

## Key Competence Choices of Students at a Science Festival in Turkey: A Preliminary Study

### Türkiye’deki Bir Bilim Şenliğinde Öğrencilerin Anahtar Yetkinlik Seçimleri: Bir Ön Çalışma

Merve Kocagül<sup>1</sup>

<sup>1</sup>Sorumlu Yazar, Dr. Arş. Gör., Pamukkale Üniversitesi, mervekocagl@gmail.com,  
(<https://orcid.org/0000-0002-1152-9220>)

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#### ABSTRACT

This study focuses on ensuring quality education, among other SDGs. Participants' choices of competency areas in a local science festival, themed around European key competences for lifelong learning, and the influence of demographic and contextual variables on these choices were investigated. The survey method was used to infer participants' attitudes towards competence areas through their choices. Data were collected using the Participant Information Form. Descriptive statistics and chi-square independence tests were performed in the SPSS-22 program to analyze the data. The results showed that students selected the mathematics, science, and technology competency area the most and the digital competency area the least. In addition, the students' choice of competency area differed according to their gender, educational level, and the socioeconomic level of the district in which they resided. It can be concluded that there are political, social, and economic reasons for the students' choice of competency area. In this context, it is recommended that educational policies should include practices that promote all areas of competence, that government incentives for competence development should be expanded and maintained, that the technical infrastructure of socio-economically disadvantaged schools should be strengthened, and that appropriate learning environments should be created to ensure both the development of students' key competences and the elimination of gender differences.

**Keywords:** Key competencies, quality education, science festival, lifelong learning.

#### ÖZ

Bu çalışma diğer Sürdürülebilir Kalkınma Hedeflerinin arasında kaliteli eğitimin sağlanmasına odaklanmaktadır. Hayat boyu öğrenme için Avrupa anahtar yetkinlikleri temalı yerel bir bilim festivalinde katılımcıların yetkinlik alanları seçimleri ve demografik ve bağlamsal değişkenlerin bu seçimler üzerindeki etkisi araştırılmıştır. Katılımcıların seçimleri üzerinden yetkinlik alanlarına yönelik tutumlarını çıkarsamak için anket yöntemi kullanılmıştır. Veriler Katılımcı Bilgi Formu kullanılarak toplanmıştır. Verileri analiz etmek için SPSS-22 programında tanımlayıcı istatistikler ve ki-kare bağımsızlık testleri yapılmıştır. Sonuçlar, öğrencilerin en çok matematik, fen ve teknoloji yetkinlik alanını, en az ise dijital yetkinlik alanını seçtiklerini göstermiştir. Ayrıca, öğrencilerin yetkinlik alanı seçimleri cinsiyetlerine, eğitim düzeylerine ve ikamet ettikleri ilçenin sosyoekonomik düzeyine göre farklılık göstermiştir. Öğrencilerin yetkinlik alanı seçimlerinin siyasi, sosyal ve ekonomik nedenleri olduğu sonucuna varılabilir. Bu bağlamda, eğitim politikalarının tüm yetkinlik alanlarını teşvik eden uygulamaları içermesi, yetkinlik gelişimine yönelik devlet teşviklerinin yaygınlaştırılarak sürdürülmesi, sosyo-ekonomik açıdan dezavantajlı okulların teknik altyapısının güçlendirilmesi ve hem öğrencilerin temel yetkinliklerinin geliştirilmesini hem de toplumsal cinsiyet farklılıklarının giderilmesini sağlayacak uygun öğrenme ortamlarının yaratılması önerilmektedir.

**Anahtar Kelimeler:** Anahtar yetkinlikler, kaliteli eğitim, bilim şenliği, yaşamboyu öğrenme.

## INTRODUCTION

The 2030 Agenda for Sustainable Development provides countries with a roadmap of 17 universal goals to address current and future social, economic, and environmental challenges (United Nations [UN], 2015). One of these goals, which addresses a wide range of global challenges from gender equality to ending hunger, is to ensure inclusive and quality education for all and to promote lifelong learning skills. Ensuring quality education is also important as a catalyst for achieving other sustainable development goals. For example, only a person with a quality education can achieve gender equality in society and take initiatives to end poverty and hunger.

Since scientific and technological progress is constantly changing society's needs and requires a wide range of knowledge, skills and attitudes from individuals, quality education outcomes for sustainable development highlight lifelong learning skills (UNESCO, 2017). In this context, countries/organizations propose some frameworks that define the required competencies. Some of the best known frameworks are OECD Core Competencies, OECD Global Competencies, P21 Framework, World Economic Forum, and European Key Competencies for Lifelong Learning. The subject of this study is the European Key Competencies for Lifelong Learning.

The European key competences, which consist of knowledge, attitudes, and skills that serve to realize the goal of quality education, include literacy, multilingualism, numerical, scientific, and engineering skills, digital and technology-based competences, interpersonal skills, active citizenship, entrepreneurship, and cultural awareness and expression (European Commission [EC], 2019). The curriculum reformed within the scope of the Turkish Qualifications Framework in 2018 aims to graduate from compulsory education with the knowledge, attitudes, and skills required by eight key competences (*communication in the mother tongue, communication in foreign languages, mathematical competence and competence in science and technology, digital competence, learning to learn, social and civic competences, initiative and entrepreneurship, and cultural awareness and expression*) that overlap with the European key competences (Ministry of National Education [MoNE], 2018). However, the study by Duru et al. (2020) reported that university graduates do not have the knowledge and skills that business representatives consider when hiring them. The results of PISA 2022 also show that student performance in reading, mathematics, and science has declined significantly since PISA began (OECD, 2023). These results point to the need to improve students' key competencies.

In addition to rich learning environments in schools (e.g., inquiry-based learning), learning outdoors and in informal or non-formal settings has been reported to develop key competencies (EC, 2019; Barth et al., 2007; Lozano et al., 2017). In informal learning environments, individuals develop an interest and understanding of scientific concepts, experience scientific inquiry and reasoning processes, reflect on what they have learned, engage in scientific practices, and develop an identity by guiding their career choices through the recognition of their interests (Bell et al., 2009). In this sense, science festivals can be seen as a type of informal learning environment.

In principle, science festivals aim to promote the interaction between science, technology and society and to contribute to the development of knowledge, skills and competences of individuals of all ages in relation to the chosen theme. In this way, they provide lifelong learning and promote the inclusiveness of education (UNESCO, 2022). Science festivals also encourage students to pursue scientific careers in their areas of interest (National Research Council [NRC], 2010; Schmidt & Kelter, 2017).

Most studies on the effectiveness of science festivals have focused on participants' learning outcomes (Grimberg et al., 2019; Idema & Patrick, 2019), scientists' mental simulations (Akkanat, 2020; Ates et al., 2021), and gains in affective factors (Akkanat, 2020; Keskin et al., 2019; Schmidt & Kelter, 2017; Wharton, 2019; Yilmaz-Ince et al., 2022). Furthermore, some studies

reported on the participants' reasons for attending the science festival (Canovan, 2020; Jensen & Buckley, 2014; Kececi, 2017), while others assessed the festival itself (Creameans et al., 2020). The identified studies on the assessment of key competencies focused on high school students' intercultural competencies (Vajak et al., 2021), elementary students' mathematical (Hubbard et al., 2022) and digital competencies (Godaert et al., 2022), middle school students' science, technology, and engineering competencies (Arikan et al., 2022), and university students' mainly digital (Ogegbo et al., 2022; Silva-Quiroz & Morales-Morgado, 2022) and entrepreneurial competencies (Almeida & Buzady, 2019; Simovic et al., 2023; Slogar et al., 2021; Solek-Borowska & Chudy-Laskowska, 2018).

Competencies can be defined as "context-specific cognitive dispositions acquired through learning that are necessary to successfully deal with specific situations or tasks in specific domains" (Klieme et al., 2008, p.9) and includes a set of knowledge, skills, and attitudes. In existing studies, data have mainly been collected through questionnaires and scales. As a result, the knowledge and skill aspects of competencies have mostly been addressed. In addition, the main drawback of this type of data collection is that participants may answer questions in a sloppy or insincere manner. In science festivals, people experience activities that meet their learning needs and desires. According to the Theory of Reasoned Action, attitudes play a key role in evaluating alternatives (Fishbein & Ajzen, 1974) and thus guide decisions and behaviors (Sanbonmatsu et al., 2005). Accordingly, the choices individuals make in a science festival can be considered as an indicator of their attitudes towards the related activity. In this study, unlike previous studies, an evaluation was made based on the students' choices as an indicator of their attitudes. Although the study focuses on only one dimension of the key competences (attitudes), its results still have the potential to provide insight into students' dispositions towards these competences (*communication in the mother tongue, communication in foreign languages, mathematical competence and competence in science/technology, digital competence, learning to learn, social and civic competences, sense of initiative and entrepreneurship, and cultural awareness and expression*) and to identify the factors associated with these dispositions. In this context, the study seeks to answer the following research questions.

- What are the students' choices of key competencies?
- Is there a relationship between demographic variables (gender, education level) and students' choices of key competencies?
- Is there a relationship between contextual factors (socio-economic status of the district of residence, reason for attending) and students' choices of key competencies?

## **METHOD**

The aim of this study is to draw conclusions about the attitudes / tendencies of the participants of a local science festival towards the European key competences for lifelong learning through their choices. For this reason, the study has a survey design. The nature of the survey is cross-sectional because the data were collected in a single time period (Fraenkel & Wallen, 2003).

### **2.1.Data Collection Tool**

Data were collected using the Participant Information Form (PIF) developed by the researcher. The purpose of this form is to identify the demographic and contextual characteristics of the students who participated in the activities. In terms of demographic variables, the PIF asked about the gender and educational level of the participants, while the contextual questions asked for information about the reason for attending the festival and the districts where they reside. The content and face validity of the form, consisting of four questions in total, was ensured by expert opinion. Data were collected by administering the PIF directly to respondents using pencil and paper. In addition, a QR code for the PIF was created to facilitate the data collection process, and

some participants also used this online survey to respond to the data collection tool. The QR code for the PIF is shown in Figure 1.

**Figure 1**

*QR Code for the Participant Information Form*



Figure 1 shows the QR code that will allow readers to easily access the online version of the data collection tool.

## 2.2.Participants

The target audience of the science festival is people of all ages in the city. In this context, protocols were organized with the Provincial Directorate of National Education and the District Mayor's Office to announce the festival, and the festival was announced to schools at all levels through official letters and to the public through billboards. The stickers used to identify the number of participants showed that more than 7000 visitors attended the festival over the three days. However, since this study focuses on the selection of key competency areas, only the number of primary, secondary, and high school students is reported. The number of students refers to the number of students who responded to the data collection instrument, not the total number of students who participated in the festival. Thus, data were collected from 3570 students. Detailed information about the participants is shown in Table 1.

**Table 1**

*Information About Participants*

		<b>Gender</b>		<b>Education Level</b>		
		F	M	PS	SS	HS
Socio-economic level of residence	1st Level	460	520	93	737	150
	2nd Level	1094	948	359	1608	75
	3rd Level	139	154	74	213	6
	4th Level	128	127	61	192	2
Reason for attending	Interest	1009	1010	416	1497	107
	Suggestion	545	462	137	790	80
	Random	267	277	33	463	47

*Note.* F: Female, M: Male, PS: Primary school, SS: Secondary school, HS: High school

According to Table 1, 51.01% of the participants are female, while 48.99% are male. While the distribution is almost equal for the gender variable, it is not the same for the education level variable. Accordingly, 16.44% of the participating students are in primary school, 77.03% in secondary school, and 6.53% in high school. In terms of contextual variables, it was observed that the students mostly resided in districts with socio-economic development level 2 (57.20%).

Another contextual variable, the reason for attending, showed that 56.58% of the students participated in the festival activities because they were interested.

### **2.3.Data Analysis**

The dependent variable of the study is the students' choice of key competency areas. This variable has a total of eight categories, one category for each key competency. The independent variables of the study are the demographic characteristics and contextual factors of the participants. In the context of demographic characteristics, gender is classified into two categories as female and male, while education level is classified into three categories as primary, secondary, and high school. Within the contextual factors, the district where the participants live is classified into four categories according to the report of the 2022 District Socioeconomic Development Index (Acar et al., 2022). It is important to note that 56 variables are used in the preparation of this report, including financial information such as the total amount of individuals' bank accounts. Therefore, the socioeconomic status of the county of residence also reflects the socioeconomic status of the participant. Participants' reasons for participating in the activity have three categories: interest, suggestion, and chance.

Descriptive statistics were used to answer the first research question. Frequencies and percentages were calculated for the number of choices for each competency. To answer the second and third research questions, the Chi-Square test of independence was conducted. This test is used for categorical variables and tests whether the variables are independent of each other and whether there is a relationship between them, in other words, whether one variable affects the other variable (Karagoz, 2017).

### **2.4.Overview of the Science Festival**

The science festival presented here is a scientific project successfully completed and supported by TUBITAK. The festival was organized in cooperation with four institutions/organizations: the university where the author works, the district municipality, the provincial directorate of national education, and the university's research center for child and youth education. The preparation of the festival took about 8-9 months, during which time the festival location, activities, activity coordinators and materials were determined.

The selection of the festival venue was based on the fact that it is already preferred by people and that it is suitable for people with disabilities. The activity coordinators were selected mainly from among academics who could answer questions that participants might ask without causing misunderstanding. Accordingly, 33 of the 38 activity coordinators were academicians. Criteria such as care for science and community activities, good communication skills, and volunteerism were also considered. In the process of determining the festival activities, firstly, the definition of key competencies related to their expert fields was explained to the volunteer academics and they were asked to design an activity that corresponds to the definition of the key competence. In this context, while some activity coordinators prepared 40-45 minutes of scientific talks related to their competence areas, some of them designed activities based on virtual reality applications, simulations, argumentation, computational thinking applications, experiments, digital storytelling, mobile applications, game-based activities, project-based learning applications, exhibitions, workshops, seminars, STEM applications, Predict-Observe-Explain applications, drama, and art. The designed talks and other activities were specifically requested to cover more than one education level.

The activities proposed by the activity coordinators are categorized under the competence areas to which they relate. The appropriateness of this classification was assessed by a separate group of three academicians with knowledge and experience in the field of key competences. The experts agreed on the appropriateness of classifying activities under each key competence.

Detailed information on the activities and the types of competencies to which they relate is presented in Table 2.

**Table 2**

*Classification of Activities by Competence Areas*

<b>Key competence</b>	<b>Activity name</b>
Communication in mother tongue	Speak correctly, Write correctly
	Fairy tale hunt
Communication in foreign languages	Word-in-word
	What is the weather today?
	Bingo
	Making scented stone
	What is inside the drinking water?
	Cloud in the Erlenmeyer flask
Mathematical competence and competence in science/technology	Making a Painter Robot
	Linoleum printing
	Making Seed Ball
	Fountain balloon
	Mystery of numbers
	Mathematical modelling from the history of science to the present
	A new look into Pythagorean theorem with baking papers
	Is there a perfect shape?
	Virtual look into science
	Virtual look into business
Digital competence	Design-Code-Share
	4 table activity
	Arguments and reasoning in philosophy
Learning to learn competence	Thinking about environmental ethics
	I am addicted to social sciences!
	Bowling
Social and citizenship competence	Where is my shadow and where am I?
	Emotional intelligence and social skills
	Home-made hovercraft
Initiative and entrepreneurship competence	Food aid team with parachuting
	Methods of Archaeological Excavation
	Anatolian Archaeology and the Ancient City of Hierapolis
Cultural awareness and expression competence	Design with waste materials

As can be seen in Table 2, there are at least two activities under each key competence. The science festival lasted three days from 9:00 am to 5:00 pm.

**2.5.Ethics Committe Approval**

All data collection tools, and informed consent forms were reviewed and approved by the Ethics Committee of the Research and Publication of Pamukkale University in Social and Human Sciences (25.02.2022/ Document Number: 175306)

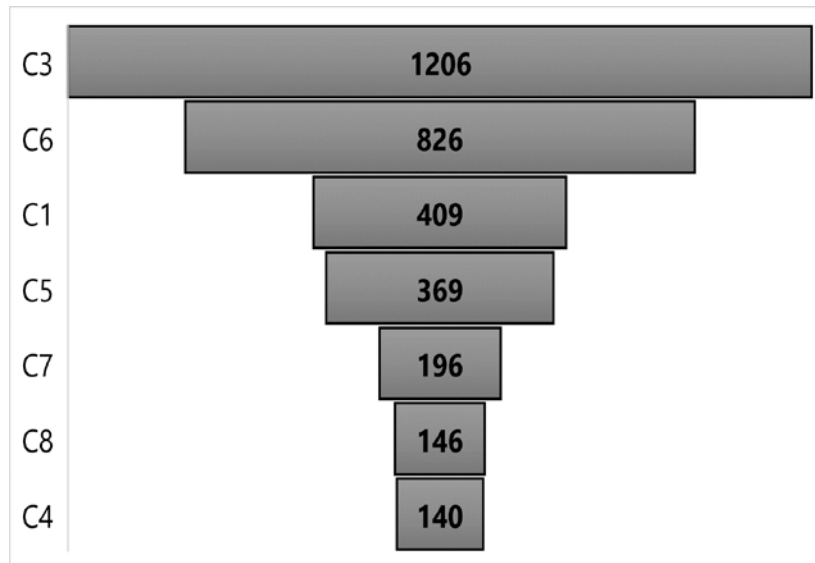
## FINDINGS

### 3.1. Students' Choices of Key Competences

To answer the first research question, "What are students' choices of key competencies?", this section presents the frequency values of students' choices for each competency area in Figure 2.

**Figure 2**

*Frequency Values Regarding Students' Competence Area Choices*



*Note.* C1: Communication in mother tongue; C2: Communication in foreign languages; C3: Mathematical competence and competence in science/technology; C4: Digital competence; C5: Learning to learn; C6: Social and citizenship competence; C7: Initiative and entrepreneurship; C8: Cultural awareness and expression

As can be seen in Figure 2, the most selected competence area was mathematical competence and competence in science and technology, while the least selected competence area was digital competence. According to the frequency values, almost one in three participating students (33.78%) chose to participate in activities related to mathematics, science, and technology competency area.

### 3.2. Students' Choices of Key Competences and Related Variables

In order to address the second and third research questions, this section presents the results of chi-squared independence tests on whether demographic characteristics (gender and education level) and contextual factors (socioeconomic level of residence and reason for attending) are associated with students' choice of key competency area.

Before results, it should be noted that 80% of the cells for every other variable, except the reason for attending, do not have an expected value below 5. In other words, the chi-square assumption is not violated for variables other than the reason for attending. For this reason, the reason for attending variable was not included in the analysis process, and the other results of the chi-square independence test are presented in detail in Table 3.

**Table 3***Chi-square Results and Effect Sizes*

	Chi-square test		Effect size	
	$\chi^2$	p	Cramer's V	p
Gender	87.633	.000*	.157	.000*
Education level	501.996	.000*	.265	.000*
Socioeconomic level of residence	287.411	.000*	.164	.000*

Note. \*p<.001

The results of the chi-square test showed that there was a significant relationship between gender and students' choices of the competency area and that gender had a moderately significant effect on the choice of the competency area. ( $X^2(7, n=3570)= 87.63, p= .000, \text{Cramer's } V= .16$ ). Detailed analyses (adjusted standardised residuals) (Sharpe, 2015) revealed that the gender variable is directly and significantly related to the choice of communication in the mother tongue, communication in foreign languages, mathematics, science and technology, and digital and entrepreneurship competency areas. Consequently, female students are more likely to choose mathematics, science, and technology competency area ( $Z=4.7, p<.001$ ), while male students are more likely to choose communication in the mother tongue ( $Z=2.5, p<.05$ ), communication in foreign languages ( $Z=2.1, p<.05$ ), digital competence ( $Z=3.5, p<.01$ ) and entrepreneurial competence ( $Z=6.9, p<.001$ ).

Table 3 also showed that there is a significant relationship between the level of education of the students and their choice of the competency area and that the level of education has a highly significant effect on the choice of the competency area ( $X^2(14, n=3570) = 501.99, p= .000, \text{Cramer's } V= .27$ ). Additional analyses showed that there was a direct significant correlation between primary school and the choice of communication in foreign languages ( $Z= 9.5, p<.001$ ), mathematics, science, and technology competency area ( $Z= -6.2, p<.001$ ), digital competence ( $Z= -4.9, p<.001$ ), learning to learn ( $Z= -3.4, p<.001$ ) and areas of competence in cultural awareness and expression competence areas ( $Z=12.1, p<.001$ ) and a primary school student would choose communication in foreign languages and the competency in cultural awareness and expression significantly more and the other areas of competence less. Furthermore, there is a direct significant correlation between the secondary school level and the choice of the competency areas of communication in foreign languages ( $Z=-8.0, p<.001$ ), learning to learn ( $Z=6.1, p<.001$ ), social and citizenship ( $Z=4.9, p<.001$ ), entrepreneurship ( $Z=2.8, p<.01$ ) and cultural awareness and expression ( $Z=-8.7, p<.001$ ), and a secondary school student tends to choose learning to learn, social and citizenship competence, and entrepreneurial competence more and the other competency area less. Similarly, there is a direct significant relationship between the high school level and the choice of other competency areas, except communication in the mother tongue and communication in foreign languages. Accordingly, a high school student is more likely to select mathematics, science, and technology competency area and digital competence and less likely to select learning-to-learn, social and citizenship competence, entrepreneurial competence, and cultural awareness and expression competence.

The results of the Chi-square test showed that there is a significant relationship between the socioeconomic level of the student district of residence and its choice of the competency area and the socioeconomic level of the residence has a moderately significant effect on the choice of the competency area ( $X^2(21, n=3570) = 287.41, p= .000, \text{Cramer's } V= .16$ ). Accordingly, students residing in Level 1 and Level 2 districts chose the mathematics, science, and technology competency area the most, while students residing in Level 3 and Level 4 districts chose the social and citizenship competence the most. Detailed analyses showed that there is a direct significant



correlation between residence in level 1 districts and the choice of communication in the mother tongue ( $Z=5.0$ ,  $p<.001$ ), communication in foreign languages ( $Z=-6.2$ ,  $p<.001$ ), mathematics, science, and technology competency area ( $Z=6.3$ ,  $p<.001$ ), digital competence ( $Z=3.6$ ,  $p<.001$ ), learning to learn ( $Z= -6.1$ ,  $p<.001$ ) and social and citizenship competence ( $Z=-4.5$ ,  $p<.001$ ) and that residence in these districts increases the choice of communication in mother tongue, mathematics, science and technology competence and digital competence, while decreasing the choice of the other competency areas. Residence in level 2 districts increases the choice of communication in foreign languages ( $Z=6.8$ ,  $p<.001$ ) and learning to learn ( $Z=9.3$ ,  $p<.001$ ) competency areas, while decreasing the choice of communication in mother tongue, mathematics, science and technology and digital competency areas. Similarly, there is a direct significant relationship between residence in level 3 districts and communication in the mother tongue ( $Z=2.6$ ,  $p<.01$ ), mathematics, science and technology ( $Z=-2.3$ ,  $p<.01$ ), learning to learn ( $Z=-2.7$ ,  $p<.01$ ) and social and citizenship ( $Z=3.2$ ,  $p<.01$ ) competency areas. In this context, residence in the Level 3 district increases the choice of only communication in the mother tongue and the social and citizenship competency areas, while decreasing the choice of the other two competency areas. Finally, residence in the level 4 district increases the choice of competency areas related to communication in mother tongue ( $Z=2.8$ ,  $p<.01$ ), digital competence ( $Z=3.3$ ,  $p<.001$ ), and social and citizenship competence ( $Z=4.2$ ,  $p<.001$ ), while decreasing the choice of competency areas directly related to communication in foreign languages, learning-to-learn, and cultural awareness and expression.

## **DISCUSSION, CONCLUSION AND SUGGESTIONS**

Education systems around the world aim to equip their citizens with some of the skills needed in the society and workforce of the future. But how successful are we? Do our students have positive attitudes towards key competences? and Which competence areas? This study provides a preliminary assessment of the goal of ensuring quality education in the Sustainable Development Goals using data collected through a locally organized science festival.

The first finding reported the general trend in key competencies. As a result, mathematics, science, and technology competency area was the most selected competence area. The main reason for this situation may be related to the national education policy. STEM education is considered important in Türkiye, and various programs are implemented to involve students in STEM activities, both in curricula and through official institutions. Coenen et al. (2021), in their study focusing on preferences for STEM education, reported that cognitive skills are more determinant than personal characteristics in moving from preferences to actual choices. Students' exposure to STEM activities in learning environments may have provided them with the skills to perform these activities, which may influence their choices. The first finding also reports that digital literacy is the least selected area of literacy. This may be due to activities. Weber and Custer (2005), in their study of students' preferences for technology education, found that students tended to choose application-oriented activities and that female students were more interested in technology activities related to designing through an application/software and male students were more interested in technology activities related to building. The fact that students' technology education interests and preferences were not fully compatible with the activities they experienced at the science festival may explain this finding.

The second finding reports that the gender of the students has an effect on their choice of competency area. Consequently, female students are more likely to choose the mathematics, science, and technology competency area. This may be due to the learning environment. Tisza et al. (2019) reported that women prefer activities in informal learning environments that they can participate in themselves, such as physics, chemistry, biology, and art. However, another study reported that encountering people from one's own ethnicity and gender working in STEM fields

served as a role model for them and encouraged them to pursue STEM fields as well (Kricorian et al., 2020). Ozlem Tureci and Canan Dagdeviren, whose names are frequently heard in the media due to their successes in recent years, may have been role models for female students in the field of science and may cause them to choose STEM fields. On the contrary, male students are more likely to choose communication in the mother tongue, communication in foreign languages, digital competence, and entrepreneurship competence areas. In a study, perceived self-competence was reported to significantly predict male students' willingness to communicate at different education levels from secondary school to university (Donovan & MacIntyre, 2004). Similarly, Arshad et al. (2015) reported that male students were more willing to communicate in a foreign language and were able to construct longer sentences. The fact that men are more likely to choose the competence of communicating in both mother tongue and foreign language may be related to the norms of the patriarchal social order that support men's comfort in public speaking, or it may be related to the higher selection of entrepreneurial competence. Consequently, male students may anticipate that they will need effective communication in both their mother tongue and the foreign language in their future jobs.

The fact that male students choose digital competence activities more is in line with Weber and Custer's (2005) study. The activity named Design-Code-Share, which is included in the scope of digital competence, may have affected male students' choices since it is a technology activity that requires a building process. The fact that male students tend to choose the entrepreneurship competency area more is consistent with other studies reporting that women are reluctant to become entrepreneurs (Osakede et al., 2017; Yordanova & Tarrazon, 2010). One reason may be related to differences in self-perception between males and females. As Pines et al. (2012) note, male students perceive themselves as more suitable for business ownership than female students. Social norms and tasks assigned to women may also explain this difference.

The third finding reports that there is a direct and significant relationship between education level and choice of competence area. Consequently, primary school students are more likely to choose communication in foreign languages and areas of cultural awareness and expression competency. The willingness of primary school students to engage in communication in foreign language activities may be due to low communication anxiety caused by the fact that these students, who are learning English as a foreign language, do not yet have complete and solid foreign language knowledge. This is supported by the fact that fear of making mistakes is reported as the main cause of Turkish students' EFL speaking anxiety (Borkowska, 2021; Hol & Kasimi, 2022; Riasati, 2017). The reason why primary school students chose the area of cultural awareness and expression competency may be related to the types of activities. In this competency, students engaged in cultural and arts activities. These activities can be attractive for students aged 7-9. Furthermore, the activity named archaeological excavation in this group may have functioned as an interesting factor, as it was recently experienced by many students. The study reporting that hands-on activities are among the most preferred activities of participants between the ages of 0-18 supports this finding (Fogg-Rogers et al., 2015). Furthermore, family and socioeconomic status are listed among factors that affect participation in these activities (van den Berg, 2019; Varadi & Jozsa, 2023). Consequently, students' previous participation in cultural trips with their families or attending an art course may encourage their participation in these activities. The fact that the vast majority of primary school students who experienced activities within the scope of this competency reside in the first and second socioeconomic level districts seems to support this view.

Secondary school students also tended to choose more areas of social and citizenship, learning-to-learn, and entrepreneurship skills. The area of social and citizenship competence focused on participatory citizenship in democracies, the importance of democracy, different regimes, human rights, empathy, and awareness of emotions. There are several reasons why social and civic competence was chosen. The first reason may be due to migration. Ekici (2019) stated that the Turkish society sees Syrian citizens as threatening the social structure, security, cultural

values, economy, and access to basic rights of the society. This idea may trigger attitudes towards citizenship. The second reason may be due to curriculum studies. Gurkan and Doganay (2020) reported that having inquiry skills and defending one's rights positively affect citizenship education. In Turkish science curricula, inquiry-based learning is a fundamental approach in science teaching, and argumentation is one of the best methods to engage in inquiry processes. In the lessons, students discuss socioscientific issues through the argumentation process. Therefore, this can influence attitudes towards citizenship. The third reason may be the socioeconomic living conditions in Turkey. This situation encourages even young people under the age of 18 to be interested in political issues. Duruhan and Sad (2011) found that Turkish students' perceptions of citizenship duties and rights are very high. Students follow political issues in a major way on social media platforms and participate in discussions through comments. This view is supported by the research result (Oz Dom & Bingol, 2021) that people who are interested in political issues through online platforms are more inclined to political issues.

The high tendency of secondary school students to choose the entrepreneurship competency area may be due to the programmes carried out by some public and private institutions/organisations and the related awards. For example, every year TUBITAK organises scientific research project competitions for secondary school students in 24 thematic areas, ranging from smart transportation vehicles to cyber security, and provides various support to the winners of these competitions. Similarly, secondary school students have the opportunity to win various prizes by participating in TEKNOFEST competitions in many fields, from unmanned underwater systems to environmental and energy technologies. These supports are an important source of motivation for both students and teachers, and participation in these competitions is highly valued in public and private schools. In the literature, government incentives are recognised as one of the main factors affecting entrepreneurship (Ali et al. 2019; Taha et al., 2017; Tiwari et al. 2020).

The activities within the scope of learning-to-learn competence at the festival were P4C activities. P4C activities provide individuals with the opportunity to practice skills such as asking questions, justifying explanations, reasoning, evaluating different opinions, which are also necessary when conducting scientific research (Isiklar & Abali-Ozturk, 2022). As explained in the previous paragraph, the interest and orientation of secondary school students towards research projects may have influenced their choice of P4C activities. In these activities, students engaged in a socratic question of the relationship between daily life and philosophy and human and environmental issues. The fact that content is important in encouraging students' participation in philosophy activities and that students tend to prefer activities related to daily life, as reported by Koc and Bahadir (2022), may also encourage secondary school students to choose these activities.

Another finding in the study is that there is a direct and significant relationship between high school education level and the choice of mathematics, science, and technology competency area and digital competence areas. The choice of these competency areas by high school students may be related to their career preferences. In various studies, it has been revealed that family and teacher are determinant factors in the choice of STEM career fields (Rafanan et al., 2020; Sahin & Waxman, 2021). Given that national curricula adopt the STEM approach, the teacher factor seems to lead students' choice of STEM competency area. In addition, high school students can also participate in the aforementioned public- or private-sector-sponsored scientific research project competitions. In addition, high school students can use the degrees they win in these competitions as additional points on the university entrance exam if they choose a department related to the field of competition. High school students may choose this competence area, as relevant competitions are mainly orientated toward STEM fields.

The last finding of the study reports the relationship between the socioeconomic level of the districts where students reside and their choice of competency area. Accordingly, students residing in the first and second level districts chose STEM competencies the most, while students

residing in the third and fourth level districts chose social and citizenship competency the most. Financial problems are one of the reasons why people do not pursue STEM career fields (Rafanan et al., 2020). For this reason, the finding that students residing in districts of high socioeconomic level chose the STEM competency area the most is consistent with other studies in the literature (Kizilay et al., 2019; Ro et al., 2021; Sovansopha, 2020). However, although it is stated in the literature that students with low socioeconomic status show lower cognitive, affective, and behavioural citizenship (Kim & Chung, 2020), the opposite finding was reached. This may be related to the high concentration of migrants in the country and the economic privileges granted to migrants, which are reported in national media.

Ensuring quality education for sustainable development is important to achieve other goals of sustainable development. The final conclusion of this study, which evaluates key competencies that play an important role in the achievement of quality education in a local context in Turkey, is that students' gender, socioeconomic status, and level of education affect their choice of competency areas. In other words, there are political, social, or economic reasons behind the choice of competence areas. Although the educational policies adopted by policy makers and the incentives they offer for this purpose seem to be successful in terms of students' and especially girls' orientation towards STEM fields, it is understood that they are not inclusive since only students from high socioeconomic level districts choose STEM competency fields. Furthermore, although national curricula (especially for middle and high schools) aim to raise individuals with key competencies, the result shows that the choice of competency areas differs according to the education level. The fact that middle school students are more likely to choose entrepreneurship, and high school students are more likely to choose STEM competency area shows that they make choices that are in line with the state-funded, in other words, adopted education policies. Therefore, it is recommended that countries implement practices that promote all areas of competence in their education policies and also include students in learning environments where competencies are taught directly and explicitly.

Another important result is that students' choices of competency area differed according to their gender. In this context, it is understood that students' competency area choices are compatible with the roles that society assigns to male and female individuals. In this context, male students, given the roles of having a job and leading the society, chose the communication and entrepreneurial competency areas, while news of the achievements of female scientists in the media led female students to choose the STEM competency area. Key competencies are gender neutral as they develop each individual's capacity to cope with the problems they face today and in the future. In other words, every individual, male or female, should have each of these competencies. Therefore, it is recommended that more efforts should be made to ensure gender equality in society and to eliminate gender differences, and both groups should be included in educational practices where they can progress in their chosen fields and develop in terms of other competencies.

The study also concluded that the socioeconomic level of the district in which students reside affects their choice of competency areas. This indicates that the choice of the competency area is based on economic reasons and points to problems in the inclusiveness of education. In this context, policy makers are recommended to strengthen the technical infrastructure of schools in disadvantaged areas and teachers to design learning activities that are suitable for different learning styles.

Quantitative data were used in this study. Researchers should conduct more studies to further elaborate on the students' knowledge and skills in each competency area. Teachers' knowledge, skills, and attitudes toward the relevant competencies can even be investigated to identify the reasons behind students' choices. Studies to be conducted in this field are believed to provide an opportunity to see where curricula need to be improved.

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## GENİŞLETİLMİŞ ÖZ

### Giriş

Sürdürülebilir Kalkınma için 2030 Gündemi, ülkelere mevcut ve gelecekteki sosyal, ekonomik ve çevresel zorlukların üstesinden gelmek için 17 evrensel hedeften oluşan bir yol haritası sunmaktadır (Birleşmiş Milletler [BM], 2015). Toplumsal cinsiyet eşitliğinden açlığın sona erdirilmesine kadar geniş bir yelpazede dünya sorunlarını ele alan bu hedeflerden biri de herkes için kapsayıcı ve kaliteli eğitim sağlamak ve yaşam boyu öğrenme becerilerini teşvik etmektir. Türkiye Yeterlilikler Çerçevesi kapsamında 2018 yılında yeniden düzenlenen müfredatlarda, Avrupa Anahtar Yetkinlikleri ile örtüşen sekiz temel yetkinliğin (anadilde iletişim, yabancı dilde iletişim, matematiksel yetkinlik ve bilim/teknolojide yetkinlik, dijital yetkinlik, öğrenmeyi öğrenme, sosyal ve vatandaşlık yetkinlikleri, girişim ve girişimcilik, kültürel farkındalık ve ifade) gerektirdiği bilgi, tutum ve becerilerle donatılmış kişilerin zorunlu eğitimden mezun olması hedeflenmektedir (Milli Eğitim Bakanlığı [MEB], 2018).

Gereççeli Eylem Teorisine göre, tutumlar alternatiflerin değerlendirilmesinde kilit rol oynamakta (Fishbein ve Ajzen, 1974) ve böylece seçimlere ve davranışlara rehberlik etmektedir (Sanbonmatsu vd., 2005). Buradan hareketle, bu çalışmada öğrencilerin katıldıkları bir bilim şenliğinde her biri özel bir anahtar yetkinlik kapsamında sınıflandırılan etkinliklere yönelik seçimler aracılığıyla onların anahtar yetkinliklere yönelik tutumlarının ortaya çıkarılması ve yaptıkları seçimlerin demografik ve bağlamsal bir takım değişkenlerle ilişkisinin incelenmesi amaçlanmaktadır.

### Yöntem

Bu çalışma tarama tasarımına sahiptir. Veriler tek bir zaman diliminde toplandığı için taramanın doğası kesitseldir (Fraenkel & Wallen, 2003).

Çalışma ilkokul, ortaokul ve lise düzeyinden 3570 öğrencinin katılımıyla gerçekleştirilmiştir. Katılımcılar cinsiyet açısından neredeyse eşit dağılmışlardır. Eğitim düzeyi açısından ise katılımcıların yaklaşık %77'si ortaokul öğrencisi, %16'sı ilkokul öğrencisi ve %7'si lise öğrencisidir. Ayrıca, katılımcılar çoğunlukla ikinci düzey sosyo-ekonomik gelişmişliğe sahip ilçelerde ikamet etmektedir.

Veriler, araştırmacı tarafından geliştirilen Katılımcı Bilgi Formu (KBF) kullanılarak toplanmıştır. KBF, demografik değişkenler açısından katılımcıların cinsiyet ve eğitim seviyelerini sorarken, bağlamsal sorular için festivali ziyaret etme nedenleri ve ikamet ettikleri ilçeler hakkında bilgi istemektedir. Veriler, hem doğrudan uygulama hem de çevrimiçi form aracılığıyla toplanmıştır.

İlk araştırma sorusunu yanıtlamak için tanımlayıcı istatistikler kullanılmıştır. İkinci ve üçüncü araştırma sorularını yanıtlamak içinse ki-kare bağımsızlık testi yapılmıştır.

### Sonuç ve Tartışma

İlk bulgu, temel yetkinliklerdeki genel eğilimi rapor etmiştir. Sonuç olarak, matematik, fen ve teknoloji alanındaki yetkinlik en çok seçilen yetkinlik alanı olmuştur. Bu durumun temel nedeni ulusal eğitim politikaları olarak yorumlanmıştır. STEM eğitimi Türkiye'de önemli görülmekte ve öğrencileri STEM faaliyetlerine dahil etmek için hem müfredatta hem de resmi kurumlar aracılığıyla çeşitli programlar yürütülmektedir. Coenen ve diğerleri (2021), STEM eğitimi tercihlerine odaklanan çalışmalarında, tercihlerden gerçek seçime geçerken bilişsel becerilerin kişisel özelliklerden daha belirleyici olduğunu bildirmiştir. İlk bulgu aynı zamanda dijital yetkinliğin en az seçilen yetkinlik alanı olduğunu bildirmektedir. Weber ve Custer'ın (2005) belirttiği gibi, öğrencilerin teknoloji eğitimi ilgi ve tercihlerinin bilim şenliğinde deneyimledikleri etkinliklerle tam olarak uyumlu olmaması bu bulguya neden olabilir.

İkinci bulgu, öğrencilerin cinsiyetlerinin yetkinlik alanı seçimleri üzerinde etkili olduğunu bildirmektedir. Sonuç olarak, kız öğrencilerin matematik, fen ve teknoloji alanlarındaki yetkinlikleri seçme olasılığı daha yüksektir. Bu durumun sebebi, son yıllarda medyada yer alan kadın bilim insanlarının başarıları olabilir. Buna göre, bir çalışmada, STEM alanlarında çalışan kendi etnik kökeninden ve cinsiyetinden kişilerle karşılaşmanın onlar için bir rol model görevi gördüğü ve onları da STEM alanlarını takip etmeye teşvik ettiği bildirilmiştir (Kricorian vd., 2020). Buna karşılık, erkek öğrencilerin anadilde iletişim, yabancı dilde iletişim, dijital yetkinlik ve girişimcilik yetkinlik alanlarını seçme olasılığı daha yüksektir. Erkeklerin hem anadilde hem de yabancı dilde iletişim yetkinliğini daha fazla seçmesi, ataerkil toplum düzeninin erkeklerin topluluk önünde konuşma konusundaki rahatlığını destekleyen normlarıyla ilgili olabileceği gibi, girişimcilik yetkinliğinin daha fazla seçilmesiyle de ilgili olabilir.

Üçüncü bulgu, eğitim seviyesi ile yetkinlik alanı seçimi arasında doğrudan ve anlamlı bir ilişki olduğunu bildirmektedir. Sonuç olarak, ilkökul öğrencilerinin yabancı dilde iletişim ile kültürel farkındalık ve ifade yetkinliği alanlarını seçme olasılığı daha yüksektir. İlkokul öğrencilerinin yabancı dil etkinliklerinde iletişim kurmaya istekli olmaları, İngilizceyi yabancı dil olarak öğrenen bu öğrencilerin henüz tam ve sağlam bir yabancı dil bilgisine sahip olmamalarından kaynaklanan düşük iletişim kaygısından kaynaklanıyor olabilir. İlkokul öğrencilerinin kültürel farkındalık ve ifade yetkinliği alanını seçmelerinin nedeni etkinlik türleriyle ilgili olabilir. Bu etkinlikler 7-9 yaş arası öğrenciler için cazip olabilir. Ortaokul öğrencileri de sosyal ve vatandaşlık, öğrenmeyi öğrenme ve girişimcilik becerileri alanlarını daha fazla seçme eğilimindedir. Bu bulgu, Duruhan ve Sad (2011) tarafından raporlanan Türk öğrencilerin vatandaşlık görevleri ve haklarına ilişkin algılarının çok yüksek olduğu bulgusuyla uyumludur. Ortaokul öğrencilerinin girişimcilik yetkinlik alanını seçme eğilimlerinin yüksek olması, bazı kamu ve özel kurum/kuruluşlar tarafından yürütülen programlardan ve ilgili ödüllerden kaynaklanıyor olabilir. Örneğin, TÜBİTAK her yıl ortaokul öğrencileri için bilimsel araştırma proje yarışmaları düzenlemektedir. Araştırmada elde edilen bir diğer bulgu da lise eğitim düzeyi ile matematik, fen ve teknoloji ve dijital yetkinlik alanlarının seçimi arasında doğrudan ve anlamlı bir ilişki olduğudur. Lise öğrencilerinin bu yetkinlik alanlarını seçmeleri kariyer tercihleri ile ilişkili olabilir. Çeşitli çalışmalarda, aile ve öğretmenin STEM kariyer alanlarının seçiminde belirleyici faktörler olduğu ortaya konmuştur (Rafanan vd., 2020; Sahin ve Waxman, 2021).

Araştırmanın son bulgusu, öğrencilerin ikamet ettikleri ilçelerin sosyoekonomik düzeyi ile seçtikleri yetkinlik alanı arasındaki ilişkiyi raporlamaktadır. Buna göre, birinci ve ikinci düzey ilçelerde ikamet eden öğrenciler en çok STEM yetkinliklerini seçerken, üçüncü ve dördüncü düzey ilçelerde ikamet eden öğrenciler en çok sosyal ve vatandaşlık yetkinliklerini seçmiştir. Sosyoekonomik düzeyi yüksek ilçelerde ikamet eden öğrencilerin en çok STEM yetkinlik alanını seçtiği bulgusu literatürdeki diğer çalışmalarla tutarlıdır (Kızılay vd., 2019; Ro vd., 2021; Sovansophal, 2020). Bununla birlikte, literatürde düşük sosyoekonomik statüye sahip öğrencilerin daha düşük bilişsel, duyuşsal ve davranışsal vatandaşlık gösterdiği belirtilmesine rağmen (Kim ve Chung, 2020), tam tersi bir bulguya ulaşılmıştır. Bu durum, ülkedeki yüksek göçmen yoğunluğu ve ulusal medyada yer alan göçmenlere tanınan ekonomik ayrıcalıklarla ilgili olabilir.

Kaliteli eğitime ulaşmada önemli rol oynayan temel yetkinliklerin Türkiye'de yerel bağlamda değerlendirildiği bu çalışmanın nihai sonucu, yetkinlik alanı seçimlerinin arkasında siyasi, sosyal veya ekonomik nedenlerin olduğudur. Siyasi nedenler bağlamında, ülkelerin eğitim politikalarında tüm yetkinlik alanlarını teşvik eden uygulamaları hayata geçirmeleri ve ayrıca öğrencileri yetkinliklerin doğrudan ve açık bir şekilde öğretildiği öğrenme ortamlarına dâhil etmeleri önerilmektedir. Sosyal nedenler bağlamında, toplumda cinsiyet eşitliğinin sağlanması ve cinsiyet farklılıklarının giderilmesi için daha fazla çaba gösterilmesi, her iki grubun da seçtikleri alanlarda ilerleyebilecekleri ve diğer yetkinlikler açısından geliştirebilecekleri eğitim uygulamalarına dahil edilmeleri önerilmektedir. Ekonomik nedenler bağlamında ise, politika

yapıcılara dezavantajlı bölgelerdeki okulların teknik altyapısını güçlendirmeleri ve öğretmenlere farklı öğrenme stillerine uygun öğrenme etkinlikleri tasarımları önerilmektedir.