösterdiği görülmüş ve Cronbach's alpha katsayısı 0.91 olarak hesaplanmıştır. Farklı teorik çerçeveleri tek bir yapı altında toplayan ve pratik kullanım sunan bir ölçme aracı olan 21CS ölçeği, öğrencilerin 21. yüzyıl becerilerini değerlendirmeyi amaçlayan eğitimciler ve araştırmacılar için güvenilir ve geçerli bir araç olarak kullanılabilir.

Anahtar Kelimeler: 21. yy becerileri, 21.yy becerileri entegrasyonu, Ölçek geliştirme

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CHAPTER 1

INTRODUCTION

What we all try to do in life is bring out the best in us and eventually achieve success. Although this construct means different things to each of us, there are certain skills, knowledge, competences, and abilities we need in common. Regardless of their definition of success and what they want to do in life, successful people achieve their goals using that set of skills and competences. The present research focuses on how we identify them, which ones are more important than the others, and more importantly how to instill them in younger generations so that they get to prosper in the 21st century.

1.1 Statement of the Problem

It is commonly accepted that students need far more than what has been taught in the traditional classrooms to succeed in today's world. Skills such as reading, writing, and arithmetic or basically knowing how to use a computer is not enough to equip students for academic success, a better career or higher standards of living. What individuals need in addition to this fundamental set of skills and basic knowledge is beyond what current educational systems cover. The term "21st century skills" is frequently used to define this list of abilities and competencies such as communication, collaboration, creativity, problem solving, productivity and critical thinking, which varies across different frameworks designed by various organizations and educational circles.

21st century skills is not a new concept but includes the traits and competences that people have been using for ages. What has changed now and what brings those skills to the fore in education? Silva (2009, 631) describes 21st century skills not as a

new set of skills but as “newly important” skills. Since they are regarded as the most crucial success drivers today and have become more important than ever, this set of skills is not only crucial for a particular group of people but takes priority for anyone who would like to thrive in life.

Why 21st century skills are seen as a necessity today is highly because of the rapid change the world has been going through thanks to information and communications technology. As access to knowledge has increased due to the internet, the question now is to know how to process and apply this huge amount of information in a meaningful, productive and innovative way rather than simply remembering it. This requires a transformation in educational systems which are mostly still based on information transmission.

According to Andreas Schleicher, Director of the OECD Directorate for Education and Skills, “Education is no longer about teaching students something alone; it is more important to be teaching them to develop a reliable compass and the navigation tools to find their own way in a world that is increasingly complex, volatile and uncertain. Our imagination, awareness, knowledge, skills and, most important, our common values, intellectual and moral maturity, and sense of responsibility is what will guide us for the world to become a better place.” (Schleicher, 2019). Therefore, it is imperative to have a paradigm shift in education, redefine the mission of schools and teachers’ role in the classroom to get students involved in communication, collaboration, technology, innovation, problem solving and so forth to be able to meet changing needs of the learners in the 21st century.

Similarly, with the impact of globalization and digitalization, the implementations in the English Language Teaching field should be revised and reshaped according to what 21st century demands from learners. English, being a global language, has been included as one of the core subjects at schools and has been studied by learners from different cultural backgrounds, with various levels of attainment and learning styles, which turns English language classrooms into a favorable and convenient environment to interweave 21st century themes such as

global awareness, civic literacy, financial literacy, health literacy, and environmental literacy (P21, 2009b). Since language is a tool for communication, helps increase intercultural awareness of the learners, and enables the integration of any relevant material as input in reading and listening, English language classrooms can provide more flexible and adaptable learning contexts for consolidating 21st century skills. For that reason, English language classrooms should drift away from conventional methods and content, but rather concentrate on integrating 21st century themes, learning and innovation, life and career, and technology skills in the curriculum and implementation phases (Fandiño Parra, 2013).

To be able to integrate 21st century skills in language education, it is prerequisite to define, clarify and categorize those skills first. Although the importance of 21st century skills has been often mentioned in recent literature (Göksün & Kurt, 2017; Lai & Viering, 2012; Schleicher, 2011), there is no common agreement in regards to their definition and classification (Dicerbo, 2014; Kylonen, 2012; Lai & Viering, 2012). For this reason, it is helpful and convenient to delve into current major conceptual frameworks designed for 21st century skills.

Based on thorough review of literature, internationally recognized, well-known frameworks for 21st century skills have been found and used in this study. Those frameworks include *the Partnership for 21st Century Skills (P21)*, *the enGauge 21st Century Skills (enGauge)*, *Assessment and Teaching of 21st Century Skills (ATCS)*, *National Educational Technology Standards (NETS)*, *21st Century Skills and Competences for New Millennium Learners*, and *Key Competences for Lifelong Learning*.

The Partnership for 21st Century Skills was developed in 2006 by P21, an organization funded by the US government and various private organizations. It provides a comprehensive conceptualization of 21st century skills and has been more widely used than any other frameworks examined. The skills and knowledge the students need in the 21st century have been categorized as the key subjects and 21st century themes; learning and innovation skills; information, media and technology

skills; life and career skills along with the support systems and partnership needed in education (P21, 2009).

The enGauge 21st century skills is a framework designed by The North Central Regional Educational Laboratory and Metiri Group in 2002 to promote 21st century skills of students, teachers, and administrators. The enGauge classifies 21st century skills into four groups: digital age literacies, inventive thinking, effective communication, and high productivity (Lemke et al. 2003).

Assessment and Teaching of 21st century skills (ATC21S) was developed between 2009 and 2012 in cooperation with Intel, Cisco, Microsoft and the University of Melbourne aiming to support learners to become successful by integrating these skills in the curricula. The framework groups ten skills into four categories: ways of thinking (creativity and innovation; critical thinking, problem solving, and decision making; learning to learn/metacognition), ways of working (communication and collaboration), tools for working (information literacy, information and communication technology literacy), and ways of living in the world (citizenship, life and career, personal and social responsibility) (Binkley et al. 2010, Csapo et al. 2010).

National Educational Technology Standards (NETS), developed by the International Society for Technology in Education (ISTE) in 2007, stresses digital literacy skills and provides a more detailed vision on technology use in education. The standards listed include creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving and decision making, digital citizenship, and technology operations and concepts (ISTE, 2007).

21st Century Skills and Competences for New Millennium Learners, developed by the Organization for Economic Cooperation and Development (OECD) in 2005, categorizes the skills and competencies the learners need into three dimensions: information, communication, and ethics and social impact. The Definition and Selection of Competencies (DeSeCo) Programme and the Programme for International Student Assessment (PISA) were central to this framework (OECD, 2005).

Key Competences for Lifelong Learning was developed by the Council of the European Union in 2007, with the aim of identifying 21st century skills and providing a reference for educators to equip the learners fully so that they can adapt to change. This European framework has eight categories: literacy; multilingual; mathematical, science and engineering; digital; personal, social and learning to learn competence; citizenship; entrepreneurship; cultural awareness and expression competence (European Commission, 2019).

Although those internationally recognized frameworks all focus on defining and categorizing 21st century skills, they vary in their approach, value certain skills more than others, and exclude some of the skills considered important in other frameworks. Having compared all the frameworks listed above, it has been seen that collaboration, communication, ICT literacy and social and/or cultural skills were included in all frameworks; creativity, problem solving, critical thinking and productivity were mentioned in most of them, whereas skills such as learning to learn, self-direction, planning, flexibility and adaptability were listed in only a few frameworks (Voogt & Roblin, 2012). Even though there is no complete consensus on what are acknowledged as 21st century skills between the frameworks, it is invaluable to have such guidance for educational policy makers and educators themselves.

The ultimate purpose of all the frameworks is to ensure that 21st century skills are integrated in educational practices so that learners can prosper in their academic life and career. For this reason, the frameworks cover the issue from three key areas: how to address those skills in school curricula, what roles the teachers should have, and how to collaborate with other public and private partners (Voogt & Roblin, 2012). It is well acknowledged that educational systems should be revised and adjusted to raise successful generations equipped with essential skills and competences of the 21st century.

The prominence of integrating 21st century skills into education is widely recognized and there is adequate literature on definitions and categorizations of these

skills; however, in terms of assessment there are still many questions to be answered, which need thorough consideration and radical changes in teaching practices. Many problems about creating tasks that portray theoretical frameworks, measuring these skills successfully, assessing and grading student performance, and what the consequences and value of these assessments are yet unsolved (Greiff & Kyllonen, 2016). 21st century skills have to be assessed in a different way than the content knowledge of the learners in the core subjects.

In conclusion, to be able to accommodate 21st century skills in curriculum and assess the outcomes later on, first we need to determine the existing levels of students to inform the integration process and shape instructional practices accordingly. For this purpose, there is a need for a measurement tool which will allow researchers, policy makers and educators to make informed decisions while planning this change in curriculum. Although there are several scales developed to measure 21st century skills, they either focus on only a couple of skills or take one dimension of the international frameworks to the core. Thus, there is a lack of a more comprehensive scale based on different frameworks and encompassing all related skills.

1.2 Aim of the Study

All aforementioned international frameworks provide a base for general conceptual understanding of 21st century skills with similarities and differences they hold. Besides setting the ground for educators and researchers, the frameworks have been adopted as a structure to assess and evaluate those skills, which is important for integrating this perspective in educational policies and curricula, comparing existing systems and outcomes to what attainment of 21st century skills entails in educational settings.

As Dede (2009) suggests learners' current performance should be examined universally to see whether they are ready and instilled with 21st century skills. At this point, it is of first priority to measure existing skills of learners and create a course of action accordingly. This measurement can be done through scales, situational

judgment tests, performance evaluations, and portfolios (Kylonen, 2012; Soland, Hamilton & Stecher, 2013). However, when compared to other tools, scales are more practical in the sense that they are low-cost, fast and easy to administer and analyze, valid and reliable as well as ensuring respondent anonymity (Hinkin, 1995) and they also enable the researchers to work with larger groups of participants and provide a broader perspective and standardized findings (Abu-Alhija, 2007; Nagy, 2000; Stecher, 2002).

Most of the scales developed so far focus on only particular competencies such as critical thinking (Kwon et al., 2006; Sosu, 2013; Stupple et al., 2017; Valenzuela, Nieto & Saiz, 2011) communication (Korkut, 1996; Lueg & Finney, 2007; Rees, Sheard & Davies, 2002), or creativity (Kaufmann, 2012; Rawlings & Locarnini, 2007; Richardson & Mishra, 2018) but do not comprise all the skills considered as 21st century skills in aforementioned frameworks (Boyacı & Atalay, 2016; Çevik & Şentürk, 2019; Javed, Athar & Saboor, 2019). That's why the current research aims to develop a more comprehensive scale which addresses the most common skills mentioned in those internationally acknowledged theoretical frameworks so that it can be used by teachers, educational policy makers, curriculum developers and meet the needs of other researchers studying 21st century skills.

1.3 Research Questions

The prominence of 21st century skills in terms of lifelong skills and teaching practices shows that there is a need for a scale to measure these skills. This scale should be in scope and originality to include the common skills emphasized by the multidimensional theoretical frameworks developed with the focus of education. For this reason, the current study intends to create a more inclusive scale that addresses the most prevalent skills described in all those international theoretical frameworks rather than narrowing down the scope to only one of the frameworks or only several of the skills mentioned in frameworks, so that it may be utilized in a variety of settings and fulfill the demands of other researchers investigating 21st-century skills. In addition to that, such a scale intends to enable researchers to conduct large-scale assessment

studies since it is based on multiple frameworks and practical to collect and analyze data with high numbers of participants. As no scale as such has been encountered in the literature, this scale aims to allow researchers to examine how well the participants have mastered 21st century skills. Based on this argument, this study aims to answer the following research questions:

1. Does the 21st Century Skills Questionnaire developed yield an appropriate level of reliability?
2. Does the 21st Century Skills Questionnaire developed yield an appropriate level of validity?
3. Are there any statistically significant differences between the 21 Century skills scores of participants in terms of their age, gender, and level of education?

1.4 Rationale for the Study

It is now beyond dispute that 21st century skills hold great significance and priority for students to become successful in life. The current educational systems fail to answer this need with their traditional perspectives which simply date back to previous centuries. Therefore, a drastic and rapid change is required to be able to keep up with the improvements in the modern world. This prominence has been widely acknowledged today and there is profound research and considerations on how to integrate these skills in educational processes and curricula. Influential international organizations such as OECD and UNESCO, private sector leaders like Microsoft and Intel, and divisions of education in national and global institutions focus on this issue. Although there is a considerable amount of studies to define and categorize 21st century skills and design new approaches to accommodate them in school curricula, the amount of research based on measuring and assessing them is scarce. Therefore, the current study intends to address this gap by designing a scale to measure participants' current levels of 21st century skills based on their self-report, allowing researchers to conduct studies with larger groups in an easier and more practical way.

1.5 Operational Definitions

21st century skills: the set of skills that 21st century learners need to lead a successful and fulfilling life, which comprises collaboration, communication, creativity, critical thinking, information and communication technology (ICT) literacy, problem solving, productivity, and socio-cultural skills.

Collaboration: “deciding goals together with others, sharing responsibilities, and working together to achieve more than could be achieved by an individual on their own” (Barfield, 2016, p. 222).

Communication: sharing or exchanging information, feelings or any other messages to others through convenient media and channels ensuring understanding takes place.

Creativity: “the way of thinking that leads to the generation of valuable and original ideas” (OECD, 2019).

Critical thinking: “reflective and reasonable thinking that is focused on deciding what to believe or do” (Ennis, 1985, p. 45).

Information and Communications Technology (ICT) literacy: “using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society.” (International ICT Literacy Panel, 2002, p.2).

Problem solving: “cognitive processing directed at achieving a goal when the problem solver does not initially know a solution method” (Mayer, 2013).

Productivity: the ability to successfully complete a task or create a product by setting and meeting goals, prioritizing needs, managing time to perform effectively.

Socio-cultural skills: the ability to develop positive social and cultural identities representing and expressing one's own culture and existing amongst other cultures with different beliefs, traditions, and habits without denying but recognizing the value and dignity of others.



CHAPTER 2

LITERATURE REVIEW

In this chapter, literature on 21st century skills is reviewed. The importance and the role of 21st century skills in education are discussed, international frameworks for 21st century skills are explained and compared to each other, and finally, the measurement of those skills and the research on it is summarized, respectively.

2.1 21st Century Skills

Today's rapidly changing world brings along the need for change in different aspects of our lives. Globalization and improvements in information and communication technologies reshape the world we live in very quickly, leaving us with no other option but to keep up with it. As we change our way of living and working constantly, we are obliged to adapt how we prepare future generations for this ever evolving conditions and requirements of a fulfilled life. Therefore, this continuous and quick change poses critical challenges to educational systems where we are supposed to instill young generations with all the necessary knowledge and skills.

All of these advancements necessitate a greater focus on identifying and acquiring the skills that individuals require to engage actively and successfully (Ananiadou & Claro 2009). Even though these skills are referred to as 21st century skills by many, there is no consensus on how to exactly define them and we come across diverse definitions by different institutions and organizations. It is often used as an umbrella term without specifying the skills involved. Such an ambiguity regarding the nature of 21st-century skills may cause troubles because people use the same words to signify very different things (Dede, 2010). It is hard to define 21st century skills mostly because they are interdisciplinary and multidimensional which means they are associated with many fields and involve knowledge, skills, and attitudes altogether

(European Commission, 2019; OECD, 2005; Gordon et al. 2009).

As it is hard to imagine what future technologies will bring more and how the world will continue evolving, we cannot stop questioning the educational systems which mostly still depend on the educational policies of the previous century. We should keep reformulating more appropriate teaching methodologies and content. This does not necessarily mean that we should abandon common core subjects like mathematics and language arts but instead broaden and enrich the content of core subjects with 21st century key themes and competences to help students keep up with the changes we all experience (Geisinger, 2016). Designing more complex teaching materials which require students to use their higher level thinking skills, get creative, think critically, change perspectives and solve problems should be our priority so that they are not going to settle for information transmission but improve their skills and competences. Cultivating 21st century skills in students would only be possible through a holistic approach in which teachers, administrators, policy makers and students are involved. It is our job to help students succeed in this complex world filled with improvements and unfamiliar problems. Therefore, transforming educational systems with integration of 21st century skills is highly significant to make students get ready for whatever future may hold.

Similarly, English language teaching practices should be revised and adapted in order to accommodate 21st century skills. Considering the learning objectives and ultimate goal of English language teaching, it is clear that 21st century skills are of increasing importance. English language classrooms can be claimed to offer an available and helpful context for practicing 21st century skills, as it requires students to communicate in the international language, to benefit from resources and materials written in English on the Internet, to provide reliable and up-to-date solutions to the problems encountered with the help of resources in English, to benefit from software and technologies offered in English, to understand and respect different cultures and diversities. These examples demonstrate how 21st century skills are relevant to the ELT – especially in today's world where English is the lingua-franca.

2.2 Frameworks for 21st Century Skills

While there are several frameworks created to define and categorize 21st century skills, for the purpose of this study the ones which are comprehensive with a broad spectrum of disciplines and competences, describe the skills in detail, and the ones that have been universally adopted have been chosen only. Therefore, the list has been narrowed down and six internationally acknowledged frameworks for 21st century skills have been included in this study upon a detailed review of the literature. In this section the following frameworks are summarized respectively: *the Partnership for 21st Century Skills (P21)*, *the enGauge 21st Century Skills (enGauge)*, *Assessment and Teaching of 21st Century Skills (ATCS)*, *National Educational Technology Standards (NETS)*, *21st Century Skills and Competences for New Millennium Learners*, and *Key Competences for Lifelong Learning*.

2.2.1 P21 Framework for 21st Century Learning. One of the most detailed and widely adopted frameworks is the P21 Framework for 21st Century Learning, which is designed for integrating 21st century skills into learning processes. The Partnership for 21st Century Learning (P21) is a network of Battelle for Kids which is a non-profit organization in the United States, aiming to ensure 21st century learning for every learner. It focuses on the skills and knowledge needed to succeed in work, life, and citizenship in today's world. The P21 Framework was initially published in 2006 and has since been modified and updated several times.

The P21 Framework was developed with the help of teachers, education professionals, and business people in order to describe and explain the skills and knowledge students need to excel in work and life in the 21st century. This framework was intended to bring together a set of competencies that highlights 21st century skills for students while also assisting teachers in teaching them. The current core subjects at schools are used as a ground to build on “life and career skills”, “learning and innovation skills”, and “information, media, and technology skills”. P21 aims to prepare students for today’s ever changing technologies and global culture of the world

so that they will succeed in their academic career and work life. Therefore, learning outcomes in this framework are frequently depicted with a regard to the influence they will have on learners' future career prospects (P21, 2009b).

Table 1

P21 Framework for 21st Century Learning

Key Subjects & 21st Century Themes	Learning & Innovation Skills	Information, Media & Technology Skills	Life & Career Skills
English, reading, or language arts, world languages; arts; mathematics, economics; science; geography; history; government; and civics.	Creativity and Innovation	Information Literacy	Flexibility and Adaptability
	Critical Thinking and Problem Solving	Media Literacy	Initiative and Self-Direction
	Communication	ICT (Information, Communications, and Technology)	Social and Cross-Cultural Skills
Global Awareness		Literacy	Productivity and Accountability
Financial, Economic, Business, and Entrepreneurial Literacy	Collaboration		Leadership and Responsibility
Civic Literacy			
Health Literacy			
Environmental Literacy			

The 21st-century skills and competencies, defined as student outcomes in the P21 Framework, are grouped into four categories: key subjects and 21st-century themes, learning and innovation skills, information, media, and technology skills, and life and career skills. It is suggested in the P21 Framework that in addition to aiming for mastery in the core school subjects, integrating multidisciplinary 21st-century themes such as global awareness, financial, civic, health, and environmental literacy within core subjects enables learners to have a higher level of understanding of academic content. The subjects, themes, and skills in each category are listed in Table 1 above.

P21 defines *learning and innovation skills* as the ones that will create differences for the students in a more complicated academic life and career. A 4C model is proposed consisting of creativity and innovation, critical thinking and problem solving skills, communication, and collaboration. Creativity and innovation is defined as being able to come up with original and useful ideas and turning these ideas into concrete products. Critical thinking and problem solving skills are identified as reasoning, making effective judgments and decisions, questioning and creating solutions. Communication is explained as being able to express self in various contexts and forms, for different purposes, through a variety of media, while collaboration is defined as the ability to work with others for a common purpose in an effective and respectful way.

In the P21 framework, *information, media, and technology skills* are given in a close relation to each other and can be summarized as accessing and using information efficiently and effectively, understanding how different media work and being able to use digital technologies for various goals.

Life and career skills, on the other hand, involve a list of lifelong skills. The first ones in this category, flexibility and adaptability means being able to adapt to changing roles and environments and handling feedback and criticism positively. Initiative and self-direction is defined as the ability to set goals, manage time effectively and work independently. Another life and career skill is social and cross cultural skills meaning

being able to work and communicate with others effectively by respecting and valuing diversity. While productivity and accountability is explained as setting goals, planning and working to reach these goals despite any obstacles, leadership and responsibility is summarized as taking charge in guiding others.

The P21 Framework claims that integration of those 21st century skills into education is only possible if the support systems are available. *21st century standards, assessments, curriculum and instruction, and professional development for teachers* should be incorporated to ensure mastery of those skills (P21, 2009b). This framework emphasizes that the transformation the educational systems need to go through should be handled and supported with the engagement and contribution of all stakeholders from teachers to administrators, curriculum developers, and policy makers. While 21st century themes are interwoven in the core subjects, instruction and assessment processes should be adapted accordingly, requiring a well-rounded approach.

2.2.2 The enGauge 21st Century Skills. The second international framework included in this study is the “enGauge 21st Century Skills: Digital Literacies for a Digital Age”. The enGauge framework, developed in 2002 by the North Central Regional Educational Laboratory (NCREL) and Metiri Group (an educational consulting organization in the US), is a framework that specifies six key criteria that ensure the effective use of technology in learning (Lemke, 2002). Rather than focusing only on students and schools, the enGauge embraces a broader perspective and considers integration of those skills both for educational systems and workplaces.

Similar to P21, the enGauge is based in the US and builds on national educational standards. However, the enGauge adopts a different perspective to list 21st century skills and brings technology use and digital literacies to the forefront. For this purpose, the enGauge 21st-century skills framework has determined the skills and categories according to eight different national standards in the US, including *National Education Technology Standards* by International Society for Technology in Education, *What Work Requires of School* by U.S. Department of Labor, *Standards for Technological Literacy* by International Technology Education Association, *FIT: Being Fluent With*

Information Technology by National Research Council, *Information Literacy Standards for Student Learning* by American Association of School Librarians (AASL), Association of Educational Communications Technology (AECT), and American Library Media Association (ALA), *A Nation of Opportunity: Building America's 21st Century Workforce* by U.S. Congress, *Growing Up Digital: The Rise of the Net Generation* by Don Tapscott, and *Preparing Students for the 21st Century* by American Association of School Administrators (Lemke, 2002).

Table 2

The enGauge 21st Century Skills

Digital Age Literacy	Inventive Thinking	Effective Communication	High Productivity
Basic, Scientific, Economic, and Technological Literacies	Adaptability, Managing Complexity, and Self-Direction	Teaming, Collaboration, and Interpersonal Skills	Prioritize, Plan, and Manage for Results
Visual and Information Literacies	Curiosity, Creativity, and Risk Taking	Personal, Social, and Civic Responsibility	Effective Use of Real-world Tools
Cultural Literacy and Global Awareness	Higher-order Thinking and Sound Reasoning	Interactive Communication	Relevant, High-quality Products

The enGauge framework argues that to reach academic success the students need to improve themselves in terms of *digital age literacies*, *inventive thinking*, *effective communication*, and *high productivity*. Although NCREL approaches the issue from a more digital literacies perspective, other skills are seen as essential complementary components and valued equally. Table 2 above lists the 21st century skills and categories developed by the enGauge Framework.

2.2.3 Assessment and Teaching of 21st Century Skills (ATCS). *Assessment and Teaching of 21st Century Skills (ATCS)* is different from the previous ones mentioned above, in the sense that it was developed in an international project and in cooperation with leading business companies in the world, emphasizing the importance of tackling 21st century skills on a global scale and handling it through an international partnership. The project was held in Australia, Finland, Portugal, Singapore, and the United States, Costa Rica, and the Netherlands between 2009 and 2012. This project, funded by Cisco Systems Inc, Intel Corporation and Microsoft Corporation and headquartered at the University of Melbourne, was completed in five stages in which they worked on defining skills, methodology, technology issues, evaluation, and new assessment types (Assessment and Teaching of 21st Century Skills, 2021). Another significant difference of ATCS from other frameworks is that it also focuses on finding ways to measure how good students are at 21st century skills and how successful the schools are in instilling those skills (Cisco, 2010). The ATCS framework argues that assessment is vitally important in defining standards and reshaping teaching content and implications, therefore measuring 21st century skills will encourage schools to do more to teach them.

Table 3

Assessment and Teaching of 21st Century Skills (ATCS)

Ways of Thinking	Ways of Working	Tools for Working	Ways of Living in the World
Creativity and Innovation	Communication	Information Literacy	Citizenship
Critical thinking, problem solving, and decision making	Collaboration	Information and Communication Technology (ICT) Literacy	Life and career Personal and social responsibility
Learning to learn/ metacognition			

Within the ATCS framework, 21st century skills that will lead to fundamental

change in learners are grouped into four: ways of thinking, ways of working, tools for working, and ways of living in the world. Although some skills such as ‘learning to learn’ stands out when compared to the P21 and enGauge frameworks, the ATCS framework covers similar skills but under different category names. Table 3 above shows categories and skills adopted in the ATCS framework.

2.2.4 National Educational Technology Standards. The International Society for Technology in Education (ISTE) developed National Educational Technology Standards (NETS), also called ISTE Standards, in collaboration with educators all around the world in 2007. ISTE Standards stresses the importance of effective technology use in education along with other 21st century skills.

Table 4

National Educational Technology Standards (NETS)

Student Standards	Educator Standards	Education Leader Standards	Coaching Standards	Computational Thinking Competencies
Empowered Learner	Learner	Equity and Citizenship Advocate	Change Agent	Computational Thinking
Digital Citizen	Leader	Visionary Planner	Connected Learner	Equity Leader
Knowledge Constructor	Citizen	Empowering Leader	Collaborator	Collaborating around Computing
Innovative Designer	Collaborator	Systems Designer	Learning Designer	Creativity & Design
Computational Thinker	Designer	Connected Learner	Professional Learning Facilitator	Integrating Computational Thinking
Creative Communicator	Facilitator		Data-driven Decision Maker	
Global Collaborator	Analyst		Digital Citizen Advocate	

In this framework, the 21st century skills are explained as the roles the students, teachers, and administrators should undertake, listed in Table 4 above. Although the categorization in this framework is entirely different from the previous ones, the core skills assigned to 21st century learners, teachers, and education leaders still revolve around the same competences. In other words, information and technology literacies, innovation and creativity, problem solving, communication and collaboration, critical thinking, decision making, and leadership are the key success drivers for all in education.

ISTE Standards resemble P21 Framework with regards to value and emphasize they put on the support systems in education. ISTE calls them as essential conditions and there are fourteen elements necessary for effective technology integration in education. According to ISTE, the following pillars are absolute must for equipping learners with all the necessary skills and knowledge in the 21st century: “shared vision, empowered leaders, implementation planning, consistent and adequate funding, equitable access, skills personnel, ongoing professional learning, technical support, curriculum framework, student-centered learning, assessment and evaluation, engaged communities, support policies, and supportive external context” (ISTE 2021).

2.2.5 The 21st century skills & competences for new millennium learners.

The Organization for Economic Cooperation and Development (OECD) started working on “*The 21st century skills and competences for new millennium learners*” framework through two initiatives: *the Definition and Selection of Competencies (DeSeCo) Programme* and *the Programme for International Student Assessment (PISA)* in 2005. The DeSeCo Project intended to create this framework to guide the assessment process of PISA and the findings of the DeSeCo project underlined theoretical grounds that PISA was built on. Although all OECD countries were invited to collaborate in this project, it started with the participation of the following seventeen countries: Australia, Austria, Belgium, Canada, Finland, Ireland, Italy, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, and Turkey (OECD, 2005).

OECD Framework differs from previous frameworks in the sense that it draws attention to the difference between skills and competences. In the others, the terms ‘skill’ and ‘competence’ were either used interchangeably or referred to as ‘skills’ only. Suggesting that competence is a far-reaching concept as it comprises the knowledge, skills, attitudes and being able to apply these in a given context, OECD used the word ‘competences’ as the main target of the project (Ananiadou & Claro, 2009).

In the first executive summary OECD published in 2005, the competencies were given in three broad categories: using tools interactively, interacting in heterogeneous groups, and acting autonomously. Using tools interactively was focused on how the information accessed and used by the learners and comprised “using language, texts, knowledge, information and technology interactively” (OECD, 2005, p.10). Interacting in heterogeneous groups consisted of collaboration and problem solving and the competencies were listed as “relating well to others, working in teams, and managing conflicts” (OECD, 2005, p.12). The last category acting autonomously was about being aware of social dynamics and roles and complying with them and creating a personal identity within the society. The competencies within this category were summarized as: “acting within the big picture, forming and conducting life plans and personal projects, defending and asserting rights, interests, limits and needs” (OECD, 2005, p.14).

After four years, as the project continued, the competences and categories were revised based on the data coming from OECD countries, educators, administrators, and policy makers. The preliminary findings of OECD Education Working Papers named 21st Century Skills and Competences for New Millennium Learners in OECD Countries, reveals three categories of the skills and competencies the learners need in the 21st century: information, communication, and ethics and social impact (Ananiadou & Claro, 2009). Table 5 below represents how 21st century skills and competencies were categorized by OECD.

Table 5

The 21st century skills and competences for new millennium learners

Information	Communication	Ethics and Social Impact
Information as source: searching, selecting, evaluating and organizing information	Effective communication	Social responsibility
Information as product: the restructuring and modeling of information and the development of own ideas (knowledge)	Collaboration and virtual interaction	Social impact

OECD also published a more detailed framework called “OECD Learning Framework 2030” in 2018 claiming that to overcome environmental, economic, and social challenges we face, we need to come up with new solutions with a shared vision in education encouraging learner agency for which we need to focus on certain knowledge, skills, attitudes, and values (OECD, 2018). The OECD Learning Framework 2030 builds on OECD key competencies (the DeSeCo project) mentioned above and adds “*transformative competencies*” which includes “creating new value, reconciling tensions and dilemmas, and taking responsibility”. This framework encloses a broader set of skills and highlights the importance of transformation through anticipation, action, and reflection (OECD, 2018).

2.2.6 Key Competences for Lifelong Learning. The European Commission and the Member States within the Education and Training 2010 Work Programme developed “Key Competences for Lifelong Learning” in 2006. This European reference framework approved by the European Parliament aimed at identifying key competences, providing a reference for educational policy makers and educators as well as supporting the member states for integrating them into their educational practices (European Parliament, 2007).

Similar to OECD’s approach, this European reference framework defines competences as a broader term which combines knowledge, skills, and attitudes needed for personal fulfillment and becoming a global citizen in today’s world. It is

emphasized in this framework that these competences are those which all individuals need for different purposes and are developed in different contexts. They complement and support each other, are mostly intertwined, and equally valued. It was stated in the European Commission's Education and Training report that the skills such as critical thinking, problem solving, creativity, team work, communication were interwoven in the key competences listed (European Commission, 2019), which demonstrates the similarities to other frameworks mentioned before.

Table 6

Key Competences for Lifelong Learning

The eight key competences
Literacy competence
Multilingual competence
Mathematical competence and competence in science, technology and engineering
Digital competence
Personal, social and learning to learn competence
Citizenship competence
Entrepreneurship competence
Cultural awareness and expression competence

The eight key competences, given in the Table 6 above, are explained in detail in the framework; definition of each competence is provided and knowledge, skills, and attitudes required to develop every competence are specified. Similar to the aforementioned frameworks, this one also underlines the importance of engaging and supporting all stakeholders in education. It is claimed that for all individuals to develop these eight competences, they need competence oriented quality education rather than knowledge based learning which is only possible with adapting teaching and learning activities accordingly, supporting and training educators, and ensuring assessment of competences (European Commission, 2019).

2.3 Comparing and Analyzing Frameworks

Within the scope of this study, following international frameworks have been examined respectively: *the Partnership for 21st Century Skills (P21)*, *the enGauge 21st Century Skills (enGauge)*, *Assessment and Teaching of 21st Century Skills (ATCS)*, *National Educational Technology Standards (NETS)*, *21st Century Skills and Competences for New Millennium Learners*, and *Key Competences for Lifelong Learning*. The official documents and websites of chosen frameworks were thoroughly examined. The frameworks were compared in terms of their main focus, motivation behind, countries and/or organizations involved, how they define 21st century skills and suggestions for implementation and assessment of the skills. According to this analysis, it was seen that they all take the same stance on the prominence of 21st century skills claiming that they are indispensable for 21st century learners. NETS and ATCS had an international approach involving a number of countries, Key Competences for Lifelong Learning was adopted by European Union member states, 21st Century Skills and Competences for New Millennium Learners was developed with OECD countries, while P21 and enGauge were based in the US only. Key Competences for Lifelong Learning, 21st Century Skills and Competences for New Millennium Learners and NETS attend to identify and define 21st century skills, while P21 and enGauge adds implementation considerations to this. ATCS, on the other hand, mainly focuses on assessments of 21st century skills.

All aforementioned frameworks seem to be mainly conforming with each other in terms of the skills included in them (Dede, 2010; Voogt & Roblin, 2012). The frameworks developed by P21, OECD, and European Union seem to have prepared the way for the others which keep most of the 21st century skills in these frameworks only by attributing different levels of importance to each of them. All the frameworks seem to name and categorize the skills differently depending on their rationale and main aim. Although there are overall similarities between the frameworks, depending on their focus and perspective, the emphasis they put on each skill varies across them. Table 7 below demonstrates the skills according to how frequently they are covered in

these six international frameworks (Voogt & Roblin, 2012, p.309).

Table 7

Comparison of the 21st century skills included in the frameworks

Mentioned in <i>all</i> frameworks	Collaboration Communication ICT literacy Social and/or cultural skills, citizenship
Mentioned in <i>most</i> frameworks	Creativity Critical thinking Problem solving Productivity (except in ATCS)
Mentioned in <i>a few</i> frameworks	Learning to learn (ATCS, EU) Self-direction (P21, enGauge, OECD) Planning (enGauge, OECD) Flexibility and adaptability (P21, enGauge) Core subjects: Mathematics, communication in mother tongue, science, history and arts (P21, ATCS)
Mentioned <i>only in one</i> framework	Risk taking (enGauge) Manage and solve conflicts (OECD) Sense of initiative and entrepreneurship (EU) Interdisciplinary themes (P21) Core subjects: economics, geography, government and civics (P21)

Communication, collaboration, ICT literacy, and social and/or cultural skills are the ones in which all the frameworks have a common agreement. Most frameworks consider creativity, critical thinking, problem-solving, and productivity to be crucial competencies in the 21st century. Core subjects such as mathematics, arts, history and whether or not to incorporate them in the framework seem to be creating one of the major differences between frameworks. Only the P21, the ATCS, and the EU frameworks make specific references to core subjects. However, this does not mean that they are advocating for 21st century skills to replace core subjects. Instead, they claim that it is only possible to integrate 21st century skills into curriculum by building on the existing core subjects and enriching the instruction with interdisciplinary knowledge and abilities 21st century skills have to offer.

2.4 21st Century Skills in Education

When we consider the overall aim of education, students, parents, and teachers might think differently. For students it might be passing the exams with good grades, for parents it is to ensure a better future for their children. Teachers, on the other hand, intend to raise qualified individuals who will contribute to making the world a better place. For such purposes, schools should aim to equip students with 21st century skills to help them thrive in today's world. Schools can provide an inspiring and supportive environment while encouraging students to take responsibility for their futures by focusing on 21st century skills Kaufmann, 2013).

21st century skills refer to the skill sets that individuals need to have and constantly develop in order to be competent and qualified in this time (Hamarat, 2019). Though there are various perspectives on what 21st century skills hold and how they are defined, all highlight what students can do with knowledge and how they use what they learn in real life (Larson & Miller, 2011). Therefore, the focus is no more on memorizing the information, which is now available in seconds thanks to information and communication technologies, but it is to find ways to use information in meaningful, productive, and creative ways.

21st century skills are not a new set of skills that we have discovered recently, however it would be accurate to say that they are increasingly important. The advances brought about by the ever evolving information and communication technologies change the needs of the individual and work life, and this change is reflected in the educational goals. These changing needs of individuals and the importance of integrating 21st century skills into education have been taken into consideration in different educational policies and reforms (Carnegie Council on Adolescent Development, 1989; Hamarat, 2019; Jackson & Davis, 2000).

Various countries have started to integrate 21st century skills into their educational systems at different times. The report titled "A Nation Prepared: Teachers

for the 21st Century” published in the USA in 1986 is one of the first reports emphasizing the need for these skills to come to the fore (Carnegie Forum on Education and the Economy, 1986). In many countries such as Finland, Belgium and Spain, which are among the OECD countries, educational policy changes were made between 1995 and 2005, emphasizing skills such as critical thinking, problem solving, creativity, communication and informational technologies (Hamarat, 2019). While most of these policy changes also emphasized teacher training, they were limited in terms of assessment (Hamarat, 2019).

Changes for the integration of 21st century skills on global scale are also reflected in educational policies and curriculum revisions in Turkey. In this context, the Turkish Qualifications Framework was created in 2016, which shows all the competences targeted at primary, secondary and higher education and other training programs and is designed to be compatible with the European Qualifications Framework (MYK, 2016). All of the key competencies identified in the framework are interrelated, and each focuses on skills such as critical thinking, creativity, and problem solving (MYK, 2016).

Competencies and skills listed in the Turkish Qualifications Framework report were also mentioned in the curriculum revision made in 2018, it was emphasized that competencies and skills were directly or indirectly related to the learning goals and objectives of subject areas (TTKB, 2017). The most highlighted skills in this framework were information and communication technology literacy and sociocultural awareness (TTKB, 2017), which are also mentioned in all the international frameworks analyzed in this study.

21st century skills like collaboration, creativity, communication and critical thinking were highlighted in the MEB 2023 Education Vision report published in 2018, the year the revised curriculum was in use. In order to support the development of these skills, the report emphasized that teacher graduate education opportunities and training on raising awareness and skill training related to skills should be organized (MEB, 2018). In the 2023 Education Vision report, the importance of integrating 21st

century skills into curricula is emphasized with the following words:

“In recent years, the educational approach, which is called "21 century skills" and is seen as an indispensable global norm today, imposes the understanding of the development and maturation of human beings in the light of what they can achieve in the material world, under the name of "acquiring soft skills" such as creativity, communication, teamwork, and critical thinking. In fact, this understanding is now a strategic conceptual framework imported to every corner of the world” (MEB, 2018, p. 14).

Although 21st century skills are emphasized in education policies and curricula, the development of these skills in students can only be achieved by integrating them into classroom practices. In line with this, teaching practices should be shaped according to 21st century skills without considering it as a separate subject but intertwining the skills across curricula (Larson & Miller, 2011). However, when the curricula of different disciplines in the education system are examined, it is observed that the development of teaching materials and methods aimed at gaining these skills to students is limited.

Within the scope of curricula designed by the Ministry of National Education, the most important courses that can support students to raise awareness of 21st century skills are Turkish and English courses with an emphasis on text reading and interpretation. When the curricula of two courses at both primary and secondary school levels are examined, it is seen that 21st century skills are very limitedly mentioned in learning outcomes, suggested materials and tasks, and assessment tools. Tasks such as group problem solving, communicative games, collaborative story writing were suggested, but no guidance was given on how teachers could teach these skills. At this point, although 21st century skills have reflections on education policies at macro level, it can be argued that the content and support for use of them in practice is quite limited.

The key role of teachers in curriculum implementation has been widely documented in research (Fullan, 2007; Liebermann & Pointer Mace, 2008). And to design materials and activities regarding 21st century skills and implement them in the classroom, teachers need support and professional development activities. 21st century qualifications pose pedagogical challenges for teachers in many ways. These difficulties can be listed as in their own abilities in these skills, in using various methods with students, understanding of subject content and interdisciplinary content orientation, developing technology-enhanced learning environments and ways of using a variety of assessment tools (Erstad & Voogt, 2018). Teaching 21st-century skills is a trend that may contradict conventional teaching approaches, but aims to provide practice of this essential skills set (Kaufmann, 2013). Higher education institutions that train teachers face similar challenges (Voogt & Pareja Roblin, 2012). At this point, it is important to increase the awareness of teachers in order to raise individuals competent in 21st century skills.

The world we live in changes quickly and drastically. The role of every stakeholder in education at this point is to prepare students for the society they will live in in a way that responds to this change. Teaching 21st century skills is a must and cannot be ignored (Larson & Miller, 2011; Care et al., 2018; Erstad & Voogt, 2018). Consequently, it is especially important for educators to see 21st century skills not as an additional subject but as skills that will be integrated into the entire curriculum (Larson & Miller, 2011).

2.5 21st Century Skills in English Language Teaching

Technological advancements and their repercussions are reflected in education and English language teaching. The teaching practices in language learning has been widely influenced by common trends in education. For years now, English language teaching has been affected by different trends such as blended learning, mobile learning, gamification, and glocalization. Only the ones that are accompanied by sound teaching approaches endure in time. Similarly, now 21st century skills necessitate

some drastic changes in language teaching practices.

English being an international language today is acknowledged as a prerequisite of success on a global scale. In many countries, English is a core subject at schools and preparatory subject at tertiary level where learners receive English medium instruction. Being so prevalent in almost all levels of education now, English language teaching plays a critical role in raising global citizens. The goal of English language teaching cannot be limited to simply learning rules of the language but it should be extended for helping learners become fully competent users of English who can also think critically, are socially conscientious and aware of world issues, engage in problem solving, use effective communication skills (Crystal, 2004; Cook, 2005), which shows how directly and closely related 21st century skills are to English language teaching.

For the English language teachers, it is important to decide how to integrate these skills in classroom teaching and design learning activities accordingly (Halvorsen, 2018). Language teaching approaches such as Communicative Language Teaching (CLT), Content and Language Integrated Learning (CLIL), Task Based Learning (TBL), Computer Assisted Language Learning (CALL) create learning environments in which students can practice most of the skills specified in 21st century skills frameworks. Especially the ones named as 4C in P21 framework, namely communication, collaboration, critical thinking, and creativity skills can be focused on and improved through various language learning activities.

As one of the ultimate goals of language learning is to acquire communicative competence in the target language, communication skills are already a part of English language teaching curricula. The students at all proficiency levels are required to work on their communication skills using the target language. As communicative competence calls for sociolinguistic, pragmatic, discourse and strategic competences in addition to linguistic knowledge of the learners, this part of language teaching readily serves to incorporate communication skills in the classroom. Communication aspects of language teaching can be best reflected in the Communicative Language

Teaching method through which 21st century themes like global awareness, civic, financial and environmental literacies can be covered in class. Allowing students to express their opinions and elaborate on the issues that matter on global scale both in spoken and written tasks rather than turning classroom interaction to old initiation-response-feedback paradigm and focusing on their accuracy only would be the most effective use of CLT in that sense (Hurstetal, 2018).

Collaboration is another 21st century skill that can be targeted in English language classrooms easily. Pair work and group work are already used in language classrooms frequently encouraging student-to-student interaction in addition to teacher-student interaction. Collaboration entails students participating in real and meaningful cooperative learning opportunities and generating new ideas together (Sharratt & Planche, 2016). As students engage with collaborative tasks which require them to make decisions, share responsibility and work together towards a common goal, they also need to find effective ways of communication, think critically and focus on problem solving, which highlights how intertwined the skills are. Collaborative tasks can be employed in various teaching methodologies like Communicative Language Teaching, Task-based learning and Content and Language Integrated Learning. Project-based learning, on the other hand, may create vast opportunities for collaboration as well as focusing on group work, productivity, and problem solving skills.

There are a variety of ways and strategies for incorporating critical thinking and problem solving skills into English language instruction. Hermann (2015) suggests learners need to interpret knowledge, analyze facts, make judgements about content presented in listening or reading texts, use reasoning and inferences. As critical thinking requires learners to look at the things from different perspectives and ask questions, make inquiries, it also contributes to their communication and collaboration with others making them more open minded. Use of open ended opinion questions, which increase the amount and quality of language production in language classrooms, is helpful for promoting critical thinking as well (Klynhout, 2018).

Since language is a creative system by its nature, creativity is not something that should be separately taught to language learners but an integral part of the language teaching process. Language users express their ideas, opinions, feelings, and perspectives in many different ways manipulating the language structures and words. Even learners with lower proficiency levels in English bring their capacity for creativity to the classroom. Language teachers' job at this point is to promote this creative potential and design learning activities accordingly. Creativity in language classrooms can be ensured by promoting self-esteem, giving the learners choice in activities, presenting a good model of creativity, using higher order thinking questions, and focusing on imagination and critical reflection, which makes the language learning process more engaging and motivating for the learners (Read, 2015). As all 21st century skills are interrelated, creativity has a strong bond with problem solving and critical thinking, for all of which learners are supposed to think out of the box, come up with original ideas, and make logical and meaningful decisions. Multicultural aspects of languages also trigger creativity because learners become exposed to different behaviors, ideas, lifestyles, concepts, and cultural elements in the target language and these multiple experiences make them think and act in novel ways (Tin, 2013).

ICT literacies are directly linked to language learning today as it moves learning processes beyond the physical classrooms with online and blended learning practices and use of digital tools and applications (Halvorsen, 2018). In addition to that, ICT enables language learners to connect with anyone around the world and have access to information presented in English online, contributing in their interaction skills and use of language in an authentic context with real people speaking the target language (Ghasemi & Hashemi, 2011). Moreover, Grabe and Grabe (2001) claims that judicious use of ICT provides room for active and student-centered learning practices where learners' creative thinking is also promoted. Use of technology in and outside of the language classrooms facilitates self-study skills of the learners and gives them more opportunities to use the language rather than leaving them to classroom interaction only.

In terms of productivity, English language classrooms can be seen as environments offering various options. Tasks and activities for productive language skills, namely speaking and writing call for language production instead of merely receiving input presented to learners (Spratt, Pulverness, & Williams, 2005; Harmer, 2007). In addition to teaching productive skills, productivity of language learners can be promoted through Project-based learning where the aim is to increase learners' active participation with projects used as learning and assessment tasks. PBL classrooms require learners plan, apply, reflect, and self-assess their learning through authentic problem solving tasks (Westwood, 2008), boosting their critical thinking, collaboration, and productivity skills at the same time.

There is a direct relationship between language learning and sociocultural skills. Language and culture are inseparable, that is why learning a language involves recognition of its culture as well (Baker, 2012). In line with this, Kumaravadivelu (2003) suggests that it is language teachers' responsibility to adopt cultural dimensions of language teaching in the classroom. Integration of culture into language teaching also conforms to the sociocultural perspective proposed by Vygotsky (1978) which views learning as a social and interactive process shaped by culture and language.

Designing materials and learning activities tackling 21st century themes and skills is also needed for integration of these skills in language classrooms. In addition to the approaches and strategies, it is seen that the resources for teaching English have been also diversified for 21st century skills. Developed in partnership with the BBC and Pearson, the "Wider World" portal and books emphasize using English to access a wider world of knowledge, skills and experience (Hasting & McKinlay 2017). The "Perspectives" educational content series by National Geographic, uses real-life stories and TED talks to motivate students to think critically and creatively. In addition to these, course books like English for 21st Century Skills (Mavridi & Xerri 2020) and 21st Century Skills in the ELT Classroom (Finnie 2020) focusing on teaching 21st century skills in ELT classes have also been published.

All in all, it is beyond question that 21st century skills and key themes are requisite in English language teaching. Skills such as collaboration, communication, creativity, critical thinking, ICT literacy, problem solving, productivity, and sociocultural skills are complemented in English classrooms and increases the quality of language education as suggested above. Language teaching approaches like CLT, CLIL, PBL, TBL can easily be employed to accommodate 21st century skills. Although there is a common agreement and understanding about relevance of 21st century skills, teaching implications are not fully reflected in the language classrooms yet. English language teachers should be supported by professional development activities focusing on raising their awareness on 21st century skills, developing activities, teaching materials, and assessment tools and implementing them in the classroom.

2.6 Assessment of 21st Century Skills

21st century skills are defined as the skills that students will need in order to be successful in their academic and work lives in this century. These skills can be acquired in formal and informal environments throughout life. For a strong foundation and better understanding and acquisition of these skills, it is important to integrate them into schools where the students can have an early start and opportunities to practice in meaningful contexts. Preparing future generations for rapidly changing needs and requirements of the day necessitates a transformation in educational systems. To equip students with all the knowledge, skills, attitudes and values of the 21st century requires a complex and holistic approach in which the schools, teachers, administrators, policy makers along with all other stakeholders should be involved and invested. 21st century skills, although named or described slightly differently across various frameworks, are all related to changing needs of learners today, which force educators to drift away from rote learning methodologies. The nature of what the learners need to prosper and succeed in life has changed as McCain and Jukes (2001) stated:

“In the past, when information had a much longer shelf life, learning was something that was done once in your youth. Then you were done with learning for life. In the good old days, what you learned in your youth prepared you for your single career. Today, learning has become a lifelong process. Given the rapidly changing nature of our world, people of all ages must constantly learn and relearn what they need to know. What they learned yesterday may no longer be valid in tomorrow’s world. Tomorrow, they will have to learn again because today’s information will already be out of date.” (p. 89)

Despite this drastic change, educational systems seem to fall behind with adjusting and stick to outdated teaching methodologies and materials where teachers still have the role of information transmitter in many parts of the world (OECD, 2009). However, learning 21st century skills demands 21st century teaching, which requires relevance, interdisciplinarity, focusing on thinking skills, promoting learning transfer, teaching how to learn, constructing new understandings, learning from and with others, effective use of technology and nourishing creativity (Saavedra & Opfer, 2012).

As with any other teaching processes, assessment should be an indispensable and integral component if 21st century skills are to be taught to students (Battelle for Kids, 2019; Marzano & Hefflebower, 2011; P21, 2008). Understanding how well students have mastered 21st century skills, what they lack, where they need more support, what creates challenges for them is only possible by measuring and assessing these skills.

Assessment prompts student learning. It helps students get an idea of their own learning progress and helps teachers see how effective they are in teaching their students the target skills. Assessment on a larger scale guides education policies while small scale assessment tools feed back into teaching practices and create space for improvement informing the students and teachers about what is going well or not. Therefore, it can be claimed that assessment improves curricula and education programs as well as supporting various teaching implementations in individual settings (Bialik, Martin, Mayo & Trilling, 2016).

The skills and competences we needed to succeed in life before the 2000s were a lot different than what is needed now. Easy access to the internet which provides all kinds of information quickly and in great amounts, has made us realize that what matters is not the information itself now but the ability to use that information in a meaningful and productive way in any aspect of our lives. As the learners are now engaged and challenged with these relatively new skills, it is inevitably urgent for the 21st century skills to be integrated into the curricula, and consequently taught and assessed (Geisinger, 2016). The transformation the education systems need to go through to encompass 21st century skills, demands finding new ways of assessment and designing different assessment tools (Krokfors et. al., 2010; Norrena et al., 2012). Geisinger (2016) stated that the assessment of 21st century skills has been highly popular in the field of educational measurement recently.

The assessment of 21st century skills includes but goes beyond the skills of reading, writing, expression, comprehension, interpretation, analysis and synthesis (Geisinger, 2016). In addition to these core skills existing in the present school curricula, teaching and assessment should also focus on cognitive, intrapersonal, interpersonal, and technical skills, which are highlighted by OECD (Ananiadou & Claro, 2009). We may establish more practical inferences about the skills and knowledge that students are anticipated to acquire using effective and well-prepared assessment instruments.

There are several challenges in terms of assessing 21st century skills. Scardamalia, Bransford, Kozma & Quellmalz (2012) states that many issues obstruct the pursuit of evidence-based assessments of twenty-first-century competencies. First, formal and informal learning contexts, as well as the types of assessments used within them, differ greatly. Second, domain-specific knowledge and abilities must be separated from the knowledge and skills regarding the media and technologies employed within a domain (Bennett et al., 2007; Quellmalz & Kozma, 2003). Third, there aren't many procedures for constructing 21st-century evaluations and documenting their technical quality (Quellmalz & Haertel, 2008). Fourth, evaluations must be consistent across educational levels (Quellmalz & Pellegrino, 2009; Pellegrino

et al., 2001). This coherence must begin with consensus on how to define twenty-first-century skills, how they are explained and categorized. In addition, the international, national, and classroom-level tests must be devised in a clear and consistent fashion so that assessment across levels will be fair, providing accurate inferences about student performances.

Identifying 21st century skills is the first and most crucial challenging step. As mentioned before, there are several frameworks defining and categorizing 21st century skills. Although some skills (e.g., collaboration, ICT literacy, communication) are included in all frameworks, there are also different skills that are not included in every framework or are defined within another construct. When it is aimed to develop a scale covering more than one skill, it is necessary to decide which skills should be included in this scale. In other words, the content of a measurement tool that aims to holistically measure 21st century skills should be supported by empirical evidence in terms of validity.

Even if it is decided what skills to include in the scale, reaching an agreement on the operational definitions of these skills yet creates another challenge. Constructs such as sex or age are basic constructs and easier to categorize and measure. On the other hand, some constructs such as creativity and problem solving are regarded as difficult to measure constructs as they are complex structures, attitudes, behaviors, or ways of acting and thinking and hard to define in a single way (Ercikan & Oliveri, 2016). There are significantly more obstacles in assessing such complex constructs than there are in measuring simpler constructs like factual knowledge or isolated skills (Ercikan & Oliveri, 2016; Shute & Wang, 2016).

Scales are multidisciplinary measurement tools that combine different constructs. Developing a scale means trying to measure phenomena known as constructs that are known to exist but hard to observe (DeVellis, 1991). As a result of this, in scale development studies, vaguely defined or badly measured constructs may be encountered. (Millet et al., 2009). When not addressed completely, these complexities can cause a variety of unwanted statistical outcomes such as validity

issues and biased estimates of relations between variables. This issue arising from the complex structure of multidisciplinary scales, appears as a challenge for statistical verification.

The fact that 21st century skills are not yet fully integrated into the curriculum is another challenge encountered in the assessment process. In order to effectively assess how well students have mastered these skills, teachers and educational policy makers should also adopt and be involved in these skills, which is only possible with an inclusive curriculum and designing skills-targeted instructions and materials. Although instructional methods and assessment materials are being developed to make these skills a part of the school curriculum in the education systems of some countries such as Finland (Ahonen, Häkkinen & Pöysä-Tarhonen, 2018), most of the countries are not there yet. Even though we cannot say that educators do not know these skills, they will remain as new skills to teachers as well unless they are implemented in the teaching practices. That is to say that to focus on these new skills, instruction must also shift drastically (Geisinger, 2016).

2.7 21st Century Skills Assessment Tools

All the assessment tools that aim to measure 21st century skills are not holistic and multidisciplinary assessment tools designed for measuring how well students have mastered all the skills. There are also studies on the assessment of individual skills such as problem solving, computer and information literacy, communication and collaboration (e.g. Ainley et al, 2016; Care, 2016; Lucas, 2016), which are among the 21st century skills. In some studies, only two or three of the 21st century skills were addressed (Herde et al., 2016; Soland, Hamilton & Stecher, 2013). The point to be considered in all measurement tools that measure general or subjective skills is that these tools do not require disciplinary content knowledge and skills (Geisinger, 2016). Disciplinary content knowledge and skills can create a construct-irrelevant variance effect in skill measurement and threaten the validity of the measurement.

When the studies on assessment of 21st century skills are examined, it is seen that different measurement tools that can be used for specific skills and overall assessment have been developed. Tang et al. (2022) in their study carried out in China, developed a scale called Twenty-First Century Skill Tool (TFCST) to measure the 21st century skills of primary school students in flipped EFL classes. It is aimed to measure students' collaboration, creation, self-regulation, interest, and engagement skills in the scale developed in a 5-point Likert-type format. It is stated that the biggest limitation of the scale, which is reported with its valid and reliable psychometric properties, is that although practicality and convenience is a priority, it is limited to only 5 skills and tests a very basic understanding of those skills. Developing the scale in the context of a flipped classroom for EFL teaching and testing it in this sample only is another limitation.

Kelley et al. (2019), developed a scale for measuring 21st century skills of high school students addressing only 4C skills mentioned in the P21 framework. This self-report instrument focuses on collaboration, communication, creativity, and critical thinking skills of students and intends to reflect students' perceptions about their own abilities. The scale consists of 30 items and explains 48% of the total variance for 21st century skills. In this study, researchers also highlighted that these 4C skills are highly interrelated causing ambiguity between the constructs of the scale.

Goksun and Kurt (2017) developed two Likert-type scales focused on 21st century skills in their study: 21st century learner skills use scale and 21st century teacher skills use scale. Although they received support from different studies for developing the scales, OECD resources were used for learners' use and ISTE standards were adopted for teachers' use. 21st century learner skills use scale consists of 31 items and contains four factors of cognitive skills, autonomous skills, collaboration and flexibility skills, and innovation skills. The 21st century teacher skills use scale consists of 27 items and is grouped under five factors of administrative skills, technological skills, confirmative skills, flexible teaching skills and productive skills. While the first scale explains 34% of the total variance, the second scale explains 40%. The reason why the explained variances are relatively low is stated as the preference

of the maximum likelihood method in statistical analysis in order to avoid overlapping items. This indicates that latent variables in complex constructs, like 21st century skills, are affected by many observed or latent variables.

Christensen and Kzenek (2017), on the other hand, adapted the Technology Proficiency Self-Assessment (TPSA) scale (Christensen & Knezek, 2000), which has been used for 15 years to assess teacher self-efficacy regarding the skills of integrating technology into classroom teaching and learning in their study and updated it with the name TPSA for 21st Century Learning (TPSA C-21), taking into account standards and changes targeted 21st century skills. In its new version, the scale consists of 34 items and measures six technology-oriented dimensions. TPSA C-21 is a large-scale assessment tool focused on technology proficiency specific to a single skill, unlike measurement tools that evaluate 21st century skills collectively. TPSA C-21 is presented as a worthy tool for pre-service and in-service teachers' professional development training.

Anagün et al., in 2016, developed a scale in Turkish aiming to measure pre-service teachers' perceptions of 21st century skills. This Likert-type scale consists of 42 items and three factors of learning and innovations skills, life and career skills, information, media and technology skills which are the categories of P21 framework. The scale has also been used in different studies (Cemaloglu et al. 2019; Kozikoğlu & Altunova, 2018). The fact that the scale is intended for pre-service teachers is also stated as a limitation by the researchers and it is recommended to adapt it to different contexts.

When the given measurement tools are examined, it is seen that there are gaps in terms of validating inclusivity and the construct structure of them. While some of the measurement tools that will enable large-scale assessment are limited in terms of the skills they focus on, others are limited in the context of variance and generalizability. The development and implementation of proficiency scales that can provide meaningful interpretations of performances in relation to several components is a fundamental challenge in constructing assessments of 21st century constructs

(Ercikan & Oliveri, 2016).

Another striking point is that most measurement tools have been developed based on only one framework such as P21, OECD, ISTE or ACTS. However, there are multiple frameworks with different focuses and are acknowledged universally. In terms of feasibility and practicality, it is hard to develop a scale that will cover all the skills in all frameworks. At this point, there is a need for a scale which will allow large-scale assessment to measure the common and most frequently defined skills in different frameworks, namely communication, collaboration, creativity, critical thinking, information and communication technology literacy, problem solving, productivity, and sociocultural skills. And this study aims to fill this gap in the literature.

CHAPTER 3

METHOD

The 21st century skills scale (21CS Scale) has been developed as a self-report measure to determine students' current level of the 21st century skills they will need in their academic and professional lives. This chapter introduces the research design and method of this study. Research design, scale development procedures, participants, data collection and data analysis procedures are discussed in this chapter, respectively.

3.1 Research Design

This scale development study was mainly designed as a mixed methods research. Combining methods in mixed methods research is difficult and there must be a specific reason to do so (Creswell & Clark, 2011). Scale development studies refer to the contexts in which qualitative data is used so that better and more comprehensive statements can be created in developing scale items (Bryman, 2006). This supports and justifies the use of mixed methods design in a study conducted for scale development.

There are various classifications of mixed method designs. The present study was framed according to the *instrument building model* listed under the discipline of education policies according to Creswell (1999)'s mixed methods design classifications. In the instrument building model, the aim of the researcher is to develop an instrument that appropriately reflects the views of the people who answer the items on the scale (Creswell, 1999). In this research model, the researcher collects data using an exploratory qualitative approach, analyzes it, and then utilizes it to create items on the scale (Creswell, 1999). The analysis begins by condensing qualitative observations and documentation to variables and specific questions for scale development. In the qualitative process, the text is reduced to a set of themes and

indicators are found for each theme (Creswell, 1994; Tesch, 1990). These themes might stand for the variables in the quantitative instrument and the indicators might be utilized to form specific items on the instrument.

In order to make the research manageable, make the application easy, and explain the procedure clearly, it is necessary to select the most appropriate research design for the research problem as well as the rationale for using a mixed methods approach. In the instrument building model, the researcher begins to work with an exploratory qualitative data collection and uses the data obtained at the end of the exploratory process to create a quantitative data collection tool. At this point, in order to provide a framework to guide the research process in line with the adopted research model, the research design in the study was defined as *exploratory sequential design* (Creswell & Clark, 2011), one of the major mixed methods designs.

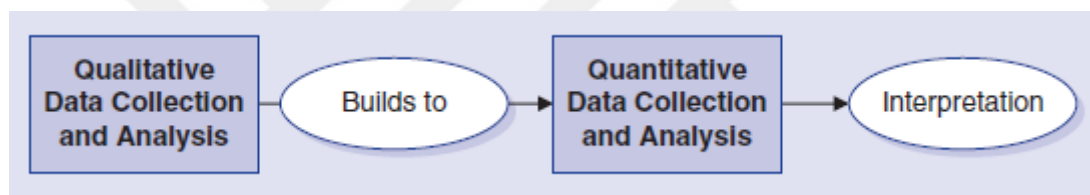


Figure 1. The exploratory sequential design (Creswell & Clark 2011, p. 69)

Exploratory sequential design used in this study is a two-phase sequential design. The researcher begins by exploring the subject qualitatively before moving on to quantitative research (Creswell & Clark, 2011). As seen in Figure 1, qualitative data is converted into quantitative analysis and then interpreted. In other words, qualitative data shapes scale items. This design is particularly useful when the researcher needs to develop and test a data collection tool and a tool for the same purpose does not already exist (Creswell, 1999; Creswell Feters & Ivankova, 2004). For this reason, this design has also been called instrument development design (Creswell et al., 2004) and quantitative follow-up design (Morgan, 1998).

3.2 Instrument Development

Scales are measurement tools that are typically used to capture a behavior, feeling or action that cannot be easily captured in a single variable or item (Boateng et al. 2018). In scale development processes, constructs are generally built from various items and variables to have a better understanding of what is to be measured. Scale development and validation is not a simple and straightforward endeavor; it is a complex process that requires following many steps. In this study aiming to develop a valid and reliable self-report instrument for measuring 21st century skills, the eight-step guideline of DeVellis (2003) for scale development was followed. These steps are: “(1) determine clearly what it is you want to measure, (2) generate an item pool, (3) determine the format for measurement, (4) have a completed initial item pool reviewed by experts, (5) consider the inclusion of validation items, (6) administer items to a development sample, (7) evaluate the items, and (8) optimize scale length” (DeVellis, 2003, p.60). Each step is explained in detail under the following sub-headings.

3.2.1 Identifying construct domains. The 21CS scale is constructed within the scope of eight skills. Upon examining six different international frameworks of 21st century skills, these skills were determined as the most essential skills that students should acquire to become successful in the 21st century and were used as construct domains in the scale. The construct domains determined for the 21CS are: collaboration, communication, creativity, critical thinking, information and communication technology (ICT) literacy, sociocultural skills, problem solving, and productivity. These eight skills were chosen according to how often they were mentioned across the frameworks because they differ in their approaches, place a higher emphasis on certain skills than others, and ignore some of the skills that other frameworks consider significant. Collaboration, communication, ICT literacy, and social and cultural skills were addressed in all of the frameworks; creativity, problem solving, critical thinking, and productivity were highlighted in most of them. The rest

of the skills such as learning to learn, risk taking, or planning were not included in this scale as a construct simply because they were highlighted in only one or a few frameworks and mostly considered as subcomponents of one of the eight skills in the list.

3.2.2 Generating an item pool. In the exploratory qualitative part of the study, the international frameworks were studied and compared, as a consequence, eight skills were identified as construct domains for the scale. These construct domains paved the way for the item generation stage. Upon careful review of literature, codes and themes were constituted for each construct domain and then those themes were used to form scale items. A total of 61 items were developed, ranging from 5 to 10 for each subscale. The initial item pool consisted of these items. One sample item and the number of generated items for each factor is given on Table 8.

Table 8

Sample items for domains in the 21CS Scale

Factors	# of Items	Sample Items
Collaboration	7	I get prepared for group work and fulfill my responsibilities.
Communication	8	I can effectively present what I have to say.
Creativity	8	I come up with interesting and original ideas.
Critical Thinking	7	I question the methods and strategies I should use when solving a problem.
ICT literacy	9	I search the internet effectively.
Social and cultural skills	11	I show empathy to understand how a person feels at any time.

Problem solving	7	I approach complex problems logically and systematically.
Productivity	4	I complete my work in the most efficient way.

While writing the items, it was taken into consideration that the language was appropriate for the participants who are students at universities with English medium instruction, terminological expressions that the participants might not be familiar with were avoided, and the items were formed in a way that they were short and easy to comprehend. It was also ensured that each item related to only one single construct domain and there were no overlaps or redundant repetitions across the item pool. To increase test score reliability, three reverse items worded in the opposite direction to that of other items were included in the item pool.

3.2.3 Determining the format for measurement. Different tools such as situational judgment tests, performance evaluations and scales can be used to measure 21st century skills (Kylonen, 2012; Soland, Hamilton, & Stecher, 2013). These measurement methods differ from each other in terms of providing detailed information, observing practical implementations, practicality, and scope. At this point, the aim of the study is to develop a scale that will determine how well students have mastered the 21st century skills that are frequently defined in different frameworks and to have an overall grasp of their existing skills. Although there are separate scales for some of the construct domains of this scale (e.g. collaboration, critical thinking), it was intended to create a more comprehensive and useful scale that would cover all target skills enabling them to be measured with a single tool. This scale will address different skill areas easily and at the same time, and make it possible to quickly collect data from a large number of participants in a short period.

The 5-point Likert-type scale is the most widely used scale type for self-report measures in scientific and academic studies. For this reason, a Likert type scale format that emphasizes self-reporting was employed. The rating options for the scale items were determined as “Never”, “Rarely”, “Sometimes”, “Often”, and “Always”. The

scale intends to allow researchers to work with larger participant groups and to provide statistical findings from a wider perspective.

3.2.4 Expert review. 61 items developed by the researcher were first reviewed by a language expert in terms of language clarity, coherence and cohesion. Then, to obtain construct validation in the scale development process, a language expert and a measurement and evaluation expert were asked to evaluate which construct domains these items were written for and to mark them on the given table. The operational definition for each construct domain was clearly written at the beginning of the scale to avoid ambiguity. In addition, experts were asked to code their assessments of item-category compatibility on a 3-point Likert-type scale (0: Inappropriate, 1: Slightly appropriate, 2: Appropriate) to ensure content validity regarding how relevant each item is to the marked domain.

After the reviews of the experts, it was seen that three items were coded as different categories by two experts. Two of these three items were removed from the item pool, and the wording of one item was revised and its category was changed from problem solving to critical thinking. In line with expert opinions, revisions on expressions and language use were made on four items to make the meaning clearer. Apart from revised and removed items, there was a high level of agreement between the experts, which supported the content validity of the items generated for the initial item pool of the scale.

After removing two items from the item pool, the consistency between the concordance scores coded by the experts on a 3-point Likert scale for the remaining 59 items was analyzed. If both experts scored the items exactly the same, an agreement was reported for this item. If the items were not scored the same by both experts, then a disagreement was reported. The percent agreement was derived by dividing the number of agreements by the total number of items. The interrater reliability was 0.93.

It may be intriguing to give percentage agreement to represent such data, however, due to chance, reliability in this case might be overestimated (Gwet, 2014).

It is convenient to calculate unweighted coefficients adjusting for chance agreement in order to evaluate agreement in this case. Cohen's Kappa, the percentage of agreement adjusted for chance, is the most frequently employed coefficient (Cohen, 1960). Cohen's Kappa value in this study was 0.68, which indicates substantial agreement (Cohen, 1968; Viera & Garrett, 2005).

3.2.5 Instrument testing. The items created for the 21CS scale were analyzed by performing exploratory and confirmatory factor analysis with data collected from two different sample groups in order to develop the scale and examine its psychometric properties after expert evaluation. In addition, the Cronbach alpha reliability coefficients of the scale and its sub-dimensions were calculated. In this process, some items were eliminated and the scale was finalized.

3.3 Participants

In the study, data were collected from two different sample groups for EFA and CFA analyses for which convenient sampling was preferred. As the scale was formed in English, to ensure the participants had sufficient proficiency in English, the participants were selected from students studying in the departments where the language of instruction was English or students studying in the English Language Teaching departments. All participants were informed about the study and about how to fill in the survey in the instructions given at the beginning of the survey form.

It is important to have a large sample size in factor analysis studies. There were more than 300 participants in both samples in the study. Comrey and Lee (1992) state that it is good to have at least 300 participants in factor analysis studies. Similarly, Tabachnik and Fidell (2001) argue that working with at least 300 participants would be a good number for analysis. Indeed, the size of this sample was large enough to provide information about the scale's factor structure and ensure statistical power in the results.

3.3.1 Participants for EFA. The data for EFA were collected in the fall semester of the 2020-2021 academic year in Turkey. Target participant group was determined as students who were registered to a program at a university offering English medium instruction to ensure that they all were proficient enough in English to fill the form out. A total of 346 participants from two universities took part in the study, 14 of which needed to be excluded from the data, which led to a final sample of $N = 332$ participants. The reasons why those participants were excluded from the analysis were their pre-maturely quitting the scale before completing all of the items and the inaccuracy that emerged in the reverse item analysis as an indication that they were not paying enough attention to the scale.

3.3.2 Participants for CFA. For confirmatory factor analysis, the participants of the study were determined as students studying at university departments which had English medium instruction. As the scale was developed in English, it was aimed to ensure that all participants had enough proficiency in English to be able to respond to the form without language barriers. To invite participants to respond to the form, they were reached through the instructors at different universities. During the preparation of the data for the model test, the data of two participants outside the range of -3 and +3 were determined as outliers according to the z-score calculation over the scale total scores. By excluding the data of these participants from the analysis, it was decided that the data of 282 participants were suitable for evaluation as the final sample of the CFA analysis. EFA is first used to extract factors from a dataset, while CFA is used to validate factors extracted from a separate dataset. Therefore, students who took part in the EFA analysis were not included in the CFA analysis.

In order to depict the profile of the participants in the CFA sample, which is the second statistical analysis phase of the study, some demographic information was requested from the participants. Demographic information of gender, age, level of education, faculty and university were collected from participants. The frequency of the participants according to their demographic information and the distribution rates

according to the groups are given in Table 9.

According to Table 9, 62.4% of the 282 participants in the study were female (n=176) and 36.2% were male (n= 102). 4 participants did not want to specify their gender. However, the highest participation was from the 18-21 age group with 64.2% (n=181). There were only 11 participants (3.9%) aged 26 and over. In terms of the level of education, it was seen that undergraduate students were 62.8 % (n=177), preparatory level was 26.6 % (n=75) and graduate students were 10.6 % (n=30). When the faculties of the participants were examined, participants registered to the faculty of education were the highest in number with 62.1% (n=175). Participants studying at Bahçeşehir University, where the research was conducted, were the highest in number with a rate of 64.9 (n=183).

Table 9

Demographics of CFA participants

		Frequency (n)	Percentage (%)
Gender	Female	176	62.4
	Male	102	36.2
	Prefer not to say	4	1.4
	Total	282	100
Age group	18-21	181	64.2
	22-25	90	31.9
	26-29	7	2.5
	30+	4	1.4
	Total	282	100
Level of Education	Prep School	75	26.6
	Undergraduate	177	62.8
	Graduate	30	10.6
	Total	282	100
Faculty of	Education	175	62.1
	Engineering	41	14.5
	Economic and Admin. Sciences	33	11.7
	Architecture	13	4.6

	Health Science & Medicine	10	3.5
	Communication	10	3.5
	Total	282	100
University	Bahçeşehir Uni.	183	64.9
	Yeditepe Uni.	32	11.3
	Boğaziçi Uni.	31	11
	FSM Uni.	16	5.7
	Other	20	7.1
	Total	282	100

3.4 Data Collection

Online data collection tools were used for both stages of the study. In this process, the scale items were entered into an online form and the survey link was sent to the participants. Online surveys are the most optimal data collection tools in terms of accessing broader data, making the obtained data ready for analysis in the easiest and fastest way and completing the data collection process quickly (Carbonaro & Bainbridge, 2000; Lefever, Dal & Matthíasdóttir, 2007). Considering that we live in the world of technology, surveys also provide an opportunity for participants to answer the scale online regardless of place and time, making the administration process more practical for the researcher.

One of the disadvantages of online surveys might be the difficulty of controlling the sample group (Evans & Mathur, 2005). In order to keep this under control, the survey was delivered to the participants through their instructors and was collected only from those groups. The participants were not asked to share the questionnaire with their friends or acquaintances so that data collection would not turn to a snowball sampling environment just to avoid disrupting the reliability of the target participant sample.

3.5 Data Analysis

The present study is a multiphase study comprising the development of a scale for measuring university students' 21st century skills, followed by validation of the scale. The scale development process consists of three main stages: 1) generating items, 2) reducing the number of items and checking the construct validity, content validity, and internal consistency of the scale, and 3) assessing the psychometric properties of the final version of the scale. In line with these three stages, the data analysis was completed in three steps within the exploratory sequential research design: 1) exploratory qualitative data analysis for item generation, 2) exploratory factor analysis (EFA), 3) confirmatory factor analysis (CFA). An overview of the procedure for developing the 21CS Scale is shown in Figure 2. Each step of the data analysis procedure is explained under separate headings.

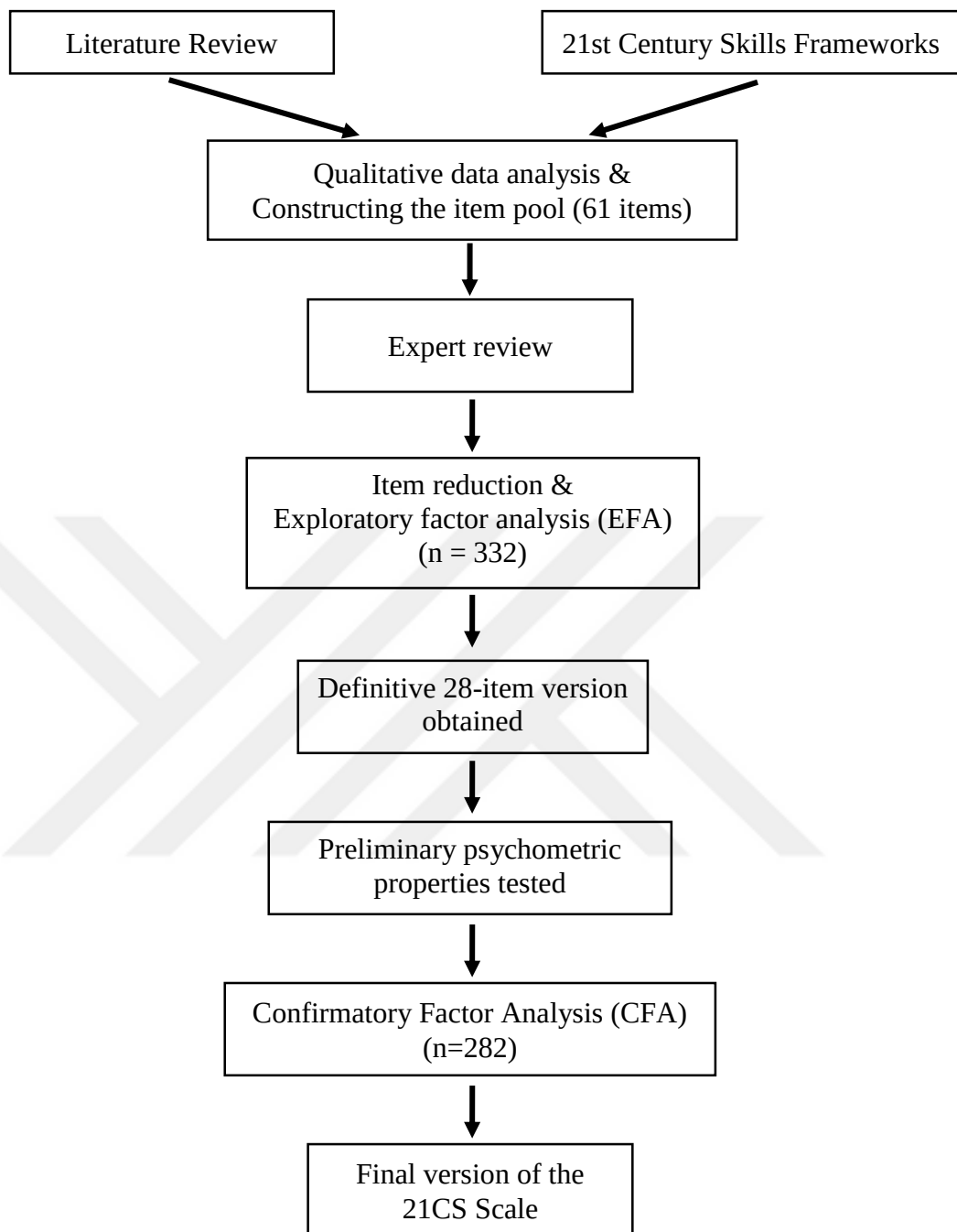


Figure 2. Overview of the 21CS Scale Development

3.5.1 Exploratory qualitative data analysis. For the qualitative data analysis of the study, document analysis was utilized. Document analysis, when employed to examine preceding texts, enables researchers to undertake studies that they may not be able to do any other way (Morgan, 2022). The 21CS Scale is based on the thorough examination and analysis of internationally acknowledged frameworks created by different organizations, rather than a single theoretical framework. After analyzing the frameworks, the skills to be used as domains in the scale were determined according to how common they were in the frameworks and by comparing and contrasting the definitions and different points of view within each framework. For this study, six different theoretical frameworks of 21st century skills were examined. Those frameworks were chosen because they are the most extensive and universal ones, have been utilized in various projects and recognized internationally. In addition to this analysis of frameworks, research studies on 21st century skills were also examined. As a result, eight skills were defined as the most fundamental skills that students should develop to become successful in the 21st century.

After defining the skills as domains, the codes and themes that are integral to each domain were listed with the literature review of the studies based on those skills. Using these codes and themes as indicators for the domain, the scale items were written for each relevant factor. The domains created after the document analysis, the indicators of the domains and a sample item written in accordance with the indicators are given in Table 10.

Table 10

Indicators and sample items for 21CS Scale domains

Domain	Indicators	Sample item
Collaboration	Responsibilities Working with others Group work Group dynamics	I get prepared for group work to fulfill my responsibilities.

	Obeying team rules Contribution Negotiation	
Communication	Exchanging messages Appropriate conduct Expressing ideas and emotions Nonverbal language Effective presentation of information Shared understanding Staying on topic to reach a goal	I can effectively present what I have to say.
Creativity	Imagination Thinking out of the box Finding extraordinary ideas Designing original and useful things	I come up with interesting and original ideas.
Critical thinking	Reasonable thinking Questioning Inferencing Making deductions Rethinking Making decisions	I think thoroughly before making a decision.
ICT literacy	Digital technologies Searching the internet Accessing information Creating digital content Online communication tools	I know where and how to access the information I need on the internet.
Problem solving	Creating solutions Using knowledge and skills Examining reasons Considering possible consequences Step by step planning	Before trying to solve a problem, I examine the reasons.
Productivity	Completing a task Finalizing an assignment/project Time management Setting goals Prioritizing Sticking to the plan	I complete my tasks timely, as planned.
Socio-cultural skills	Respecting others Valuing different opinions and beliefs	I show respect for others' opinions,

Empathy Open-mindedness Existing with others from different cultures in peace	beliefs, and values even if I do not share the same perspective.
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3.5.2 Quantitative data analysis. The quantitative data analysis part of the study consists of two phases: exploratory and confirmatory factor analysis. The procedures of these stages are explained in detail under separate sub-headings. For both factor analysis phases carried out in the study, data cleaning was done and the data set was checked and ensured to be suitable for analysis. First, the total scores of the participants were converted into z-scores, and outliers, z-scores of which were not between -3 and +3, were removed from the data set. Besides, data of participants with conflicting matches on reversed items and incomplete forms were also excluded from the analysis.

The first step in any factor analysis involves checking whether certain features of the data set meet the basic requirements for statistical analysis, which can be considered assumption testing. Sample size and the strength of the inter-correlations between items are the two main issues that need to be looked at while determining whether a data set is suitable for factor analysis (Pallant, 2010). These assumptions were checked before statistical analysis. Besides, in order to assess the factorability of the data, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity test to support the existence of factors within the data were computed.

3.5.2.1 Exploratory Factor Analysis (EFA). Factor analysis is a group of statistical methods that attempts to reveal factors in a structure underlying the observed data. During the factor analysis, it was checked whether the indicators collected under a certain factor were indicators of the theoretical structure and whether the factors corresponded to constructs (i.e., unobservable latent variables), which helps us to understand behavior (Green & Salkind, 2014). In order to examine the construct validity of the 21CS Scale, Exploratory Factor Analysis (EFA) was conducted with the initial item pool at first.

Exploratory Factor analysis (EFA) is a multivariate statistical technique that aims to reduce the data complexity by forming a smaller set of summarized variables and uncovering the theoretical structure of the phenomena (Tabachnick & Fidell, 2007). In EFA with a factor loading pattern, it is determined which indicators have the highest load on one factor and not on the others (Pallant, 2010). For the item analysis method, item-total correlation and comparison of lower and upper approximations were used. To determine the reliability of the scale, Cronbach's alpha internal consistency and split-half methods were conducted.

At the beginning of this study, the researcher supposed that the scale structure could have eight factors according to the literature and the theoretical model. After checking the initial results of the assumption tests and initial analysis to see whether the data were appropriate for further analysis, exploratory factor analysis was conducted to test the existence of eight factors. Later, psychometric properties of the remaining items and factors were checked. IBM SPSS v25 statistical analysis program was used for exploratory factor and reliability analyses.

3.5.2.2 Confirmatory Factor Analysis (CFA). In the last phase of the study, Confirmatory Factor Analysis (CFA) was used to validate how the factor structure of the final form of the 21CS Scale fits the hypothesized model (Thompson, 2004; Suhr, 2006). The IBM SPSS v25 software package program was used in most of the data analysis while the AMOS v25 software package program was employed in confirmatory factor analysis. After testing the construct validity with CFA, Cronbach's Alpha coefficient, item-total correlations for lower and upper groups, and t-test were performed using SPSS v25 to determine the reliability of the results obtained from the scale. Descriptive statistics and relevant demographic characteristics of the participants were also examined.

3.6 Ethical Considerations

The ethical principles were adhered to during this research, remaining an integral part of it throughout the whole process. The following steps were taken in order to ensure that ethical considerations were fully addressed in this study. Prior to the data collection, full consent of the participants was obtained upon informing them that participation in the study was on a voluntary basis. Participants were informed about the purpose of the study and confidentiality of the data and anonymity of the participants were ensured. Dignity of the participants was prioritized and they were not subjected to harm in any way.



CHAPTER 4

RESULTS

In this section, the results of statistical data analysis regarding the scale development process were reported. Analyses were grouped under two subtitles as Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In both stages, first the assumption tests regarding the compatibility of the data set were shared. Then, EFA and CFA findings were explained. Finally, the psychometric properties of the 21 CS scale were reported.

4.1 Exploratory Factor Analysis (EFA)

Before moving on with factor analysis, the assumption testing for the data set needs to be done to see whether the data set meets the requirements for statistical analysis. To ensure the data set was convenient for factor analysis, the sample size and inter-correlations between the items need to be checked (Pallant, 2010). There are different recommendations concerning the sample size in factor analysis. Gorsuch (1983) recommended the minimum ratio as five participants for each item (5:1) to perform Exploratory Factor Analysis (EFA). Moreover, Tabachnick and Fidell (2007) stated that having at least 300 participants is sufficient for factor analysis. In this context, the number of participants (n=332) was deemed sufficient to perform factor analysis.

Table 11

Results of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.92
Bartlett's Test of Sphericity	Approx. Chi-Square	9326.91
	df	1830
	sig.	.000

In order to assess the factorability of the data, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was computed and Bartlett's Test of Sphericity test to support the existence of factors within the data was applied. As seen in Table 1, KMO coefficient of sampling adequacy was found to be .92 and Bartlett's test of Sphericity was significant ($\chi^2=9326.91$, $df=1830$, $p<.000$). The results indicated that the data used can be judged as factorable since the KMO value is greater than .60, and Bartlett's test of Sphericity is significant (Huck, 2012).

Factor analysis requires employing a group of statistical methods to identify factors in a structure underlying the observed data. The factor analysis determines if the indicators gathered under a given factor are indications of the theoretical structure, and whether the factors correspond to constructs (i.e., unobservable latent variables) of a theory that let us understand behavior (Green & Salkind, 2014). According to the literature and the theoretical model, the scale structure was predicted to contain eight factors at the beginning of the study. At this stage, factor analysis was used to determine whether or not eight factors existed in the structure.

The results of the exploratory factor analysis (EFA) indicated that the data supported the proposed eight-factor solution for 28 of the original 61 items that were retained in the eight factor structure. There are four items in the four factors: productivity, information and communication technology (ICT) literacy, sociocultural skills and creativity factors; and three items in the other four factors: communication, critical thinking, problem solving and collaboration. The final factor pattern with the corresponding items for each factor is shown in Table 12.

Table 12

Exploratory Factor Analysis: Factor pattern for eight factor solution

Item no	Item	F1	F2	F3	F4	F5	F6	F7	F8
PRO-2	I do my best both in quality and quantity by using my time effectively.	.78							
PRO-3	I complete my tasks timely, as planned.	.76							
PRO-4	I complete my work in the most efficient way.	.73							

PRO-1	I set my priorities correctly and complete my work without getting stuck on unnecessary details.	.63
ICT-8	I can create and present content on office programs like Word, Excel, PowerPoint etc.	.78
ICT-7	I search the internet effectively.	.74
ICT-5	I use electronic mail, messaging and social media effectively.	.73
ICT-9	I know where and how to access the information I need on the internet.	.61
SCS-4	I show respect for others' opinions, beliefs and values even if I do not share the same perspective.	.85
SCS-5	I approach different ideas and values open-mindedly.	.83
SCS-10	I treat the people around me politely, regardless of their age or status.	.69
SCS-11	I show empathy to understand how a person feels at any time.	.64
CREA-6	I design new things when I am on my own.	.81
CREA-4	I am interested in designing and creating things of my own.	.76
CREA-2	I come up with interesting and original ideas.	.68
CREA-8	Others consider me as someone with creative ideas.	.67
COM-7	I can effectively present what I have to say.	.78
COM-2	I can express myself precisely.	.69
COM-6	I use my body language (hand gestures, facial expressions etc.) effectively in a conversation.	.62
CT-2	I think thoroughly before making a decision.	.74
CT-1	I rethink the solutions offered to me and try to find better ones.	.68
CT-5	I question the methods and strategies I should use when solving a problem.	.55
COL-6	I comply with team rules and requirements during planning and decision making.	.69
COL-7	I help my teammates when necessary.	.66
COL-2	I get prepared for group work to fulfill my responsibilities.	.43
PS-7	Before trying to solve a problem, I examine the reasons.	.65
PS-6	In a difficult situation, I get to the root of the problem for the solution.	.58
PS-5	I approach complex problems logically and systematically.	.45

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

To determine scale items, only items that had factor loadings greater than .40 were retained in the final structure of the scale. Cross-loaded items with a factor load difference of less than 0.15 were excluded from the analysis (Dilorio, 2005). According to the Kaiser-Guttman criterion for deciding on the number of factors, seven factors with eigenvalues greater than 1 were selected. The eigenvalues for these factors ranged from 8.73 to 1.02. Moreover, the eigenvalue for the eight factor (.86) was close to 1 and had a close explained variance with the nearest one. Thus, the eighth factor, which is problem solving, was added to the final version of the scale because the calculated variance explained (3.08%) was very close to the nearest factor, which is collaboration (3.63%). The eight factors totally accounted for 66.2% of the variance. Table 13 below shows the number of items, eigenvalues, percentages of explained variance of the eight factors.

Table 13

Eigenvalues and explained variance for each factor

	# of items	Eigenvalues	Variance (%)	Cumulative variance (%)
Productivity	4	8.73	31.18	31.18
ICT literacy	4	2.20	7.86	39.04
Sociocultural skills	4	1.73	6.16	45.20
Creativity	4	1.47	5.25	50.45
Communication	3	1.37	4.89	55.34
Critical thinking	3	1.16	4.15	59.50
Collaboration	3	1.02	3.63	63.13
Problem solving	3	.86	3.08	66.21

To support the decision to keep the eighth factor in the scale, the parallel analysis suggested by Horn (1965) was used. Parallel analysis helps determine the number of factors to retain in a scale, as an additional strategy to Kaiser-Guttman criterion. Huck (2012) suggests that a combination of strategies must be employed while deciding on the number factors to be retained and Pallant (2010) argues that for researchers working in the education field it is highly important and expected to use and report the parallel analysis in scale development studies.

The parallel analysis approach creates a number of random matrices with dimensions that match the original data and analyses the scree plots produced by their correlation matrices. The data that is generated by Monte Carlo simulation is normally distributed. Furthermore, the original data is re-sampled using bootstrap, and the scree plots are evaluated once again. A combination of re-sampled and simulated data is used in this approach (Çokluk & Koçak, 2016; Huck, 2012; Pallant, 2010). For each generated dataset, the eigenvalues of the correlation matrices are determined. The eigenvalues of the matching factors are averaged and shown against their factor indices. The curve for the eigenvalues calculated from the original data is also shown in Figure 3.

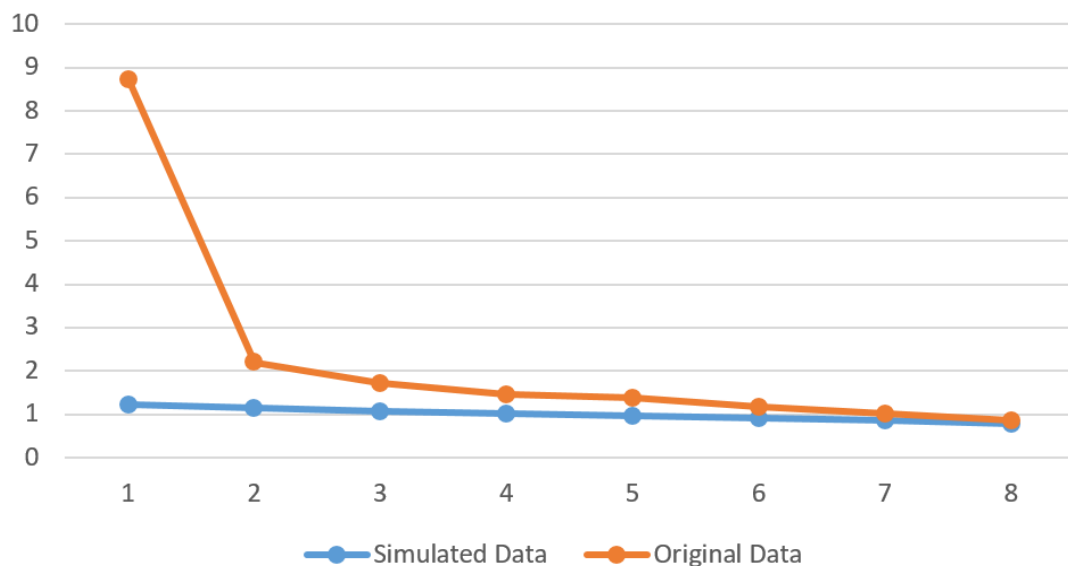


Figure 3 The scree plot of the original data and the simulated data

Table 14 displays which of the actual data's eigenvalues are greater than or equal to those from the simulated data. Based on the confirming results of parallel analysis, all eight factors were decided to be retained in the 21CS scale.

Table 14

Eigenvalues from PCA and criterion values from parallel analysis

Factor number	Actual eigenvalue from PAF	Criterion value from parallel analysis	Decision
1	1.2269	8.730	Accept
2	1.1405	2.202	Accept
3	1.0753	1.725	Accept
4	1.0253	1.469	Accept
5	0.9723	1.370	Accept
6	0.9186	1.163	Accept
7	0.8603	1.017	Accept
8	0.7808	0.862	Accept

Accepted for all factors

As reported in Table 15, the results show that there are statistically significant correlations among all eight factors ranging from .20 to .59. While the highest correlation (.59) was calculated between critical thinking and problem solving, the lowest correlation was between creativity and sociocultural skills. Although some correlations were lower than expected, statistical significant relationships among the factors were considered to provide evidence of the inter-connection between the domains of 21CS Scale.

Table 15

Correlation matrix of 21CS Scale factors

	COL	COM	CREA	CT	ICT	PRO	PS	SCS
COL	1	.52	.33	.48	.50	.53	.41	.43
COM		1	.38	.47	.50	.48	.52	.31
CREA			1	.36	.34	.34	.39	.20
CT				1	.41	.42	.59	.38
ICT					1	.45	.51	.31
PRO						1	.47	.35
PS							1	.37
SCS								1

All values are significant at .01 level.

COL: collaboration, COM: communication, CREA: creativity, CT: critical thinking, ICT: communication technology literacy, PRO: Productivity, PS: problem solving, SCS: sociocultural skills

The psychometric properties of the factors are provided in Table 15. The eight factors in the 21CS Scale demonstrated satisfactory internal consistency and reliability with Cronbach's alpha coefficients ranging from .67 - .82. Cronbach's alpha value for the whole scale was calculated as .91, which is also satisfactory. The mean, standard deviation and standard error values are also reported in Table 16.

Table 16

Psychometric properties of eight factors

	Cronbach's alpha α	$\bar{X}$	SD	SD $_{\bar{x}}$
Collaboration	.73	12.99	1.95	.11
Communication	.75	11.77	2.25	.12
Creativity	.78	14.94	2.99	.16
Critical thinking	.67	12.22	1.95	.11
ICT literacy	.80	16.82	2.69	.15
Productivity	.80	15.16	3.07	.17
Problem solving	.71	11.80	1.94	.11
Sociocultural skills	.82	17.75	2.54	.14
The 21Cs Scale	.91	113.45	13.48	.74

The analysis was followed by confirmatory factor analysis (CFA) to confirm the result gained from the EFA.

4.2 Confirmatory Factor Analysis (CFA)

After Exploratory Factor Analysis (EFA), for the second phase of data analysis Confirmatory Factor Analysis (CFA) was conducted on the 28 items of the 21CS Scale, specifying the eight-factor structure derived through EFA. As in EFA, the first step in CFA involves assumption testing to check whether the data set meets the requirements for statistical analysis. At this stage, first the data cleaning was done to eliminate incomplete or inaccurate responses and the data set was assured to be convenient for analysis. First, the total scores of the participants were converted into

z-scores, and outliers, z-scores of which were not between -3 and +3, were removed from the data set. Finally, CFA steps were performed with data obtained from 282 participants. To ensure the data set was suitable for factor analysis, the sample size and intercorrelations between the items need to be checked (Pallant, 2010). It is emphasized that the minimum number of participants for CFA should be at least 200 (Kline, 2015; Boomsma and Hoogland, 2001). In this regard, a total of 282 participants were considered a sufficient number for CFA.

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was calculated and Bartlett's Test of Sphericity test to support the existence of factors within the data was used to assess the data factorability. As seen in Table 17, KMO coefficient of sampling adequacy was found .90 and Bartlett's test of Sphericity was significant ($\chi^2 = 3500.92$, $df=378$, $p<.000$). When the correlation matrix table was examined, it was seen that most of the inter-item correlation values are 0.3 or above, which shows that factor analysis can be performed. (Pallant, 2010). The results suggested that the data set is suitable for factor analysis since the KMO value is greater than .60, and Bartlett's test of Sphericity is significant (Huck, 2012; Tabachnick & Fidell, 2007).

Table 17

Results of KMO and Bartlett's Test for CFA

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.90
Bartlett's Test of Sphericity	Approx. Chi-Square	3500.92
	df	378
	sig.	.000

The maximum likelihood method was used to calculate the model's parameters for the CFA (Jöreskog, 1969). The fit statistics and modification indices were used to test the model. The validity of the scale is determined by interpreting the fit indices and factor loadings in light of the results of confirmatory factor analysis. (Thompson, 2004).

For evaluating overall fit of the model, the Chi-Square is the most traditional measure displaying how much the sample and fitted covariance matrices are discrepant from each other (Hu & Bentler, 1999). The Chi-Square statistic is frequently called as a “badness of fit” (Kline, 2015) or a “lack of fit” (Mulaik et al, 1989) measure, because it is expected for a good model fit to have an insignificant result at a 0.05 threshold (Barrett, 2007).

While the Chi-Squared test continues to be popular as a fit statistic, it has a number of serious drawbacks. The chi-square statistics are sample size dependent. Large samples, like with most modeling studies, lead to unrealistically large chi-square values, in most cases causing fit problems (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1993). As a result, in large-sample studies, the value of chi-square divided by degrees of freedom (χ^2/df) is taken into account (Byrne, 2001). If the (χ^2/df) value falls between 1 and 3, it indicates an acceptable fit between the hypothetical model and the sample data (Carmines & McIver, 1981). Various fit statistics, in addition to the (χ^2/df) value, were considered during the analysis.

The hypothesized model created for confirmatory factor analysis consists of latent and observed variables (Figure 4). At this point, the skills (e.g., collaboration, communication, critical thinking, etc.) defined within the factorial structure of the scale as a result of the EFA analysis were defined as latent variables and shown in circles on the model. Latent variables in research studies are complex constructs. The term "latent variable" refers to a variable that cannot be observed. The presence of latent variables, on the other hand, can be identified through their impact on observable variables (Kline, 2015; Byrne, 2001). The observed variables that are indicators of these latent variables (factors) are the scale items and shown in rectangles on the model. Indicators have an error variable represented by "e"s and is linked to them by one-headed arrows. Error variables, measurement errors in other words, show not just random variations in the score of the variable because of measurement error, but also other variables not included in the model but could affect scores (Brown, 2015; Byrne, 1998).

Modification indices have an important role in the evaluation of model fit according to the results of confirmatory factor analysis. When a fixed or constrained parameter is estimated, an approximation of how much the Chi-square should decrease from the total model is determined with modification indices (Brown, 2015). When there is a high modification index between two items, this suggests that inserting a path between them should increase the overall fit of the model. Creating this new path is plausible both statistically and theoretically, because a new path must be relevant within the theoretical framework in order to be included in the model (Pai et al., 2007).

After the first run of the analysis, the items “Crea 4: I am interested in designing and creating things of my own. and “Crea-6: I design new things when I am on my own” indicated a high modification index. The high modification index indicates that these two substances may be related to each other in scope. When looked closely, it was seen that these two items were both written from the perspective of ‘designing things’ and they were semantically close to each other. For this reason, a correlation was added between Crea-4 and Crea-6 on the path diagram, which is statistically appropriate. CFA was performed again with this modification.

A series of goodness of fit indices were computed to check on the adequacy of the fitted model. These fit indices consisted Chi-square/Degrees of freedom (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR), and Comparative Fit Index (CFI) or TLI (Prudon, 2014). Figure 4 illustrates the confirmatory factor model of the scale by showing the relation of each item with its factor.

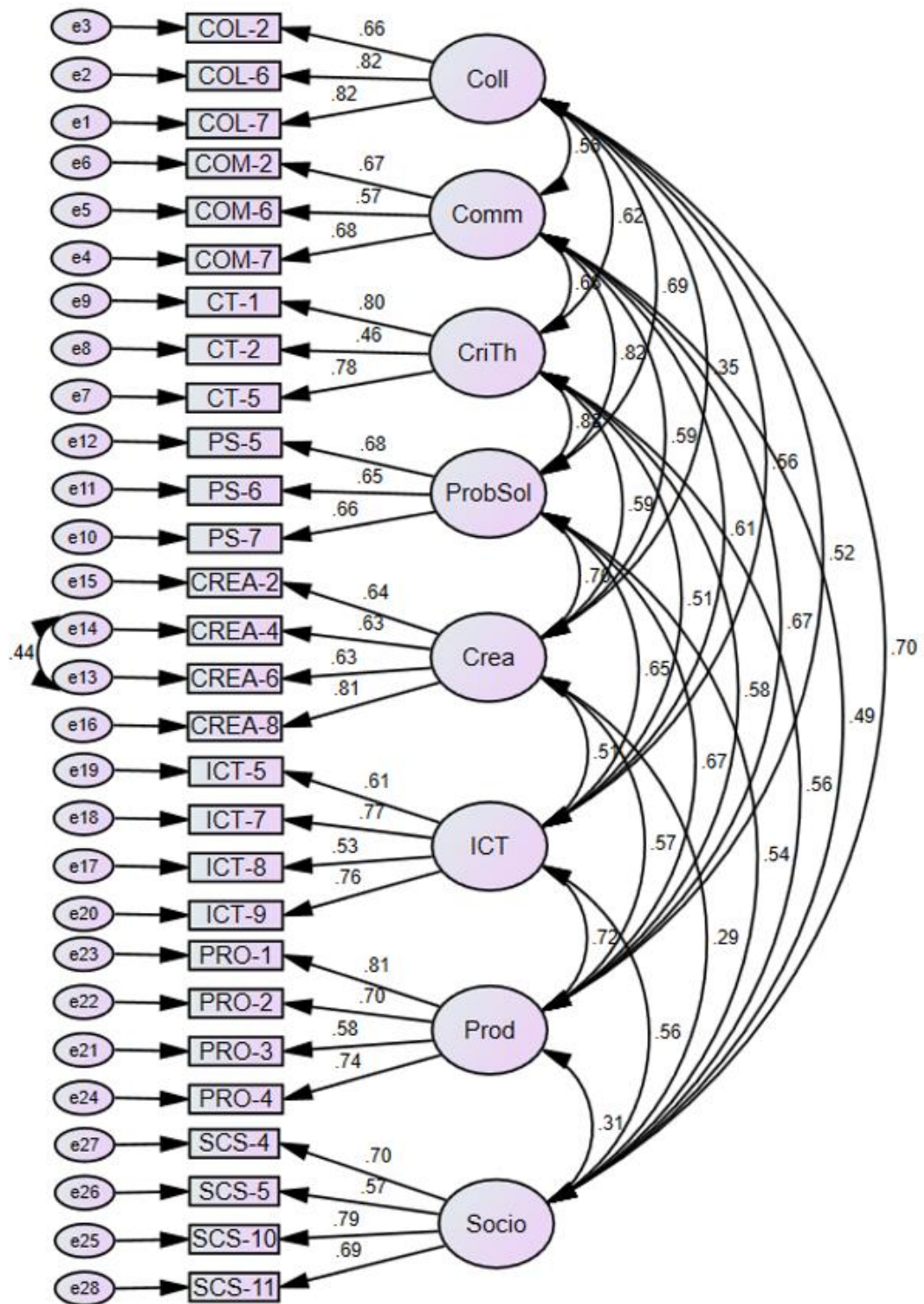


Figure 4 Confirmatory Factor Model of 21CS Scale

Conforming to the output data for CFA of the model shown in Figure 4, CMIN/DF (χ^2/df) value and other goodness of fit indices were explained respectively. In this study, the values of χ^2 (641,188) and df (321), χ^2/df was found to be 1.99. This value being under 2 shows that there is an acceptable ratio for this statistics (Kline, 1998, Tabachnick and Fidell, 2007).

The RMSEA value of.060 was established in this research as another important criterion for determining how well the model fits. According to Hoe (2008), RMSEA values less than.05 suggest good fit, whereas values up to.08 suggest reasonable fit. In this case, the RMSEA value signified a reasonably good fit of the model.

As another indices of goodness of fit for CFA, CFI was calculated and found as .91. CFI is a fit index which compares the model's anticipated covariance matrix to the covariance matrix of the null hypothesis model (Bentler, 1990). Bentler (1990) proposed that a CFI value ranges from 0 to 1, with bigger values suggesting better fit, and are less affected by sample size. There are differences in the values accepted as good fit criteria. According to Hu and Bentler (1999), the criterion for a good fit is $CFI \geq .95$, while Kline (2015) argues that $GFI > 0.90$ indicates good fit. The value of .91 obtained in the CFA of this study indicates a good fit of the model according to Kline (2015).

Finally, SRMR was calculated as a complement to the chi-square test and found to be 0.06. Hu and Bentler (1999) recommend an SRMR cut-off value of.08 for a good fit, with 0 indicating perfect fit.

Table 18

The Fit indices of Confirmatory Factor Analysis

χ^2/df (≤ 3)	CFI ($.90 \leq$)	SRMR ($\leq .08$)	RMSEA ($< .08$)
1.99	.92	.06	.068

The results of the confirmatory factor analysis provide evidence to support the construct validity of the 21CS Scale. As Table 18 above demonstrates, all the fit indices indicate good fit of the data, resulting in a valid 21CS Scale. The final version of the scale was confirmed with eight factors: collaboration, communication, creativity, critical thinking, information and communications technology literacy, problem solving, productivity, and sociocultural skills. As seen in Figure 4, the standardized path coefficients of eight factors ranging from .46 and .82 are all acceptable and significant ($p < .01$).

Table 19

Correlation matrix of 21CS Scale factors, means and standard deviations

	COL	COM	CREA	CT	PRO	PS	SCS	ICT	($\bar{X}$)	SD
COL	1								4.37	.67
COM	.56	1							3.89	.71
CREA	.36	.59	1						3.72	.82
CT	.62	.66	.59	1					4.05	.70
PRO	.52	.67	.58	.58	1				4.09	.69
PS	.69	.82	.70	.88	.67	1			3.74	.79
SCS	.70	.49	.29	.56	.31	.54	1		3.98	.69
ICT	.56	.61	.51	.51	.72	.65	.56	1	4.38	.61
21CS	.71	.72	.66	.74	.75	.78	.65	.73		

All values are significant at .01 level.

COL: collaboration, COM: communication, CREA: creativity, CT: critical thinking, ICT: information and communications technology literacy, PRO: Productivity, PS: problem solving, SCS: sociocultural skills, 21CS: 21st Century Skills Scale

The Pearson correlation coefficients between the eight factors derived from the CFA model and the 21CS Scale are given in Table 19. According to the correlation coefficients among the factors, the lowest correlation value was between creativity and socio-cultural skills ($r = .29$), and the highest value was between problem solving and critical thinking ($r = .88$). Correlation coefficients between .00 and .30 indicate a weak relationship between the subscales, while those between .30 and .70 indicate a

moderate relationship, and coefficients between .70 and 1.00 indicate a strong relationship (Buyukozturk, 2007). Examining zero order correlations, referring to the correlation between two variables without considering the influence of any other factors, reveals that the eight factors are mostly moderately correlated with each other. In a confirmatory factor analysis, singularity may become a concern when factors intended to assess independent aspects of a construct have strong inter-correlations. High inter-correlations suggest that the subscales may be measuring the same construct. According to the statistical results, although the correlation coefficient calculated between problem solving and critical thinking may seem to cause a concern for singularity, there is no singularity problem for CFA in all other values. The high correlation of problem solving and critical thinking which can be explained with the support of literature, is also discussed in the discussion section.

Besides, the correlation matrix should have correlations of $r = .3$ at least or above to be regarded as adequate for factor analysis. (Pallant, 2010). As all the correlation values given in Table 19 are either 3 or above, the dataset satisfied the assumptions for factorability. According to the correlation coefficients calculated between the factors and the 21CS Scale, almost all of the correlation coefficients were close to the .70 value, which is the moderate and high correlation distinction suggested by Büyüköztürk (2012). At this point, it was reported that the lowest correlation coefficient for 21CS Scale was associated with creativity ($r=.66$), and the highest correlation coefficient was associated with problem solving ($r=.78$) subscales.

In addition to the correlation values, the mean and standard deviation scores of the subscales are shown in Table 19. The 21CS scale is a 5-point Likert type scale and the item codes are ranged between 1 to 5. Since the number of questions in the subscales varies between 3 and 4, the average calculations for the subscales are standardized in the range of 1-5 points, which is also the scale coding score. Higher scores indicate that participants think they have more control over the relevant skill. According to the mean scores, the lowest average score is obtained from creativity ($\bar{X}=3.98$, $SD=.69$), and the highest average score is obtained from the collaboration subscale ($\bar{X}=4.37$, $SD=.67$). In other words, the participants see themselves as more

competent in collaboration skills and they state that they are more limited in creativity skills compared to other skills. At this point, the fact that the participants scored an average of 4-5 points in all skills means that they generally consider themselves sufficient in all eight sub-skills.

4.3 Results of Item Analysis

In order to test item effectiveness and to support the construct validity of the scale, it was examined whether there was a difference in item scores between the lower and upper groups. For this purpose, the total scores of the participants in the data set were ranked from the highest to the lowest, and upper and lower success groups were formed according to the 27% segment. The middle segment of 46% was excluded from the analysis in order to differentiate between groups. The percentage of 27 is used because the upper and lower groups of 27%, from the extreme points of the normal distribution of criterion scores, are suggested to be optimal for analyzing and examining test items (Kelley, 1939). So, a total of 76 participants were included in the upper and lower score groups. Independent samples t-test was used to determine whether there was a statistically significant difference between the scores of the upper and lower groups defined for each item in the scale. According to the independent samples t-test results, the lower and upper group item scores of all items differed by 0.01 statistical significance. The t-score statistics and mean differences are given in Table 20.

Table 20

Item analysis results

	Item statistics		Upper-lower group comparison	
	$\bar{x}$	SD	t-test statistics *	Mean difference
COL-2	4.26	.86	12.09	1.38
COL-6	4.40	.75	9.67	1.03
COL-7	4.44	.77	9.91	1.11
COM-2	3.84	.87	9.48	1.22

COM-6	4.10	.94	10.29	1.36
COM-7	3.72	.95	9.08	1.29
CT-1	4.10	.84	11.57	1.30
CT-2	4.03	.93	7.93	1.08
CT-5	4.02	.89	11.77	1.38
PS-5	3.96	.88	11.68	1.36
PS-6	3.89	.90	11.96	1.38
PS-7	4.09	.85	9.49	1.17
ICT-5	4.23	.94	7.79	1.07
ICT-7	4.17	.84	10.34	1.26
ICT-8	3.98	1.02	7.79	1.15
ICT-9	3.98	.83	9.72	1.21
PRO-1	3.69	1.01	12.88	1.69
PRO-2	3.56	1.03	11.65	1.55
PRO-3	3.74	1.00	9.73	1.32
PRO-4	3.95	.96	15.05	1.66
SCS-4	4.46	.74	7.09	.84
SCS-5	4.29	.81	8.30	1.01
SCS-10	4.45	.80	7.35	.95
SCS-11	4.32	.79	7.82	.97
CREA-2	3.66	.92	8.53	1.11
CREA-4	3.85	1.09	8.12	1.32
CREA-6	3.56	1.12	8.74	1.38
CREA-8	3.80	.97	10.73	1.39

*The values are significant at p=.01 level.

In addition to the comparison of the item scores between the lower and upper groups, the mean ($\bar{X}$) and standard deviation (SD) of each item are also given in Table 20. The item with the highest average score is “SCS 10: I treat the people around me politely, regardless of their age or status” ($\bar{X}$ =4.45, SD=.80), while the item with the lowest score average is “PRO 2: I do my best both in quality and quantity by using my time effectively” ($\bar{X}$ =3.56, SD=1.03).

4.4 Results of Reliability Analysis

The degree to which a scale is free of random error is defined by its reliability and internal consistency is a key measure that determines if the scale's items are all measuring the same underlying aspect (Pallant, 2010). This statistic represents the average correlation between all items of the scale. Cronbach's coefficient alpha is the most commonly used statistic to determine internal consistency. Cronbach's alpha for the 21CS Scale was calculated to be .92, as shown in Table 21, which is considered high because values above .80 are recommended (Pallant, 2010).

Table 21

Reliability statistics for 21 CS Scale

Cronbach's Alpha	Cronbach's Alpha based on standardized items	N of items
.920	.922	28

To test the reliability of the scores obtained from the subscales, the Cronbach's coefficient alpha of each subscale was calculated separately (Table 22). The Cronbach's alpha coefficients of the subscales have values between .665 and .803, for which Nunnally (1994) suggests .70 as minimum. Since Cronbach's alpha values are related to the amount of items on the scale, and when the scale has a limited number of items (fewer than 10), Cronbach's alpha values can be relatively low (Pallant, 2010). From this point of view, the reliability coefficients obtained indicate acceptable reliability.

Table 22

Reliability statistics for the subscales

	Cronbach's Alpha	N of items
Collaboration	.798	3
Communication	.665	3
Creativity	.803	4
Critical Thinking	.689	3
Productivity	.804	4
Problem Solving	.702	3
Sociocultural Skills	.778	4
Information and communication technology literacy	.750	4

Corrected Item-Total Correlation values show how much each item correlates with the total score, and low values (less than .30) imply that the item is measuring something other than what the scale intends to measure (Pallant, 2010). The corrected item-total correlation values must be at least .40, according to Gliem J. and Gliem R. (2003). Table 23 shows that all of the correlation coefficients for items and total are above .40, implying a strong relation between items.

Cronbach's Alpha if item deleted values show the change that removing any item from the scale will make in the Cronbach's alpha value of the scale. When the Cronbach's alpha if item deleted values of the items in Table 23 were compared with the overall Cronbach's alpha value of the scale (.92), removing any item from the scale was not considered. Therefore, it can be clearly claimed the scale has good internal consistency.

Table 23

Item-Total Statistics

	Corrected Item-Total Correlation	Cronbach's Alpha if Item deleted
COL-2	.569	.916
COL-6	.549	.917
COL-7	.581	.916
COM-2	.516	.917
COM-6	.512	.917
COM-7	.512	.917
CREA-2	.450	.918
CREA-4	.455	.919
CREA-6	.434	.919
CREA-8	.558	.917
CT-1	.610	.916
CT-2	.410	.919
CT-5	.606	.916
ICT-5	.454	.918
ICT-7	.596	.916
ICT-8	.416	.919
ICT-9	.593	.916
PRO-1	.608	.916
PRO-2	.527	.917
PRO-3	.459	.918
PRO-4	.606	.916
PS-5	.612	.916
PS-6	.569	.916

PS-7	.559	.917
SCS-4	.446	.918
SCS-5	.477	.918
SCS-10	.451	.918
SCS-11	.479	.918

4.5 Descriptive Statistics for the 21CS Scale

The statistical analyses suggest that the 21CS scale is reliable and valid. Descriptive statistics for the demographic variables are also reported in Table 24. Demographic variables were determined as gender, age group, level of education, faculty, and university.

Table 24

Descriptive statistics of demographics

		n	$\bar{x}$	SD
Gender	Female	176	4.05	.50
	Male	102	3.98	.51
	Prefer not to say	4	3.66	.95
Age group	18-21	181	3.95	.50
	22-25	90	4.11	.50
	26-29	7	4.93	.28
	30+	4	4.82	.46
Level of Education	Prep School	75	3.89	.56
	Undergraduate	177	4.06	.48
	Graduate	30	4.10	.51

Faculty of	Education	175	4.05	.51
	Engineering	41	3.93	.51
	Economic and Admin. Sciences	33	3.95	.50
	Architecture	13	4.01	.66
	Health Science & Medicine	10	3.98	.42
	Communication	10	4.09	.52
University	Bahçeşehir Uni.	183	4.05	.53
	Yeditepe Uni.	32	4.03	.49
	Boğaziçi Uni.	31	3.89	.48
	FSM Uni.	16	3.88	.51
	Other	20	4.04	.39
21CS Scale		282	4.02	.51

When the mean and standard deviations for the demographic variables presented in Table 24 are examined, it can be seen that the mean and standard deviations are close to each other according to the gender variable. As for the age groups, it is seen that the participants aged 26 and over have a higher standardized mean score out of 5 points from the 21CS scale, while their standard deviation scores are lower than those of lower age groups. While making this evaluation, the limitation of having only 11 participants in the groups aged 26 and over should also be taken into consideration. When the average scores of the participants according to the education level are examined, it is seen that the average scores of the students studying in the preparatory class are lower than those of undergraduate and graduate students, and their standard deviation scores are higher. According to the faculties and university categories of education, although there are small differences in the mean and standard deviation scores, there does not appear to be a large deviation between the scores.

4.6 Inferential Statistics

After the statistical validation of the 21CS Scale, it was tested whether the 21CS scores collected from the scale differed according to demographic variables. For this purpose, it was examined whether there was a difference between the 21st century skills score of the participants according to gender, age groups and education level groups.

In order to perform parametric statistical analyses in the research, it is important that the number of participants is sufficient and that the data obtained with the measurement tools provide a normal distribution. The fact that data were collected from 282 people in this study indicates the adequacy of the sample. In addition, the normality distribution of the scores obtained from the 21CS scale was checked.

No outlier values were found in the 21CS Scale scores obtained from the research sample. Kolmogorov-Smirnov statistical significance value was examined first to ensure the normal distribution in data set. The statistical significance value was calculated as 0.01 according to the Kolmogorov-Smirnov test result. The Shapiro-Wilk value, another statistical value showing normality in distribution, was similarly calculated as 0.01. In order to indicate the normal distribution of the data, it is expected that the Kolmogorov-Smirnov test result is not statistically significant, that is, it is greater than 0.05 (Büyüköztürk, 2012). According to the Kolmogorov-Smirnov test result, the data distribution does not seem normal. However, Field (2018) states that these statistical values may be statistically significant even if they deviate very little from the normal distribution in large samples, and therefore recommends examining them together with histogram, P-P plot and Skewness and Kurtosis statistical values. For this reason, other statistical indicators were also examined to decide on the normal distribution.

The Skewness and Kurtosis statistical values of the 21CS Scale score distribution were calculated as -.42 and -.15, respectively (Table 25). These values are accepted to show a normal distribution in the data set by most researchers

(Büyüköztürk, 2012; Huck, 2012, George & Mallery, 2010).

Table 25

Test of Normality for the 21 CS Scale

	Shapiro-Wilk			Skewness	Kurtosis
	Statistic	df	Sig.		
21CS Scale	.98	282	.01	-.42	-.15

Besides Skewness and Kurtosis values, P-P plot and histogram graphs are also given as visual analyses to test the normal distribution in Figure 5 and 6.

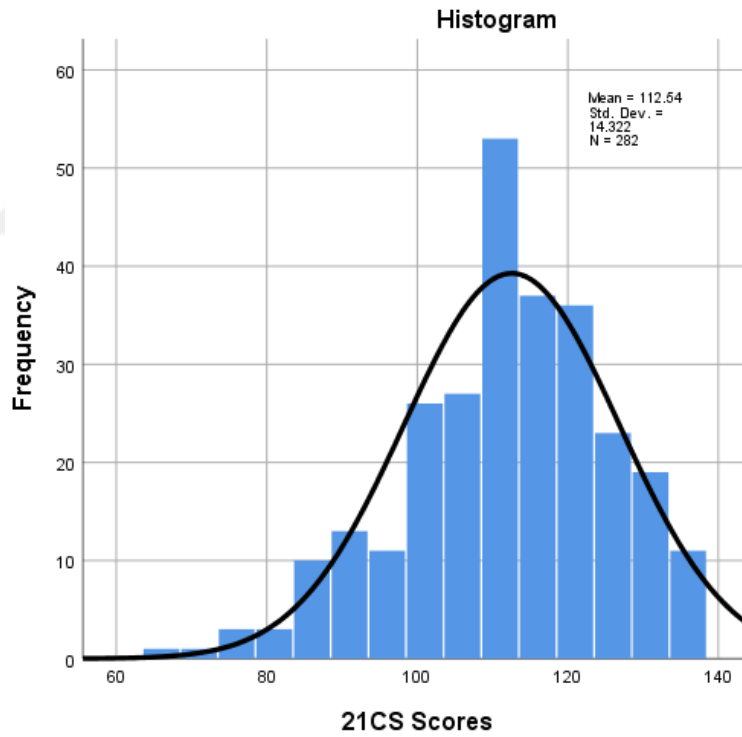


Figure 5 Histogram of 21CS Scores

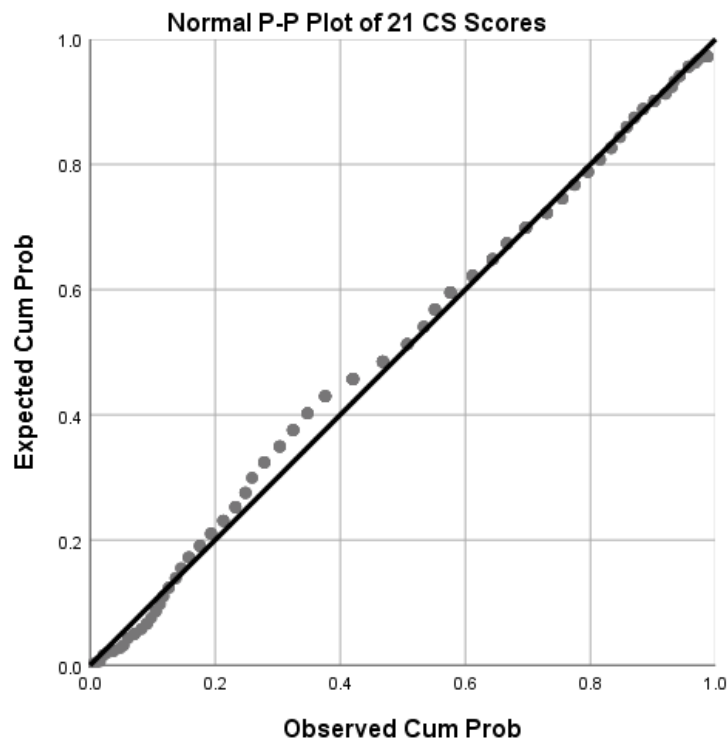


Figure 6 Normal P-P Plot of 21CS Scores

The fact that the data are distributed in a symmetrical structure in the histogram distribution shows the normal distribution of the data. Similarly, in the P-P plot graph, the data points are mostly in a distribution close to the ideal diagonal line, and they do not show any skewness at the lower and upper ends, thus indicating the normal distribution. When all the statistical results are examined together, it is concluded that the data distribution provides the normal distribution. Due to the normal distribution, which is the most important assumption test, it was found appropriate to examine group differences with parametric tests.

Differences between the groups were examined in terms of gender, age groups and education level variables. It was not tested whether there was a difference between the faculties and university categories due to the large number of subgroups and the quite different distribution of the number of participants in these groups.

The independent sample t-test was used to determine whether there was a difference between the 21CS scores of the participants according to their gender. In

order to perform the analysis, in addition to the normal distribution, the closeness of the variances of the groups, which is the homogeneity of the variances, is an assumption that needs to be tested. Levene's test was run for equal variance assumption. Since the significance value (.79) obtained in the Levene's test was greater than .05, equal variances were assumed. According to the results of independent sample t-test analysis, there was no statistically significant difference between the 21CS Scale scores of female ($M = 113.34$, $SD = 14.07$) and male ($M = 111.56$, $SD = 14.15$) participants, $t(276) = 1.02$, $p = .31$, $d = 0.13$ (95% CI [-1.67, 5.24]).

To determine whether there was a difference between the 21CS scores of the participants according to their age, the data was categorized into three. These groups were defined as 18-21, 22-25, 26 and over, based on the age of university entrance during the data collection process. While the majority of the participants were in the 18-21 age group ($n=181$), there were only 11 students in the 26 and over age group. One-way ANOVA analysis was used to compare the scores of the participants in the three groups. Levene's test was used to test the homogeneity of group variances as the hypothesis test of the ANOVA analysis. The assumption of homogeneity of variance was supported since the Levene's test turned out to be non-significant with a p-value of .86. One-way ANOVA test indicated significant difference among the three groups, $F(2,279) = 8.093$, $p < .001$, $\eta^2 = .05$. The eta squared effect size was .05, which suggests a medium effect. The ANOVA summary table indicating the differences between age groups is provided in Table 26.

Table 26

ANOVA summary table for the 21CS Scale (for the age groups)

<i>Source</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between groups	3160.413	2	1580.207	8.093	.001
Within groups	54479.576	279	195.267		
Total	57639.989	281			

Post-hoc test analysis was performed to determine between which groups the statistical difference shown by the F test result occurred. Since the number of participants in the groups was different, the Bonferroni test which is recommended in such cases was used. According to the Bonferroni post-test analysis results, the mean scores of the participants in the 18-21 age group ($M = 110.5$) are statistically significantly lower than the mean scores of the participants in both the 22-25 ($M = 115.07$) and 26 and over ($M = 125.45$) age groups. The p value showing the statistical difference between the groups was calculated as $p = .04$ and $p = 0.01$, respectively. Statistical effect sizes were also calculated as $d = .32$ indicating small difference between the 18-21 and 22-25 age groups, and $d = 1.18$ indicating a large difference for the 22-25 and 26 and over age groups. The p value showing the statistical difference between the scores of the 22-25 age group and the participants of the 26 and over age group was calculated as .06. Although this statistical value indicates that there is no difference at the level of .05, it can be assumed that it remains at the threshold level for a significant difference.

To check whether there was a difference between groups according to their educational status, one-way ANOVA analysis was used to compare the scores of the participants in the three groups: prep school, undergraduate, and graduate. While the majority of the participants are at the undergraduate level ($n=177$), the minimum number of participants is in the graduate category ($n = 30$). The Levene's test result supported the assumption of homogeneity of variance, as the Levene's test turned out to be non-significant with a p-value of .27. When one-way ANOVA was conducted, the results showed significant difference among the three groups, $F(2,279) = 3.27$, $p < .01$, $\eta^2 = .02$. The eta squared effect size was .02, which suggests a small effect. The ANOVA summary table is provided in Table 27, which indicates the difference in scores between groups according to their level of education.

Table 27

ANOVA summary table for the 21CS Scale (for the levels of education)

<i>Source</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Between groups	1320.240	2	660.120	3.27	.039
Within groups	56319.749	279	201.863		
Total	57639.989	281			

In order to determine between which groups the statistical difference demonstrated by the one-way ANOVA indicated, the Bonferroni post-hoc test analysis was performed, which is recommended when the number of participants was differently distributed. According to the test results, the mean scores ($M = 109$) of the prep students were found to be .05 statistically significantly lower than the undergraduate students' scores ($M = 113.65$) ($p = .05$, $d = .32$), with a small estimated effect size. There was no statistically significant difference in scores between prep school and graduate ($M = 114.87$), and undergraduate and graduate groups.

CHAPTER 5

DISCUSSION

In this study, the 21CS Scale was developed to measure the 21st century skills of university students. The psychometric properties of the scale were validated in two stages with data sets taken from two separate samples and a total of 614 university students. The theoretical framework of the scale was created by examining six different 21st century skills frameworks and comparative studies in the literature. In this context, the eight most frequently referred skills in the examined frameworks were determined as subscales of the scale. Collaboration, communication, creativity, critical thinking, information and communications technology literacy, problem solving, productivity, and sociocultural skills were decided as possible factors of the scale.

In the first phase of the scale development, operational definitions of the chosen skills were given, and to write items of the scale, the indicators and keywords of the relevant skills were determined according to the literature. Based on this initial exploratory research, an item pool of 61 items was created for the scale. First of all, the item-category compatibility of the related items was examined by two researchers working on English Language Teaching and measurement and evaluation. After the review of experts, two of the initial items were removed from the item pool, and statistical analyses for reliability and validity were performed on the remaining 59 items. Exploratory factor analysis was used to determine the content and construct of the scale, and then confirmatory factor analysis was performed to confirm the final structure of the scale. The 21CS scale, a 5-point Likert type scale aiming to collect data based on self-report, consists of 28 items and 8 subscales in its final form: collaboration (3 items), communication (3 items), creativity (4 items), critical thinking (3 items), information and communications technology literacy (4 items), problem solving (3 items), productivity (4 items), and sociocultural skills (4 items).

All of the CFI, SRMS, SRMEA indices required in CFA were found to be compatible with the model. Item-total correlation coefficients were calculated between .41 and .61 which can be regarded as acceptable (Gliem J. & Gliem R., 2003). The Cronbach alpha coefficient for the internal consistency reliability of the scale was calculated as .92 which is considerably high, and the internal consistency coefficients of the subscales were found to be .67 - .85 which are within the range of acceptable values (Nunnally, 1978; Pallant, 2010). The explained variance of the scale was found to be as high as 67%. It was concluded that the 21CS scale can be used in education and research studies, based on the psychometric properties of the scale.

The 21CS scale differs from other scales in several ways. First, the 21CS Scale, unlike other scales previously developed, was based on six different international frameworks, not a single one of them. When the scales in the literature are examined, the scales proposed by Kelley et al., (2019) and Anagun et.al. (2016) were developed according to the P21 framework. Goksun and Kurt (2017) adopted OECD and AASL (2007) frameworks in 'the 21st century learner skills use scale', and MEB general teacher proficiencies and ISTE standards in 'the 21st century teacher skills use' scale. Tang et. al. (2022), on the other hand, stated benefitting from the frameworks of the European Parliament (2007), the Organization for Economic Co-Operation and Development (2019), and the P21. For the development of the 21CS Scale on the other hand, six internationally acknowledged frameworks, namely *the Partnership for 21st Century Skills (P21)*, *the enGauge 21st Century Skills (enGauge)*, *Assessment and Teaching of 21st Century Skills (ATCS)*, *National Educational Technology Standards (NETS)*, *21st century skills and competences for new millennium learners (OECD)*, and *Key competences for lifelong learning (European Parliament)* were adopted. As a measurement tool that encompasses different frameworks under a single structure, the 21CS scale differs strongly from other scales.

21st century skills have been mentioned in different ways in the literature and there is no consensus on how to define and categorize these skills (Dicerbo, 2014; Kylonen, 2012; Lai & Viering, 2012). Different skills are defined under different categories in different frameworks (ATCS, 2021; European Commission, 2019; ISTE,

2021; Lemke, 2002; OECD, 2005; P21, 2009b). A scale aiming to measure 21st century skills should first define these skills. When the scales in the literature are examined, Tang et al., (2022) identified 5 skills as creation, collaboration, interest, engagement, and self-regulation in Twenty-First Century Skill Tool (TFCST); Kelley et al. (2019) focused on critical thinking, collaboration, creativity, and communication skills in the 21st Century Skills Scale; Goksun & Kurt (2017) included 5 skills in the 21st Century Learner Skills Use Scale: cognitive, autonomous, collaboration and flexibility, and innovativeness skills. Anagun et al. (2016), on the other hand, focused on measuring the P21's "learning and innovation skills, life and career skills, and information media and technology skills" categories instead of specific skills in the scale they developed.

The 21CS Scale addresses eight skills in total. These skills are the four skills (communication, collaboration, ICT literacy, social and/or cultural skills) common to all of the six different frameworks mentioned above, and the four most mentioned skills (creativity, critical thinking, problem solving, productivity) in these frameworks. In other words, the eight most frequently referred skills among more than 20 skills defined in different frameworks were defined as subscales in the 21CS Scale. The fact that the common skills in different frameworks form the focus of 21CS Scale can be considered as a feature that makes 21CS Scale effective and different from other scales.

Another point that makes the 21CS Scale sound is its being inclusive, in other words, how effective it is in explaining 21st century skills with a small number of items. The 21CS Scale measures 21st century skills with a total of 28 items in eight sub-dimensions and explains 67% of the total variance. When other scales are examined, it is seen that Kelley et al. (2019) explains 48% of the variance with four subscales, Goksun & Kurt (2017) 35% of the variance with 31 items for five factors, Anagün et al. (2016) explains 51% of the variance with 42 items in three factors. Tang et al. (2022), on the other hand, explains 65% of the total variance with 20 items in five dimensions. Although the scale developed by Tang et al. (2022) has high explained variance, in the study it is not clear or specified from which framework

factors such as “interest” and “engagement” were adopted. In this sense, besides including the most emphasized skills in the frameworks, the fact that 21CS has a high explained variance for 21st century skills can be considered as a strength.

In addition to its structural and content wise strength, the fact that the 21CS Scale was developed in English is considered as another advantageous aspect. As English is a global language, it is the most frequently used language in science, international communication and media, and the internet (ETS, 2021). That is why English was preferred as the language of the scale, intending to increase its widespread use, making it available for researchers and respondents all around the world. Findings to be obtained by testing it with different samples can make a positive contribution to the usability of the scale.

Thorndike (1949) argues that practicality is important for a measurement tool as well as its validity and reliability. Practicality relates to the cost-effectiveness of testing in terms of time, effort, and money. To put it another way, a test should be simple to design, administer, assess and analyze the findings. (Bachman & Palmer, 1996). In this respect, the 21CS Scale, which aims to measure the self-report of respondents' 21st century skills in a multidimensional structure with a reasonable number of items, will be a practical measurement tool for researchers. With its compact structure, respondents can answer questions in a short time, which helps increase the number of respondents, without causing incomplete responses. Also, the scale's suitability for data collection with online tools makes the data collection and analysis process more practical.

When the self-reports of university students for having 21st century skills were analyzed, their scores were considerably high in all subscales. The lowest mean score was 3.72 (SD= .82) on the creativity scale, the highest mean score was 4.38 (SD= .61) on the ICT scale, while the scores on the other subscales were distributed in this range. The scores regarding the 21st century sub-skills are similar to the results of other studies conducted in Turkey (Erten, 2020; Donmuş et al., 2018; Goksun & Kurt, 2017; Kozikoglu & Altunova, 2018). Erten (2020) states that pre-service teachers consider

themselves competent in 21st century skills. Similarly, Kozikoglu and Altunova (2018) state that teacher candidates have high perceptions of 21st century skills. The results of this study, in which university students studying at the faculty of education comprise the majority of the participants, show similarities with the results of the studies conducted with teacher candidates.

In the sub-skills of the scale, the skill in which the participants consider themselves best is ICT literacy with an average of 4.38 points. Considering that most of the participants were born in the 21st century and started to use technology at an early age, the participants may think that they are sufficient in terms of using technology. However, ICT skills should be evaluated not only as using technology, but also as confirming and criticizing information and accessing reliable information through digital communication technologies (ETS, 2007). While responding to the items about measuring ICT skills, the participants may have focused on using the internet only. In line with this, Karakoyun and Başaran (2022) conducted a study with 6890 students using the PISA 2018 data set, in which they argued majority of students in Turkey do not use ICT sources at a high level at home or school, and only 8% of the students have ICT literacies at high level. As a result, it would be meaningful to carry out studies to compare the ICT findings obtained in the study with the findings of different studies.

The results of the PISA 2018 research conducted by the OECD show that the average time spent on the Internet by students in Turkey both on weekdays and weekends more than doubled from 2012 to 2018 (OECD, 2019). Despite this, the same report also states that the time spent by students on the internet both at school and at home is below the OECD average. There are many connections between information communication, media and technology literacy, and mastering these skills supports increasing their overall competencies in other 21st century skills (Trilling & Fadel, 2009). The fact that the participants have the highest average score in ICT skills can be considered as positive indicators for the development of other skills.

Another skill that is very close to the ICT literacy skill average ($\bar{x}=4.38$, $SD=.61$) is collaboration ($\bar{x}=4.37$, $SD=.67$). Dede (2014) stated that digital teaching platforms can give tremendous facilitation for collaborative learning. Collaboration comprises students collaborating in meaningful and authentic group learning opportunities as well as collaboratively developing new ideas (Sharratt & Planche, 2016). At this point, it can be argued that ICT skills have a supporting role in collaboration. Having considered this close relation between these skills, it is also likely that the responses to collaboration items might be affected by their perceptions of communication and sociocultural skills. Students' having a better understanding of collaboration rather than seeing it as getting along with others might be critical in terms of receiving more accurate responses.

The relationships between the subscales of the 21CS Scale indicate that the highest correlation coefficient (.88) is between problem solving and critical thinking skills. Although the factors diverged in factor analysis, the items describing the two skills showed closeness. In this study, problem solving was defined as cognitive processing towards reaching a purpose (Mayer, 2013). On the other hand, critical thinking was defined according to Ennis (1985)'s reflective and reasonable thinking, and two skills were separated from each other. According to the broad definition of Ennis (1985), critical thinking consists of skills as a cognitive aspect and dispositions as an affective aspect (Kennedy et al., 1991). Despite this, the concurrence of problem solving and critical thinking skills is also emphasized in the literature (Halpern, 1996; Snyder & Snyder, 2008; Ülger, 2016). Snyder and Snyder (2008, p. 90) emphasized that "students who are able to think critically are able to solve problems effectively". Similarly, OECD (2014, p.30), claimed that "domain-general problem solving skills include the willingness to engage with situations in order to achieve one's potential as a constructive and reflective citizen". At this point, it can be argued that the high correlation between problem solving and critical thinking stems from the natural association between the definitions of these two variables.

When the correlation coefficients are compared, problem solving has almost the highest correlation values with other defined skills. This indicates that problem solving

is perceived as a more general 21st century skill. According to Greiff et al. (2014), education today must equip students with domain-general problem solving skills as well as domain-specific problem solving. In PISA 2012 domain-general problem solving was also named as Creative Problem Solving (OECD, 2014). Furthermore, in both the ATC21S project and PISA 2015, the domain general problem solving was decided to be collaboratively assessed. At this point, the fact that problem solving is handled from a more general perspective and that it is used and assessed in an integrated way with different skills (e.g. critical thinking, creativity, collaboration) as emphasized in the literature, explains its strong relationship with other skills defined in the 21CS Scale.

21st century learning requires a set of cross disciplinary skills that are essential to success for students of today (European Commission, 2019; OECD, 2005; Gordon et al. 2009; Hamarat, 2019). Skills such as communication, collaboration, critical thinking, ICT literacy, problem solving, productivity, and sociocultural skills are all interrelated and binding for all subject areas. Their prominence for English language teaching as well is undeniable. Language classrooms offer interactive learning environments in which 21st century skills can be cultivated through various language teaching approaches and methods such as CLT, CLIL, CALL, TBL, PBL. Considering how 21st century skills are relevant to teaching English which is the global language and how convenient the language classrooms are to engage students with authentic tasks promoting these skills, it is inevitable to adapt language teaching curriculum and implementation according to this concept. For this purpose, the scale developed in this study can be used to determine students' current levels of 21st century skills in English classrooms, to analyze relations between different variables, and it can be utilized as an assessment tool in intervention studies. In addition to that, the 21CS scale can be used across different subject areas as the items in the scale do not consist of ELT-specific content but focus on 21st century skills in general.

Measurement and evaluation of 21st century skills is as important as integrating them in education. This study aimed to develop a measurement tool to assess 21st century skills of participants based on their self-report, in a Likert-type scale format,

which is the most common form of rating scales (Katz & Rudolph, 2018). A rating scale is a closed-ended response structure in which participants respond to a series of statements or questions led by specified parameters (Katz & Rudolph, 2018). A Likert-type scale is made up of one or more statements regarding a specific variable that are used to measure the level of agreement on a consistent numeric scale (Katz & Rudolph, 2018). Selcuk et al. (2014) stated in their study that Likert-type scales are the most frequently used measurement tool in the field of education with a total usage rate of 40%. This is mainly because measurements based on self-report require substantially less time to identify skill levels and makes data collection from large groups more practical (Christensen & Knezek, 2008; Katz & Rudolph, 2018). Also, Likert-type self-report scales are a frequently used approach to measure 21st century skills as they are less costly in terms of time and effort than other open-ended measurement methods (Soland et al., 2013).

Although it is one of the most commonly used measurement methods, Likert-type self-report items have some weaknesses. First of all, the ratings (e.g. rarely, sometimes) used in Likert-type items can mean different things for different respondents (Yalçın, 2018). Another disadvantage of Likert-type scales is that the participants may manipulate their responses to look favorable for what is socially desired (Katz & Rudolph, 2018; Lombardi et al., 2011; Soland et al., 2013). In other words, there may be differences between the participants' response to the self-report scale and their actual competence in related skills. This makes the interpretation of the results difficult and may cause a validity threat. At this point, as in every self-report scale, examining the cross-relationships with different assessment tools such as open-ended questions or performance evaluations will provide more detailed information on the validity of the 21CS scale.

While evaluating the findings and results of the research, it should be taken into account that the data required for EFA of this study were collected from students studying at a single English medium university, and at the CFA stage, approximately two-thirds of the data were collected mainly from students studying at the same university. For this reason, it would be useful to compare the findings with the factor

analysis results obtained from other samples. The time elapsed between the data collection phases for EFA and CFA due to the COVID 19-related pandemic process can also be considered as one of the limitations of the study.

In addition, the 21CS Scale is a measurement tool based on self-report. In other words, it tries to measure the 21st century skills of the participants based on their own perspectives. Supporting and discussing the findings of the scale with other studies in which the real use of 21st century skills would provide an opportunity to evaluate the usability of the scale or its possible mediating role for the results of practical application.

In conclusion, beyond any doubt, the needs of and expectations from the students become different, in line with the rapid changes in the world. To adjust to these advancements, 21st century skills have utmost importance. For students to become competent and qualified individuals both in academic and work life, cultivating their 21st century skills should be a priority for educators. Integration of 21st century skills into education also calls for assessment of these skills. At this point, the 21CS scale appears to be a reliable and valuable measure for educational programs aiming to boost these skills to elevate their students' success in the current competitive world.

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