Research Article

Journal of Innovative Research in Teacher Education, 5(3), 169-185,
ISSN: 2757-6116
http://www.jirte.org
DOI: 10.29329/jirte.2024.669.2
Received: 24/10/2024
Revised: 04/12/2024
Accepted: 10/12/2024

This is an open-access article under the CC BY-NC-ND license
https://creativecommons.org/licenses/by-nc-nd/4.0/

The spatial thinking abilities and synchronic thinking skills of undergraduates in history, geography, and social studies education*

Pelin İskender Kılıç[1], and Nevin Özdemir[2]

Abstract

The study aimed to examine the spatial thinking abilities and synchronic thinking skills of undergraduate history, geography, and social studies education students in the context of specialization field, grade level, and gender variables. This study is a quantitative case study in the general screening model. The study population consisted of students from the geography and history departments of the Faculty of Humanities and Social Sciences and the social studies education department of the Faculty of Education at a university in Türkiye. The study sample, conducted in the general screening model, consisted of 269 undergraduates. The first part of the questionnaire form used as the data collection tool in the study included questions about the participants' demographic information. The second part included the Turkish version of the 16-item Spatial Thinking Ability Test (STAT), and the third part of the questionnaire form included the 18-item Synchronic Thinking Skills Test (STST). The total scores obtained from the scales were used to interpret the data. It was determined that there was no statistically significant difference in the MDBT scores according to the field of study variable. In contrast, the SDBT scores showed an essential difference between the groups according to the field of study variable. It was understood that there was a significant difference in the MDBT scores between the groups according to the gender variable. Still, there was no significant difference in the SDBT scores between the groups.

Keywords: Spatial thinking ability, Synchronic Thinking Skill, history, geography, social studies, undergraduates

Cite: İskender-Kılıç, P., & Özdemir, N (2024). The spatial thinking abilities and synchronic thinking skills of undergraduates in history, geography, and social studies education. *Journal of Innovative Research in Teacher Education, 5*(3), 169-185. https://doi.org/10.29329/jirte.2024.669.2

* Ethics committee approval was obtained at the meeting of Ondokuz Mayıs University Social Sciences and Humanities Research Ethics Committee dated 31.12.2021 with 12 sessions.

[1] Ondokuz Mayıs University, Faculty of Education, Department of Turkish and Social Sciences Education, Türkiye, pelini@omu.edu.tr.

[2] Ondokuz Mayıs University, Faculty of Education, Department of Turkish and Social Sciences Education, Türkiye, nevino@omu.edu.tr.

©The Author(s). This is an open-access article under the **CC BY-NC-ND** license https://creativecommons.org/licenses/by-nc-nd/4.0/. The authors agree that the text, figures, and documents in the article do not violate the copyrights of third parties and that the publisher is not responsible for any claim or lawsuit by third parties due to copyright infringement. The authors declare that the publisher is not responsible for the article's content and that all responsibility for the article belongs to the authors.

INTRODUCTION

The most important common element of Geography, Social Studies, and History lessons is the concepts of time and space. In the science of Geography, space and the relationship between humans and space are essential. Human geography, geography of population, and cultural geography are closely related to space. Geography is a science that complements the science of history in many ways. While teaching history, the subject of which is the events that have occurred in the past and that affect societies, geography, and, precisely, space, the characteristics of this space make history concrete. Space has influenced historical events, more or less, but beyond a doubt. In classifying historical subjects, classification according to space is extremely important in understanding the topic, establishing connections between events, and teaching synchronously. This is because events that occur at the same and in similar spaces within the same period and different spaces within the same period may differ. For example, while the developments and events that took place in other societies in Central Asia in the Middle Ages may be similar, the developments and events that took place in different societies and states in Europe within the same age may show apparent differences when compared with the societies and states of Central Asia.

Although it is said that it is impossible to teach history well without geography, this rarely happens, and it is usually limited to looking at a map and trying to understand "where the historical event took place" (Boehm, Saxe, & Rutherford, 2003). However, history is not even utilized to this extent in geography teaching. Social studies course is a lesson that combines the knowledge produced by many fields of science, such as anthropology, archaeology, geography, economics, law, psychology, politics, sociology, and history, with its interdisciplinary structure. History and geography constitute the most significant part of the social studies curriculum. With a multidisciplinary approach, scientists make sense of subjects they cannot understand within their disciplines; they fill in the gaps and clarify the subjects. History and geography curricula have been changed and renewed several times from the Statute on General Education that came into force in 1869 until today. In the curricula of social studies, history, and geography lessons published in 2005 and 2018, spatial thinking, chronological thinking, and synchronic thinking abilities were included for more effective learning. Spatial thinking, chronological thinking, and synchronic thinking abilities are also included in the curriculum, which will be implemented gradually starting from the 2024-2025 academic year (The Century of Türkiye Education Model). There are many studies on spatial and chronological thinking in national and international literature. However, studies on synchronic thinking abilities are limited, especially in geography.

Spatial Thinking Ability (STA)

The concept of ability is widely used in every field and stage of education. In general, it is defined as "using knowledge" and "problem-solving," which require the ability to perform any activity continuously at a certain level of competence, to use logical, intuitive, and creative thinking skills and hand skills, methods, materials, tools and equipment acquired in a field of study or learning (Paykoç, 1991). Space, place, and spatiality are important in the academic fields of geography, history, and social studies education (Yayla, 2019). In its simplest form, space can be defined as where an individual or group is located (Merç, 2017). The ability with the strongest innate foundations is Spatial Thinking Ability (STA). This may be one of the reasons STA is the basis of other thinking abilities, such as chronological thinking ability and synchronic thinking ability (Kızıl, 2021). Immanuel Kant is one of the names that comes to mind first when the concepts of time and space are mentioned together. Kant rejects any view that suggests space and time have an absolute reality, which attributes space and time to objects as a characteristic (Akarsu, 1963; Kızıl, 2021; Öktem, 2000). Each event should be evaluated separately within time, space, and conditions. Even if a comparison is made by including the conditions, the results will still be problematic (Erdoğdu, 2021). Immanuel Kant argues that history and geography cannot be classified together with various learning areas: while geography is based on a spatial approach with the study of the World or the earth in general, history is based on a chronological approach by examining social events that occur over time (Tümertekin & Özgüç, 2017; Yayla, 2019). Spatial thinking ability is

recognizing spatial concepts and patterns, using the necessary symbols and presentation tools to represent spatial data, and questioning and reasoning about or with spatial data or events (NRC, 2006). It has also been defined as the process of coding the knowledge, experiences, and skills individuals acquire in space throughout their lives in their minds and using these skills and knowledge in their minds in different spaces (Köşker, 2012) as a cognitive skill that can be used to identify and find answers to problems in daily life, workplace, and science and to find solutions by using the characteristics of space (Gönülaçar, 2019; Serinci & Özdemir, 2022); and as a competence that individuals will need in their lives to recognize and understand the world and to perceive space correctly (Yiğit & Karatekin, 2021). In short, spatial thinking ability is the ability to solve problems related to geospatial thinking and reasoning (Golledge, Marsh, & Battersby, 2008). Spatial thinking consists of three structurally interrelated components. These are the concept of space, representational tools (symbols), and reasoning process. Individuals need spatial abilities to conceptualize skills, understand signs or symbols, and reason spatially (NRC, 2006). Reading a map, interpreting a diagram, and understanding the spatial distribution of a phenomenon or the relationship and events are tasks based on the mental ability called spatial thinking (Bednarz & Lee, 2011; Charcharos, Kokla, & Tomai, 2015). National Research Council (NRC) has addressed spatial thinking in three contexts: living space, physical space, and mental space. Spatial thinking is also defined as knowledge, tools, skills, and mental habits. What gives spatial thinking its versatility and applicability is precisely the connection between these three (NRC, 2006). Lee and Bednarz (2005) defined spatial thinking as a constructive combination of the three components that support each other. These are the nature of space, methods of representing spatial knowledge, and spatial reasoning processes (Serinci, 2022). Spatial skills should be used to interpret pictures and visuals in history, geography, social studies textbooks, and STEM disciplines (Serinci & Özdemir, 2022; Sorby, Veurink & Streiner, 2018; Uttal & Cohen, 2012).

Geography, whose main field of study is space and which deals with the complex network of relationships formed as a result of the interaction between humans and space, has assumed an important role in defining space and approaching the world when compared with other disciplines (Sönmez & Akbaş, 2019). For this reason, space has become the main subject of geography discipline. When geography curricula are examined, it can be seen that one of their main objectives is developing spatial thinking ability in students (Ministry of National Education [MoNE], 2005, 2018, 2024). Understanding geographical processes (the formation, development, and interaction of physical and human elements that determine the structure of a place), interpreting geographical patterns/structures through direct observation or representation tools, and analyzing the interaction between humans and the environment are the essential pursuits of geography, and all of these are based on spatial thinking (Serinci & Özdemir, 2022; Sönmez & Akbaş, 2019; Şanlı & Sezer, 2019). Those working in the science of geography are particularly interested in what psychologists know about the development of brain structures and connections involved in what NRC (2006) calls spatial thinking at geographical scales, thinking about locations, characteristics of places, and relationships between places (Gersmehl & Gersmehl, 2007). It can be seen that with spatial thinking abilities, individuals can think more effectively about the concepts of location, space, place, and direction. In this sense, spatial thinking ability is an important element of geography education (Gençtürk, 2009; Kim, 2011; Yayla, 2019). Gersmehl and Gersmehl (2007) defined spatial thinking as the ability geographers use to analyze spatial relationships in the world. In this sense, for geographers, spatial thinking has meanings such as defining a location, defining conditions (the concept of geographical area), tracing spatial connections (situation), making a spatial comparison, extracting a spatial aura (effect), limiting a region, placing a space within it, a spatial hierarchy, drawing the graph of a spatial transition, determining a spatial analog, distinguishing between spatial patterns, evaluating a spatial relationship, designing and using a spatial model and mapping spatial exceptions (Gersmehl & Gersmehl, 2007).

Since history deals with events within the context of time and space, it should be considered that the characteristics of geography also affect historical events (Dinç, 2013). This is because space significantly shapes history's political events and cultural developments. For this reason, historical events and cultural

developments are mainly categorized according to space. Especially the subjects of culture and civilization are usually categorized according to space (Mesopotamian civilization, Iranian civilization, Egyptian civilization, Mediterranean civilization, Central Asian Steppe civilization, etc.). Therefore, to comprehend historical events, it is necessary to know the space's characteristics at the event's center. In the past, as well as today, people made decisions by considering the conditions of the space (Çalık, 2022). Students having concrete information about the places where events occur significantly affects their perceptions of these spaces' importance (Öztürk, 2010). At the same time, while telling abstract historical events, spatial patterns that change in the temporal process can enable the dynamic structure of time (Kızıl, 2021). For this reason, the ability to perceive space, one of the basic skills gained within history lessons, has been emphasized in the regulations made within the context of the history curriculum (MoNE, 2005, 2018, 2024). Curriculum renewal studies listed the general and historical skills related to history lessons, and the ability to perceive space was associated with the ability to use maps and included general skills (Aydoğan, 2020; Bircan & Safran, 2013). First, for students to acquire this ability, they need to realize where the events occur and visualize the historical space in their minds. For this purpose, it is important to frequently use the methods, techniques, and presentation tools (organizing trips to the place where events take place, maps, photographs, pictures, cartoons, documents, newspapers, engravings, etc.) that will concretize the historical information taught and make learning permanent. This will contribute to students' developing skills to perceive space, visualize the historical space in mind, and understand and interpret history. The abstract event in the mind that was experienced in the past will become concrete (Bircan & Safran, 2013; Çalık, 2022; Demiralp, 2006; Işık, 2014; Taş, 2006).

Understanding spatial relationships begins in the first years of human life, and this period is of great importance for developing children's brain structures and spatial reasoning functions (Gersmehl & Gersmehl, 2007). Primary and secondary schools are important in providing children with spatial perception (Ablak & Aksoy, 2018). Teaching subjects related to perceiving space in a systematic and analytical structure in the secondary school period is generally included within the scope of social studies lessons (Gönülaçar & Öztürk, 2020; Sönmez, 2010). When the content of social studies lessons is examined, it can include subjects of many social sciences disciplines, especially history and geography. Likewise, the objectives expressed in the curriculum include an emphasis on developing the skill of perceiving space in students to recognize their environment, country, and the world, in other words, developing spatial thinking ability (MoNE, 2005, 2018). Students are expected to gain behaviors such as map literacy, location analysis, seeing a shape in 3D, knowledge of plans, sketches, diagrams, graphs and interpreting these, using globe, observation, perceiving changes and continuity, understanding the place and importance of our country in the world and benefiting from these (Ablak & Aksoy, 2018; Kızıl, 2021; Safi, 2010; Sönmez & Akbaş, 2019; Taş, 2008). Spatial thinking ability was first included in the social sciences curriculum (SSC) in 2005. Later, spatial perception ability was included among the special objectives in the 2018 SSC and, in 2024, The Century of Türkiye Education Model (MoNE, 2018, 2024). Its interdisciplinary structure, geography, and history constitute most subjects and outcomes in social studies lessons. Spatial thinking ability is of great importance in subjects that cover the fields of study in these two disciplines. This ability consists of three components: spatial concepts, representation tools, and cognitive processes (NRC, 2006; Jo & Bednarz, 2014; Şanlı, 2019; Çalık, 2022). As their ability to perceive spaces develops, students realize that there are also places outside the area where they live. They learn that separate places have similar and different characteristics, how this affects human activities, the interdependence of places that are far from each other, and the relationship of these with physical and humane processes (Demircioğlu & Akengin, 2012; Ablak & Aksoy, 2018). Map reading skills, one of the skills that the Social Studies Curriculum attaches importance to, are among the most important indicators of being able to perceive and construct space (Gönülaçar, 2019). In addition, the ability to interpret by organizing the information and perspectives of time and place is also important for research skills based on historical inquiry in the teaching and learning history subjects in the Social Studies Curriculum (Bayramoğlu, 2016).

Synchronic Thinking Skill (STS)

One dimension of spatial thinking ability is related to time because space inevitably changes more or less as time progresses. Synchronic thinking skill is the dimension of space related to time, and it is a skill that emerges from the observations of humans related to natural processes in nature (Kızıl & Dönmez, 2020). What exists is the motion in space; time is an artificial phenomenon derived from this motion (Kızıl, 2021). Synchronic thinking skills are among the abilities required to make more effective and more accurate interpretations, analyses, syntheses, and evaluations in the science of history. The ability to perceive change and continuity involves distinguishing between the similarities and differences of different places. It aims to develop the ability to perceive change or continuity that occurs in a place over time (MoNE, 2005). Thus, the ability to perceive change and continuity contributes to students' ability to predict the future by looking at the mobility from the past to the present (Gönülaçar, 2019). Unlike chronological thinking, synchronic thinking reveals the evaluations of time-spatial situations of events that occur in the flow of more than one place or theme. This thinking ability enables the evaluation of underlying themes in historical events and phenomena within a context (Kızıl & Dönmez, 2020).

In Turkish historical research, which has a large spatial and temporal hinterland, historical time is critical in historiography in classifying past events, determining their relationships with each other, ensuring their semantic integrity, monitoring changes in problems, events, and understanding these, making comparisons between periods and eras and drawing accurate conclusions. In addition to linear integrity, cultural, personal, social conditions, and regional characteristics determine the historical time (Dilek, 2002; Safran & Şimşek, 2009). In the science of history, events are arranged in a particular order according to the principle of chronological succession and addressed in a time context. For this reason, teaching historical chronology is important in teaching history (Safran & Şimşek, 2009; Işık, 2014; Yelkenci, 2022). Synchronology is an indispensable link between chronology and history. However, methods can be tested, and results can be produced synchronically (Pollard, 1940). When history teaching programs are examined, it can be seen that one of the aims of history teaching is developing the chronology knowledge of students (MoNE, 2005, 2018, 2024). Globalization, developments in historical research and analysis methods, and technological conveniences in accessing sources have led to the expansion of political and cultural areas and areas related to civilization researched by historians. As a result of this, historical narrative has expanded in terms of spatial relationships across the region and the world and has necessitated a synchronic narrative (Tütüncü & Ünal, 2019). As in many dimensions of historical thinking, spatial representation is important in a synchronic process of thinking based on place and space. The success of spatial representation systems in visualizing the relationships between time and space feeds this importance (Kızıl, 2021). Wilschut (2012) discussed historical times in six basic concepts: chronology, periodization, relics, anachronism, contingency, and generations. He focused on the ability to show past events on a timeline and to periodize these. Students must think synchronically about different historical processes and spaces by comparing historical events and phenomena. Students should be able to compare historical events and phenomena or periods and eras to develop historical time skills. This requires the acquisition of synchronic thinking ability rather than the knowledge of a simple chronology (Dönmez & Oruç, 2006). Synchronized thinking ability facilitates the understanding of two different events that co-occurred in history. This ability helps students learn about historical events that occurred in their own country, the world, or other societies in a comparative way (Şimşek, 2006). A synchronic perspective compares the events and phenomena that co-occur in different geographies. It is an important thinking ability regarding historical thinking skills since it enables comparisons and analyses by establishing cause-and-effect relationships between events (Kızıl & Dönmez, 2020). Herbart associated history teaching with geography teaching. It was emphasized that after discussing a place's geography, the past could be covered with the help of old maps. An emphasis was also made on connecting with history in geography teaching (Kızıl, 2021). While analyzing Turkish history, which has a large temporal and spatial hinterland, it is impossible not to touch on the history of other nations that have spread across the many regions of the world. It can be seen that Şimşek (2006) perceived simultaneity as a simultaneousness in conventional time and considered it among chronological skills. According to this understanding, it is possible to mention the simultaneity of events

that co-occur in the metric system of absolute time (Kızıl & Dönmez, 2020). Herbart also emphasized the importance of visual materials, history timelines, and maps when teaching history. In particular, he considered history timelines to be effective in terms of showing the developments in other countries both chronologically and synchronically. In this regard, Strass's *The Stream of Time* is important in showing countries' synchronic development and change over time (Ata, 2009). In Türkiye, in the report submitted to the Secretariat of the Council, the History Teaching Commission suggested that the Ministry of Education prepare "Synchronic History Tables" as a supportive tool for history teaching to save students from memorizing historical information (Ata, 2008).

A synchronic perspective can also be used to analyze events and phenomena that co-occur in different geographies or have similar stages of development despite differences in time and space (Hroch, 2011). For example, many societies living in different regions or continents, even those unaware of each other in ancient times, established a state organization and made similar war equipment. Therefore, synchronic thinking abilities are necessary for students to fully understand the concept of historical time in history teaching because it provides an adequate comprehension of two different events that occurred at the same time in history and provides the ability to analyze and synthesize by moving students away from rote history learning. In this sense, students can evaluate historical events and phenomena in a context with the underlying elements (Kızıl & Dönmez, 2020). This helps students to learn about historical events that have occurred both in their region and country and other societies around the world more permanently in a comparative way (Şimşek, 2006). Likewise, if visual representations such as maps, historical timelines, tables, pictures, and photos are used synchronously in integrity, the relationship between historical events will become concrete and will provide significant advantages to learning the subjects (Bircan & Safran, 2013; Dönmez & Oruç, 2006). As in history, the basic concepts emphasized the most while teaching the events that have occurred and the changes in space developments are time, chronology, change, and continuity (Ablak & Aksoy, 2021; Özen & Sağlam, 2010). These are included in the social studies curricula to help students gain the skills of establishing cause-and-effect relationships and analyzing and synthesizing (Akbaba, Keçe, & Erdem, 2012). It has also been stated that synchronic history timelines are important in developing time and chronology concepts in children for social studies lessons (Harms & Lettow, 2007).

The study examines the spatial and synchronic thinking abilities of undergraduate history, geography, and social studies teaching students within the context of specialization, year of study, and gender variables. Problems of the study are:
1- How are the spatial thinking ability test (STAT) and synchronic thinking skill test (STST) scores of undergraduates who participated in the study?
2- Do participants' STAT and STST scores show significant differences according to gender, learning field, and grade level demographic variables?
3- How do STST and STAT scores correlate?

METHOD

Research Design

This study is a qualitative case study with a general survey model. A general scanning model is a scanning made on the whole or a sample of the universe to reach a general judgment about the universe in a universe consisting of many elements (Karasar, 2006). Describing is the first step in understanding and explaining events, objects, and problems. For the study, the current status of the study sample's spatial and synchronic thinking skills was described.

Participants and Procedure

The study population consists of students in the geography and history department of the Faculty of Humanities and Social Sciences of a university in Türkiye and the students in the social studies teaching department of the same university during the 2021-2022 academic year. The study sample consisted of

269 students in these departments' first and fourth years who volunteered to respond to data collection tools. As can be seen in Table 1, 31% (n=84) of the sample were students in the geography department, while 34% (n=90) were history department students and 35% (n=35) were social studies department students. Of the total sample, 56% (n=151) were female, while 44% (n=118) were male and 49% (n=133) were first-year students, 51% (n=136) were fourth-year students (Table 1).

Table 1. Demographic Characteristics of the Study Sample

		Gender		Grade Level		
Field of study	**F/%**	**Female**	**Male**	**1st grade**	**4nd grade**	**Total**
Geography	n	49	35	43	41	84
	%	*58*	*42*	*51*	*49*	*31*
History	n	41	49	45	45	90
	%	*46*	*54*	*50*	*50*	*34*
Social Studies Teaching	n	61	34	45	50	95
	%	*64*	*36*	*47*	*53*	*35*
Total	n	151	118	133	136	269
	%	*56*	*44*	*49*	*51*	*100*

Measures

Data collection instruments include the Turkish form of the Spatial Thinking Ability Test (STAT), which was prepared by (Lee & Bednarz, 2009) and which was administered by The American Association of Geographers, and the Synchronic Thinking Skill Test (STST), which was developed by Kızıl (2021). Bednarz and Lee (2011) reported that the Cronbach Alpha reliability coefficient of the 16-question multiple choice original STAT was 0.72. Kızıl (2021) and Serinci (2022) adapted STAT into Turkish and conducted the validity and reliability studies. Kızıl (2021) reported the KR 20 reliability coefficient of STAT as 0.75 and Serinci (2022) as 0.71. In the present study, the KR 20 value of the 16-question-item STAT was 0.69.

Kızıl (2021) reported that the STST questions were prepared to be answered with the cognitive performance of the respondents by limiting the effect of prior knowledge about history on the test results. The researcher stated that the questions in STST represented a five-dimensional structure called cognitive processes (matching, placement, etc.), the ability to use a synchronic historical timeline, the ability to establish a data connection between map and synchronic timeline, representation of the data extracted from verbal explanations on the synchronic historical timeline, and spatiotemporal thinking ability. Kızıl (2021) reported that the 18-question multiple choice STAT had a KR-20 reliability coefficient of 0.78. In the present study, the KR-20 reliability coefficient of STST was 0.72.

Data Analysis

The data was interpreted based on the total scores obtained from the scales. Since the correct answers in both scales were coded as 1 and incorrect answers as 0 in the data file, the maximum possible score of STAT is 16, while the maximum possible score of STST is 18. The normality of STAT and STST data was decided by analyzing Skewness and Kurtosis values of scale scores and Q-Q plot graphical analyses. As a result of these analyses, it was decided that the data were normally distributed and parametric tests should be used to analyze research questions related to demographic variables. The study data were tested descriptively using a t-test, one-way ANOVA, and Pearson correlation analyses.

FINDINGS

1. Descriptive analysis of STAT and STST scores

Table 2 shows the descriptive analysis of STAT and STST scores. Only one of the study participants could answer 14 questions correctly out of 16 questions in STAT, and eight students could not answer any

questions correctly. The STAT average was found to be 6.30. Two students could answer a maximum of 16 out of 18 questions in STST, and four could not answer any questions correctly. The STST average was found to be 8.77.

Table 2. Descriptive Analysis of STAT and STST Scores

Scores	N	Min.	Max.	$\bar{x}$	SE	Σ	σ^2	Skewness	SE	Kurtosis	SE
STST	269	.00	16.00	8.77	.2030	3.3307	11.09	-.154	.149	-.404	.296
STAT	269	.00	14.00	6.30	.1845	3.0266	9.16	.003	.149	-.596	.296

2. Analysis of STAT and STST scores according to demographic variables

It was analyzed with parametric tests to determine whether there were any significant differences between the groups based on the variables of the field of study, gender, and grade levels.

As seen in Table 3, the STST scores of the undergraduate students who participated in the study according to the field of study were listed from highest to lowest in social studies education (n= 95, $\bar{X}$= 8.87), history (n= 90, $\bar{X}$= 8.74), and geography (n= 84, $\bar{X}$= 8.70). The one-way ANOVA analysis showed that the difference between the groups was not statistically significant [$F_{(2, 266)}$ = .07; p = .94]. In contrast, STAT scores were ranked as geography (n= 84, $\bar{X}$= 7.96), social studies education (n= 95, $\bar{X}$= 6.14), and history (n= 90, $\bar{X}$= 4.93) groups, and the difference between the groups was statistically significant. [$F_{(2, 266)}$ = 26.14; p = .00].

Table 3. The One-Way ANOVA Results By Field Of Study (geography: G;

Scores	Groups	*N*	$\bar{X}$	*ss*	Source of variation	SS	Df	MS	*F*	*p*
STST	**G**	84	8.70	3.218	Between Groups	1.451	2	.726		
	H	90	8.74	3.377	Within Groups	2975.2	266	11.18	.07	.94
	SSE	95	8.87	3.421	Total	2976.6	268			
	Total	269	8.78	3.332						
STAT	**Groups**	***N***	$\bar{X}$	***ss***	**Source of variation**	**SS**	**Df**	**MS**	***F***	*p*
	G	84	7.96	2.800	Between Groups	403.29	2	201.64		
	H	90	4.93	2.913	Within Groups	2051.7	266	7.71	26.14	.00*
	SSE	95	6.14	2.619	Total	2455.0	268			
	Total	269	6.30	3.026						

*$p \leq 0.05$; G= geography, H= history, SCE=social studies education

As seen in Table 4, the mean STST scores of males (n= 118, $\bar{X}$=9.58) were higher than the mean scores of females (n= 151, $\bar{X}$=8.15). The difference between the scores of the two groups was found to be statistically significant ($t_{(267)}$ = -3.494, p=.00). On the other hand, it was determined that the average STAT scores of males ($\bar{X}$=6.38) were higher than the average of women ($\bar{X}$=6.25). However, there was no significant difference in test scores by gender ($t_{(267)}$ = -3.66, p= .72).

When the test scores were evaluated separately according to the departments, it was seen that in the geography group (n=84), the average STAT scores of the males (n=35, $\bar{X}$=8.67) were higher than the averages of the females (n=49, $\bar{X}$=7.47), and the difference between the groups was found to be statistically significant ($t_{(82)}$ = -1.948, p= .049); in the history group (n=90), the average STST scores of the males (n=49, $\bar{X}$=9.65) were higher than the females (n=41, $\bar{X}$=7.66), and the result was statistically significant ($t_{(88)}$ = -2.904, p= .003); On the other hand, no significant difference was found in both STST and STAT scores of the social studies teacher candidates according to gender.

Table 4. The t- Test Results by Gender

Groups	Scores	Gender	*N*	$\bar{X}$	*Ss*	*T*	*df*	*P*
Geography	**STST**	**Female**	49	8.20	2.761	-1.698	82	.093
		Male	35	9.40	3.695			
	STAT	**Female**	49	7.47	2.894	-1.948	82	.049*
		Male	35	8.66	2.543			
History	**STST**	**Female**	41	7.66	2.465	-2.904	88	.003*

	STAT	**Male**	49	9.65	3.772			
		Female	41	5.00	2.774	.197	88	.843
		Male	49	4.88	3.052			
Social studies education	**STST**	**Female**	61	8.43	3.293	-1.725	93	.096
		Male	34	9.68	3.548			
	STAT	**Female**	61	6.10	2.534	-.191	93	.854
		Male	34	6.21	2.804			
Total	**STST**	**Female**	151	8.15	2.915	-3.494	267	.00*
		Male	118	9.58	3.656			
	STAT	**Female**	151	6.25	2.868	-3.66	267	.72
		Male	118	6.38	3.228			

When the test scores of the total sample were evaluated, it was determined that the mean STST scores of the first graders (n=133, $\bar{X}$= 9.00) were slightly higher than the mean of the fourth graders (n=136, $\bar{X}$= 8.56). This difference was not found to be statistically significant ($t_{(267)}$ = 1.086, p=.28). Regarding STAT scores, the mean of the fourth graders (n= 136, $\bar{X}$= 6.60) was slightly higher than that of the first graders (n=133, $\bar{X}$=6.00). This difference was not statistically significant ($t_{(267)}$ = -1.639, p=.10). When the grade level variable was examined according to departments, it was seen that the mean STAT scores of the fourth-grade geography students (n= 41, $\bar{X}$=8.73) were higher than the mean of the first-grade geography students (n= 43, $\bar{X}$=7.23) and the difference between the scores of the two groups was statistically significant ($t_{(82)}$ = -2.531, p=.013). No significant difference was found in the test scores of the history and social studies groups according to grade level (Table 5).

Table 5. The t- Test Results by Grade Level

Groups	**Scores**	**Grade**	***N***	***X̄***	***Ss***	***T***	***Df***	***P***
Geography	**STST**	**1st grade**	43	8.77	3.524	.189	82	.851
		4nd grade	41	8.63	2.904			
	STAT	**1st grade**	43	7.23	2.793	-2.531	82	.013*
		4nd grade	41	8.73	2.627			
History	**STST**	**1st grade**	45	8.67	3.444	-.217	88	.828
		4nd grade	45	8.82	3.345			
	STAT	**1st grade**	45	4.67	3.176	-.867	88	.388
		4nd grade	45	5.20	2.633			
Social studies education	**STST**	**1st grade**	45	9.56	3.064	1.867	93	.065
		4nd grade	50	8.26	3.635			
	STAT	**1st grade**	45	6.16	2.142	.066	93	.948
		4nd grade	50	6.12	3.007			
Total	**STST**	**1st grade**	133	9.00	3.346	1.086	267	,28
		4nd grade	136	8.56	3.317			
	STAT	**1st grade**	133	6.00	2.912	-1.639	267	,10
		4nd grade	136	6.60	3.115			

As seen in Table 6, a moderately positive significant relationship was found between the STST scores and STAT scores of the sample (r= .403, p<.01). This result explains that if the STST scores of the students participating in the study are high, their STAT scores will also be high, or if their STAT scores are high, their STST scores will also be high.

Table 6. Pearson correlation analysis between STAT and STST scores (N= 269)

		STST	**STAT**
STST	Pearson Correlation	1	.403**
	p		.000
STAT	Pearson Correlation	.403**	1
	p	.000	

**= p<.01

DISCUSSION AND CONCLUSION

There are many studies in the literature on spatial thinking in different fields, especially from the 1980s to the present day. However, the number of studies conducted on synchronic thinking ability is limited. This ability has mainly been discussed with chronological thinking ability or comparative method. For this reason, there are very few studies on the synchronic approach, mainly on geography and history (Ata, 2009; Safran & Şimşek, 2009; Şimşek, 2006; Safran, 2002). When teaching programs are examined in detail, it can be seen that synchronic thinking ability has been discussed superficially, and there is almost no content or methods that will require or develop synchronic ability in students in terms of content and method. However, synchronic thinking ability is closely related to chronological thinking and spatial thinking abilities. There is an important gap in the literature on this subject. It is thought that the present study will contribute to the literature.

It was found that the mean STAT score of undergraduate history, geography, and social studies students who participated in the study was 6.30 out of 16. The mean STST score of the students was found to be 8.77 out of 18. Similarly, Bednarz and Lee (2011), who conducted a study on university students, found the mean STAT to be 10.7 correct answers out of 16 questions. In their study on high school students, Serinci and Özdemir (2022) found a mean of 7.6 correct answers. In a study conducted on secondary school students in China, Xie et al. (2022) found a mean of 11.67 correct answers. Therefore, the results of the current study are parallel with those of other studies. In addition, the research findings show that the variables of department, gender, and year of study create statistically significant differences in total and sub-dimension scores of spatial thinking ability.

Green and Green (2003) stated that spatial thinking affects the perception of time. While examining the various dimensions of the spatial history of the region that was the subject of their research, they stated that locations and events could not occur historically at the same time and that time was spatialized. Jo, Bednarz, and Metoyer (2010) noted that spatial thinking is an essential geographical skill that can and should be developed in schools. They also stated that one of the ways geography teachers could develop students' spatial thinking ability was to ask questions that stimulate their spatial thinking. In a study conducted by Safi (2010) in which the opinions of teachers on the development of spatial thinking ability were taken, teachers stated that the most effective method in developing spatial perception skills was learning by doing and experiencing and that especially trips and observation studies contributed positively to the development of skills. Zwartjes (2012) stated that spatial thinking is a part of daily life and that research shows there should be a fixed value in education in addition to others, such as linguistic and mathematical thinking. He also stated that it is essential in geography teaching. Bircan (2015) found that technology-assisted history teaching positively affected students' spatial perceptions. Charcharos, Kokla, and Tomai (2016) found a close relationship between spatial thinking and problem-solving in a study examining the relationship between children's spatial thinking and problem-solving skills. Ablak and Aksoy (2018) conducted a qualitative study on the spatial perception ability of 8th graders. As a result of this study, they concluded that maps are an important tool in individuals' perception of their environment, and using digital tools and equipment effectively makes the permanence of subjects concrete. Kızıl (2021) conducted a study on teaching Turkish Revolution History and Kemalism course subjects with a synchronic approach within the context of chronological and spatial thinking ability. It was found that the application of the synchronic approach in the course significantly affected the development of synchronic and spatial thinking abilities. Yiğit and Karatekin (2021) concluded that orienteering practices effectively developed students' spatial thinking ability in social studies lessons. In a study examining daily spatial thinking ability, Ishikawa (2021) examined why some individuals had difficulties with this ability and how these individuals could be helped. First, he discussed the characteristics of human spatial cognition, behavior, and spatial cognition. He emphasized major individual differences in cognitive mapping ability. He discussed using maps and the possibilities of improving cognitive mapping skills.

When evaluated in terms of the department, the difference was found between the STAT scores of departments, and it was found that geography department students had the highest scores. In contrast, the history department had the lowest scores. No difference was found between the STST scores of departments.

When the results were evaluated in terms of gender, it was found that male students had higher mean STAT scores than female students. A statistically significant difference was found between the two groups. Male students in the geography department were found to have higher mean scores, and a significant difference was found. Regarding STST scores, male students were found to have higher mean scores than female students, while no statistically significant difference was found between the two groups. Male students were found to have higher mean scores in the history department, and the result was significant.

Since the early 20th century, the effects of gender on spatial thinking have become an important field of research. Gilmartin and Patton (1984) compared genders regarding spatial ability based on their map-using skills. They stated that psychologists' previous studies concluded that men were more skilled in many spatial tasks. They also stated in their study that map-using scores were almost the same for male and female university students. These results show that psychologists' findings on gender-based developmental patterns in spatial abilities cannot be directly transferred to geography. Newcombe and Stieff (2012) reported that there were studies that showed that spatial abilities could be improved to a great extent for both men and women through education. Korkmaz and Tekin (2020) discussed the spatial thinking ability of prospective preschool teachers in terms of different variables. No statistically significant difference was found between the mean scores of male and female preschool teachers. Şanlı and Jo (2020) found that explicit teaching of spatial concepts, spatial thinking, spatial thinking in geography, use of spatial representations and technology, teaching thinking skills, and total mean scores of prospective geography teachers did not show significant differences in terms of gender. Sofias and Pierrakeas (2021) conducted a qualitative semi-experimental study with high school students to examine the effectiveness of a learning environment developed for school education based on web-CBS technology on the spatial thinking ability of students by using Project-based learning methods. The results of this study show significant progress in students' spatial thinking ability. It was also concluded that there were no significant differences between genders in the spatial thinking ability of students. Mulyadi and Yani (2021) examined the spatial thinking ability of secondary and high school students regarding gender. The results did not show a significant difference between gender and spatial thinking.

In terms of year of study, it was found that fourth-year geography department students had higher mean STAT scores than first-year geography department students, and the difference between the scores of both groups was statistically significant. No significant difference was found between the other groups regarding the year of study. Şanlı and Jo (2020) found that explicit teaching of spatial concepts, spatial thinking, spatial thinking in geography, and total mean scores of prospective geography teachers did not significantly differ in the year of study. However, they reported that the mean use of spatial representations and technology scores showed a significant difference in the year of study. The mean scores of fourth-year students were significantly higher than those of first-year students. Similarly, Kızıl (2021) found that in activities implemented within a synchronic approach, students in upper groups had higher success rates than students in lower groups. The results of our study also support these results. Synchronic thinking is an ability that should be developed regarding geographical skills. For this reason, teacher- and student-based studies can be conducted to develop students' synchronic thinking ability in geography lessons. Studies can be conducted on which methods and techniques should be used and how technology can develop students' spatial and synchronic thinking abilities in schools. Studies can be conducted about the effects of students' learning styles on their development of synchronic and spatial thinking abilities.

Statement of Researchers

Researchers' contribution rate statement: Researchers contributed equally to the study.

Conflict statement: This study is not subject to a conflict of interest.

Support and thanks: The research was not conducted with any support.

REFERENCES

Ablak, S., & Aksoy, B. (2018). Sosyal bilgiler öğretim programında yer alan mekânı algılama becerisine ilişkin öğrenci algılarının incelenmesi [Investigation of student perceptions related to spatial perception skills in social studies program]. *Turkish Studies, 13*(1), 1-32.

Ablak, S., & Aksoy, B. (2021). Sosyal bilgiler dersi öğretim programında yer alan zaman ve kronolojiyi algılama becerisine ilişkin öğrenci algılarının incelenmesi [Examining students' perceptions about the skill of perceiving time and chronology in the social studies curriculum]. *Kalem Eğitim ve İnsan Bilimleri Dergisi*, *11*(1), 41-73.

Akarsu, B. (1963). Kant'ta mekan ve zaman kavramları [Concepts of space and time in Kant]. *İstanbul Üniversitesi Felsefe Arkivi Dergisi*(14), 108-122.

Akbaba, B., Keçe, M., & Erdem, M. (2012). Sosyal bilgiler dersinde çoklu ortam kullanımının öğrencilerin zaman kronoloji ve değişim sürekliliği algılama becerilerine etkisi [Effect of using multi-media to students' time-chronology skills and perception skills of students' change-continuity]. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi, 14*(2), 237-257.

Ata, B. (2008). 1943'teki İkinci Milli Eğitim Şurasının tarih eğitimi kararlarından birinin uygulanması: Bir histomap'in yapım öyküsü [Implementation of one of the decisions of the Second National Education Council in 1943 on history education: The story of the making of a histomap]. *Kuram ve Uygulamada Eğitim Bilimleri, 8*(2), 335-353.

Ata, B. (2009). Johann Friedrich Herbart'ın tarih eğitimi üzerine görüşleri [Opinions of Johann Friedrich Herbart about history education]. *Gazi Eğitim Fakültesi Dergisi,* 29, 1377-1395.

Aydoğan, O. (2020). *Eğitsel bilgisayar oyun destekli tarih öğretiminin öğrencilerin kronolojik düşünme ve mekânı algılama becerilerine etkisi* [The effect of history teaching supported by educational computer games on students' chronological thinking and space perception skills], (Unpublished doctoral thesis). Gazi University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 24/09/2024

Bayramoğlu, A. Ç. (2016). *Sosyal bilgiler programında yer alan tarih konularının tarihsel düşünme becerileri açısından değerlendirilmesi* [Evaluation of the subject historical thinking of the social studies curriculum]. (Unpublished master thesis). Adnan Menderes University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 27/09/2024

Bednarz, R. S., & Lee, J. (2011). The components of spatial thinking: empirical evidence. *Procedia-Social and Behavioral Sciences, 21*, 103-107.

Bircan, T. Ş. (2015). Teknoloji destekli tarih öğretiminin öğrencilerin mekân algılarına ve akademik başarılarına etkisi [The effect of teaching history of the based technology to the students' academic achievement and perception of space]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 3*(13), 564-577.

Bircan, T. Ş., & Safran, M. (2013). Tarih öğretiminde haritaların önemi ve kullanımı [The usage and the importance of maps in teaching history]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 14*(2), 461-476.

Boehm, R. G., Saxe, D. W., & Rutherford, D. J. (2003). *The best of both worlds: Blending history and geography in the k-12 curriculum*. Washington, DC.: Thomas B. Fordham Foundation.

Charcharos, C., Kokla, M., & Tomai, E. (2015). Assessing spatial thinking ability in geospatial thinking: Educating the future spatial citizens. Paper presented at *the GEOTHNK International Closing Conference*, Pallini, Greece.

Charcharos, C., Kokla, M., & Tomai, E. (2016). *Linking spatial thinking and problem-solving skills of young children.* Paper presented at the Inspiring Science Education, Pallini: Greece.

Çalık, S. (2022). *Öğretmen ve öğretmen adaylarına göre mekânsal düşünme becerisi öğretimi: Eğilimler ve "kültür ve miras" öğrenme alanına uygulanabilirlik* [Teaching of spatial thinking skill of teachers and prospective teachers: Trends and applicability to the learning field "Culture and heritage"]. (Unpublished master thesis). Trabzon University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 08/10/2024.

Demiralp, N. (2006). Coğrafya eğitiminde harita ve küre kullanım becerileri [Map and globe usage skills in geography education]. *Türk Eğitim Bilimleri Dergisi, 4*(3), 323-343.

Demircioğlu, İ. H., & Akengin, H. (2012). Zamana ve mekâna ilişkin becerilerin öğretimi [Teaching skills related to time and space]. In C. Öztürk (Ed.), *Sosyal bilgiler öğretimi demokratik vatandaşlık eğitimi* [Teaching skills related to time and space] (pp. 187-224). Ankara: Pegem Akademi Yayınları.

Dilek, D. (2002). *Tarih derslerinde öğrenme ve düşünce gelişimi* [Learning and thought development in history classes]. Ankara: Pegem.

Dinç, A. (2013). Türkiye'de tarih yazımında coğrafyanın önemi [The importance of geography in historiography in Türkiye]. In V. Engin & A. Şimşek (Eds.), *Türkiye'de tarih yazımı [History writing in* Türkiye*]* (pp. 541-553). İstanbul: Yeditepe Yayınevi.

Dönmez, C., & Oruç, Ş. (2006). *II. Meşrutiyet dönemi tarih öğretimi* [History teaching in the II. constitutional monarchy period]. Ankara: Gazi Kitabevi.

Erdoğdu, A. T. (2021). Karşılaştırmalı tarih yöntemi ve eleştirisi [Comparative history method and its criticism]. *İnsan ve Toplum, 11*(4), 157-199.

Gençtürk, E. (2009). *İlköğretim sosyal bilgiler öğretmen adaylarının coğrafya okuryazarlık düzeylerinin belirlenmesi* [Investigation of preservice elementary social studies teachers? geography literacy levels], (Unpublished doctoral thesis). Gazi University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 11/10/2024.

Gersmehl, P. J., & Gersmehl, C. A. (2007). Spatial thinking by young children: Neurologic evidence for early development and educability. *Journal of Geography, 106*(5), 181-191.

Gilmartin, P. P., & Patton, J. C. (1984). Comparing the sexes on spatial abilities: Map-use skills, *Annals of the Association of American Geographers, 74*(4), 605–619.

Golledge, R. G., Marsh, M., & Battersby, S. (2008). Matching geospatial concepts with geographic educational needs. *Geographical Research, 46*(1), 85–98.

Gönülaçar, H. (2019). *Ortaokul öğrencilerinde mekânsal düşünme becerilerinin gelişimi: Bir durum çalışması* [Development of spatial thinking skills in secondary school students: A case study]. (Unpublished master thesis). Erciyes Üniversity, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Gönülaçar, H., & Öztürk, M. (2020). Ortaokul öğrencilerinin mekânsal düşünme becerileri [Spatial thinking skills of secondary school students]. *Milli Eğitim Dergisi, 49*(227), 217-243.

Green, L., & Green, D. (2003). From chronological to spatio-temporal histories: mapping heritage in arukwa, área indígena do uaçá, Brazil. *History and Anthropology, 14*(3), 283-295.

Harms, J. M., & Lettow, L. J. (2007). Nurturing children's concepts of time and chronology through literature. *Childhood Education, 83*(4), 211–218.

Hroch, M. (2011). *Avrupa'da milli uyanış: Toplumsal koşulların ve toplulukların karşılaştırmalı analizi [National awakening in Europe: A comparative analysis of social conditions and communities]* (A. Özdemir, Trans.). İstanbul: İletişim Yayınları.

Ishikawa, T. (2021). Spatial thinking, cognitive mapping, and spatial awareness. *Cognitive Processing, 22*(1), 89–96.

Işık, H. (2014). İlköğretim 6. sınıf ve ortaöğretim 9. sınıf öğrencilerinin mekânsal biliş ve kronoloji bilgilerinin karşılaştırılması [Comparison of spatial cognition and chronology knowledge of the students of grade 6 in primary education and grade 9 in secondary education]. *The Journal of International Social Research, 7*(30), 111–121.

Jo, I., Bednarz, S., & Metoyer, S. (2010). Selecting and designing questions to facilitate spatial thinking. *The Geography Teacher, 7*(2), 49-55.

Jo, I., & Bednarz, S. W. (2014). Dispositions toward teaching spatial thinking through geography: Conceptualization and an exemplar assessment. *Journal of Geography, 113*(5), 198-207.

Karasar, N. (2006). *Bilimsel araştırma yöntemi* [Scientific research method]. Ankara: Nobel Yayın Dağıtım.

Kızıl, Ö. (2021). *Kronolojik ve mekânsal düşünme becerileri bağlamında TC inkılap tarihi ve Atatürkçülük dersi konularının senkronik yaklaşımla öğretimi* [Teaching the subjects of the class of the history of revolution of Republic of Türkiye and Kemalism with a synchronic approach in the context of chronological and spatial thinking skills]. (Unpublished doctoral thesis). Gazi Üniversitesi, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Kızıl, Ö., & Dönmez, C. (2020). Tarih konularının öğretiminde senkronik yaklaşım modeli ve ölçekli senkronik tarih şeritleri [*Synchronic approach model and scaled synchronic history strips in teaching history subjects]*, International *Journal of New Approaches in Social Studies, 4*(2), 285-308.

Kim, M. (2011). *Effects of a GIS course on three components of spatial literacy.* (Unpublished doctorate thesis). Texas A&M University, Retrieved from https://oaktrust.library.tamu.edu/server/api/core/bitstreams/841600df-d352-4bf5-8bb3-00039c4e8422/content

Korkmaz, H. İ., & Tekin, B. (2020). Investigating preschool teacher candidates' spatial thinking skills. *Journal of Theoretical Educational Science, 13*(1), 191-204.

Köşker, N. (2012). Sınıf öğretmeni adaylarının mekânsal biliş yeterliliklerine ilişkin düşünceleri [*Thoughts of classroom teacher candidates regarding their spatial cognition competencies*]. *Journal of World of Turks, 4*(3), 161–173.

Lee, J., & Bednarz, R. S. (2005). Video analysis of map-drawing strategies. *Journal of Geography, 104*(5), 211-221. https://doi.org/10.1080/00221340508978986

Lee, J., & Bednarz, R. (2009). Effect of GIS learning on spatial thinking. *Journal of Geography in Higher Education, 33*(2), 183-198.

Ministry of National Education [MoNE]. (2005). *İlköğretim sosyal bilgiler dersi 4, 5, 6 ve 7. sınıflar öğretim programı*. [Primary school social studies course 4, 5, 6 and 7th grade curriculum]. Ankara: Milli Eğitim Bakanlığı.

Ministry of National Education [MoNE]. (2018). *Sosyal bilgiler dersi öğretim programı (İlkokul ve ortaokul 4, 5, 6 ve 7. Sınıflar)* [Social studies course curriculum (Primary and secondary school 4th, 5th, 6th and 7th grades)]. Retrieved from https://mufredat.meb.gov.tr/

Ministry of National Education [MoNE]. (2024). *Sosyal bilgiler dersi öğretim programı (4, 5, 6 ve 7. sınıflar) Türkiye yüzyılı maarif modeli* [Social studies course curriculum (4th, 5th, 6th and 7th grades)

Türkiye century education model]. Retrieved from https://tymm.meb.gov.tr/ogretim-programlari/sosyal-bilgiler-dersi

Merç, A. (2017). *Sosyal bilgiler dersinde mekân algılama becerisinin kazandırılmasında Google Earth uygulamasının etkililiği* [The effectiveness of Google Earth application in teaching spatial perception skills in social studies course]. (Unpublished doctoral dissertation). Anadolu Üniversitesi, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi

Mulyadi, A., & Yani, A. (2021). *Gender perspective: the spatial thinking of secondary education students.* Paper presented at the IOP Conference Series: Earth and Environmental Science, Vancouver, Canada.

Newcombe, N. S., & Stieff, M. (2012). Six myths about spatial thinking. *International Journal of Science Education, 34*(6), 955-971.

NRC. (2006). *Learning to think spatially*. Washington DC: National Academies Press.

Öktem, Ü. (2000). Descartes, Kant, Bergson ve Husserl'de sezgi [Intuition in Descartes, Kant, Bergson and Husserl]. *Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Dergisi, 40*(1), 159-188.

Özen, R., & Sağlam, H. İ. (2010). İlköğretim öğrencilerinin değişim ve sürekliliği algılayışları [Perception of primary studens on change and continuity]. *Akademik Bakış Dergisi, 22*, 1-15.

Öztürk, M. (2010). Mekânı algılama becerisi [Ability to perceive space]. In M. Safran (Ed.), *Tarih nasıl öğretilir? Tarih öğretmenleri için özel öğretim yöntemleri* [The ability to perceive space. In M. Safran (Ed.), How to teach history? Special teaching methods for history teachers], (pp. 83–94). Istanbul: Yeni İnsan.

Paykoç, F. (1991). *Tarih öğretimi* [Teaching history], Eskişehir: Anadolu Üniversitesi Açıköğretim Yay.

Pollard, A. F. (1940). Chronology, synchronology, and history. *History, 25*(99), 193-207.

Safi, H. (2010). *Sosyal bilgiler öğretim programında yer alan mekânı algılama becerisinin geliştirilmesi hakkında öğretmen görüşleri* [Teachers' opinions about the spatial cognition skills]. (Unpublished doctoral thesis). Marmara University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 06/09/2024.

Safran, M. (2002). Türk tarihi öğretimi ve meseleleri [Teaching Turkish history and its issue]. *Türkler Ansiklopedisi*, 17, 1661-1673.

Safran, M., & Şimşek, A. (2009). Tarih yazımında bir sorun: Tarih ve zaman ilişkisi [A problem in historiography: Relation of history and time] *Tarihin Peşinde., 1*, 9-26.

Serinci, H. (2022). *Ortaöğretim 9. ve 12. sınıf öğrencilerinin mekânsal düşünme becerilerinin incelenmesi: Çorum ili örneği* [Investigation of spatial thinking skills of 9th and 12th grade secondary school students: Example of Çorum province]. (Unpublished master thesis). Ondokuz Mayıs Üniversity, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Serinci, H., & Özdemir, N. (2022). Orta öğretim öğrencilerinin mekânsal düşünme becerilerinin incelenmesi [Examining spatial thinking skills of secondary school students]. *Nevşehir Hacı Bektaş Veli Üniversitesi SBE Dergisi, 12*(3), 1448-1468.

Sofias, T. A., & Pierrakeas, C. J. (2021). Effectiveness of a WebGIS-based project on high school students' spatial thinking skills. Paper presented at the *Proceedings of The First Workshop on Technology Enhanced Learning Environments for Blended Education*, Foggia, Italy.

Sorby, S., Veurink, N., & Streiner, S. (2018). Does spatial skills instruction improve STEM outcomes? The answer is 'yes'. *Learning and Individual Differences*, 67, 209–222.

Sönmez, F., & Akbaş, Y. (2019). Coğrafi bilgi sistemlerine (CBS) dayalı sosyal bilgiler öğretiminin 6. sınıf öğrencilerinin mekânsal düşünme becerilerine etkisi [The effect of social studies teaching based

on geographic information systems (GIS) on spatial thinking skills of 6th grade students]. *International Journal of Geography and Geography Education, 40*, 40-58.

Sönmez, Ö. F. (2010). *İlköğretim sosyal bilgiler öğretiminde harita becerileri [Map skills in primary school social studies education]*. (Unpublished doctoral thesis). Gazi University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 11/09/2024.

Şanlı, C. (2019). Coğrafya öğretmen adaylarının mekânsal düşünme becerisine ilişkin görüşleri. [Geography preservice teachers' views on spatial thinking skill]. *Journal of Anatolian Cultural Research (JANCR), 3*(3), 215–233.

Şanlı, C., & Jo, I. (2020). Examining preservıce geography teachers' dispositions to teach spatial thinking skills. *International Journal of Eurasian Education and Culture, 11*(5), 2069-2102.

Şanlı, C., & Sezer, A. (2019). Coğrafya derslerinde mekânsal düşünme öğretimi ölçeği: Türkçe'ye uyarlama geçerlik ve güvenirlik çalışması [Teaching spatial thinking through geography disposition inventory: a validity and reliability study on its Turkish adaptation]. *Ege Coğrafya Dergisi, 28*(2), 213-225.

Şimşek, A. (2006). *İlköğretim öğrencilerinde tarihsel zaman kavramının gelişimi ve öğretimi* [Development and teaching of the concept of historical time in primary school students]. (Unpublished doctoral thesis). Gazi University, Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/ Access Date: 18/09/2024.

Taş, H. İ. (2006). Coğrafya eğitiminde görselleştirmenin önem: Mekânsal algılamaya pedagojik bir bakış. [the importance of visualizations in geographic education: an educational approach to spatial context], *Doğu Coğrafya Dergisi, 11*(16), 211–238.

Taş, H. İ. (2008). Coğrafi beceriler ve bunları öğrencilere kazandırma yolları [How to teach geography skills to students?]. *Doğu Coğrafya Dergisi*, 13(20), 45-58.

Tümertekin, E., & Özgüç, N. (2017). *Beşeri coğrafya: İnsan, kültür, mekân [Human geography: People, culture, space]*. İstanbul: Çantay Kitabevi.

Tütüncü, G., & Ünal, N. (2019). Karşılaştırmalı tarih: Doğuşu, gelişimi, metodolojisi ve Türkiye'deki durumu [Comparative history: beginning, development, methodology and the situation in Türkiye]. *Al Farabi International Journal of Social Sciences, 3*(4), 79-93.

Uttal, D. H., & Cohen, C. A. (2012). Spatial thinking and STEM education: When, why, and how? In *Psychology of learning and motivation* (Vol. 57, pp. 147-181): Elsevier.

Wilschut, A. (2012). *Images of time. The role of a historical consciousness of time in learning history*. Charlotte: N.C. Information Age Publisher.

Xie, S., Zeng, S., Liu, L., Wei, H., Xu, Y., & Lu, X. (2022). Predicting geospatial thinking ability for secondary school students based on the decision tree algorithm in Mainland China. *Education & Science/Egitim ve Bilim*, *47*(210), 121-137.

Yayla, O. (2019). *Sosyal bilgiler eğitiminde mekânsal teknolojilere dayalı öğretim uygulamalarının öğrencilerin mekânsal düşünme becerilerine ve akademik başarılarına etkisi [The effect of spatial thinking skills and academic achievements of teaching applications based on spatial technologies in social studies education]*. (Unpublished master thesis). Trabzon Üniversitesi Retrieved from https://tez.yok.gov.tr/UlusalTezMerkezi/

Yelkenci, Ö. F. (2022). Kuantum kuramından tarih öğretimine: tarihsel zaman algısı [From theory of quantum to teaching of history: A historical perspective on time]. *Cihannüma Sosyal Bilimler Akademi Dergisi, 1*(1), 79-104.

Yiğit, T. & Karatekin, K. (2021). The Effect of orienteering applications on students' spatial thinking skills in social studies: The case of Türkiye. *Review of International Geographical Education Online, 11*(1), 75-99. https://doi.org/10.33403/rigeo.839193

Zwartjes, L. (2012). Creating a learning line on spatial thinking in education. In R. De Miguel, M. L. De Lázaro, & M. J. Marrón (Eds.), *La educación geográfica digital* (pp. 675-690). Zaragoza: Grupo de Didáctica de la Geografía de la Asociación de Geógrafos Españoles y Universidad de Zaragoza.

Author Biographies

First Author, Pelin İskender Kılıç, received her Bachelor's degree In 1990, her Master's degree in 1994, and her Doctorate from Ondokuz Mayıs University, Faculty of Education, in 1999 and Institute of Educational Sciences. She is an associate professor in the same university's Department of Turkish and Social Sciences Education. Her areas of expertise are History Education and Modern Ottoman History.

Nevin Özdemir, received her Bachelor's degree In 1986, her Master's degree in 1994, and her Doctorate from Ankara University Social Sciences Institute in 2002. She works as a professor doctor in the Department of Turkish and Social Sciences Education at the same university. Her areas of expertise are geography education and Türkiye geography**.**