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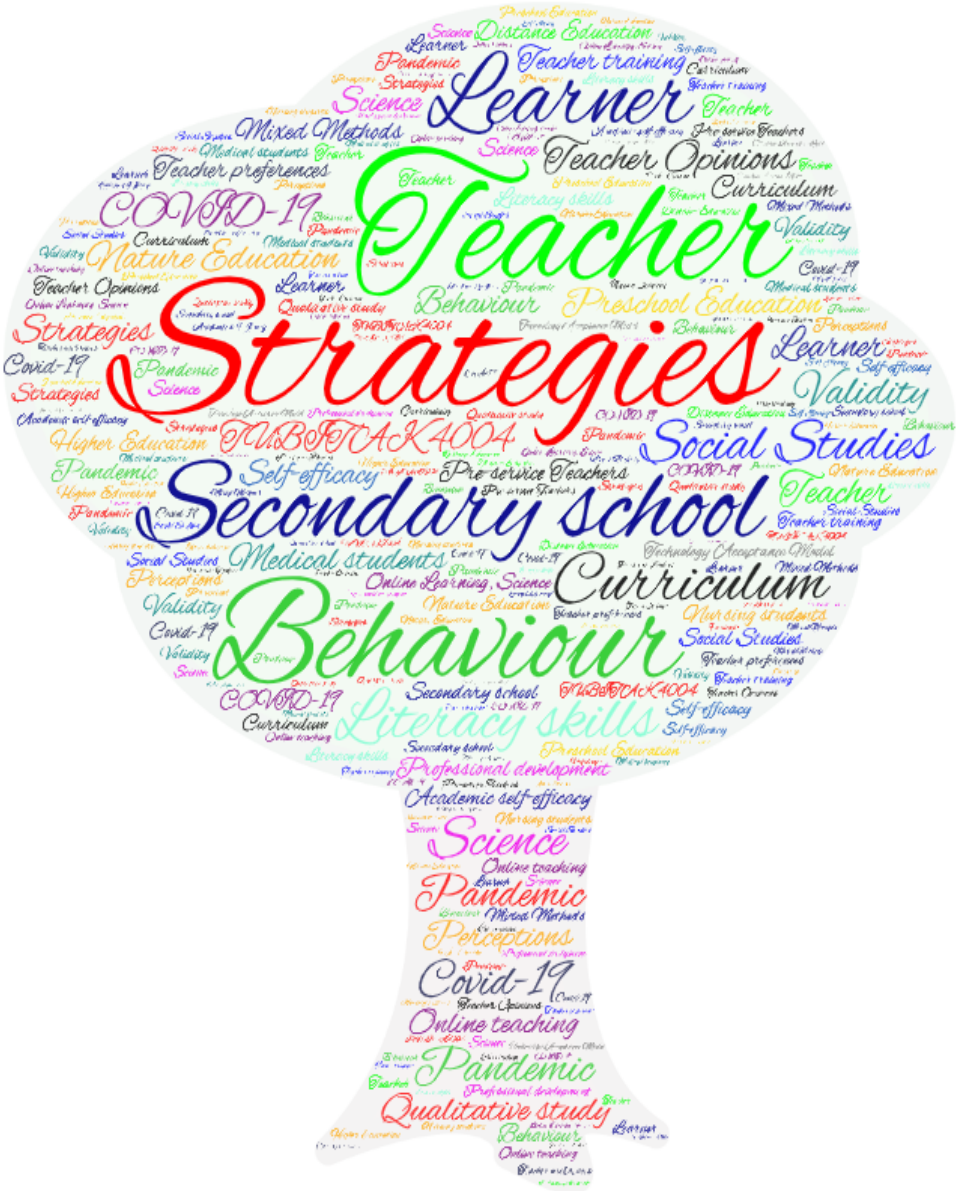

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Evaluation of the 2024 Human Rights, Citizenship, and Democracy Curriculum Outcomes Based on Bloom's Taxonomy

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Abstract: This study aims to evaluate the cognitive process skills of the learning outcomes in the 2024 4th Grade Human Rights, Citizenship, and Democracy Curriculum. As part of the Türkiye Yüzyılı Maarif Modeli, curricula have been updated, and in this context, learning outcomes and process components have replaced traditional achievement statements in the new curricula. In this study, process components were considered as learning outcomes, and the 34 process components in the 2024 Human Rights, Citizenship, and Democracy Curriculum were analyzed based on Revised Bloom's Taxonomy. Employing a qualitative research approach, a descriptive analysis was conducted using the two-dimensional matrix developed by Anderson and Krathwohl (2021). The findings indicate that the curriculum predominantly focuses on lower-order cognitive processes. The most frequently emphasized cognitive process is "Understanding" (35.1%), which includes objectives aimed at students' acquisition of conceptual knowledge. However, "Applying" (11.7%), "Analyzing" (23.8%), "Evaluating" (11.7%), and "Creating" (11.7%) were found to be less emphasized. Regarding the knowledge dimension, the learning outcomes are mostly concentrated on "Factual Knowledge" (44.1%) and "Conceptual Knowledge" (35.1%). The relatively lower proportions of "Metacognitive Knowledge" (14.8%) and "Procedural Knowledge" (5.9%) suggest that students' critical thinking and problem-solving skills are not sufficiently supported. In conclusion, the 2024 Human Rights, Citizenship, and Democracy Curriculum is structured to facilitate students' acquisition of fundamental citizenship knowledge but exhibits limitations in fostering higher-order cognitive processes.
Keywords: Human Rights, Citizenship and Democracy, Cognitive Process Skills, Revised Bloom's Taxonomy, Learning Outcomes, Primary Education.

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Introduction

In Turkey, citizenship education is generally regarded as a shared outcome of multiple subjects at all levels of education. However, the most explicit course dedicated to citizenship education at the primary level is the 4th Grade Human Rights, Citizenship, and Democracy Course. Broadly speaking, citizenship education aims to cultivate "good citizens," equipping individuals with citizenship rights and responsibilities while fostering essential values and skills required by contemporary society. Over time, numerous fundamental changes have been made in the implementation of this course, leading to the development, transformation, and modification of curricula that adapt to the needs of the era. Most recently, in 2024, all curricula were restructured within the framework of the Türkiye Yüzyılı Maarif Modeli, including the Human Rights, Citizenship, and Democracy Curriculum. Although the 2018 updated curriculum is still in use, starting from the 2024-2025 academic year**,** 1st-grade students have begun utilizing the new curricula. Consequently, by the 2027-2028 academic year, the revised Human Rights, Citizenship, and Democracy curriculum will also come into effect.

The Ministry of National Education (MoNE) emphasizes that the new curriculum aims to cultivate effective citizens who are self-aware, equipped with the skills required by contemporary conditions, sensitive to their surroundings, committed to democratic values, and capable of contributing to both their country and the world (MoNE, 2024). Unlike previous curricula, the 2024 program redefines the concept of "good citizens" as "active citizens," describing them **as** individuals who are knowledgeable, skilled, and value-oriented, socially conscious, democratic, and engaged in national and global issues**.**

Active citizenship can be defined as the ability of individuals to exercise their rights consciously, fulfill their responsibilities, and demonstrate sensitivity to social issues in democratic societies (Hoskins & Mascherini, 2009; Kerr, 1999; Türkoğlu & Dağlı, 2017). This concept not only encompasses law-abiding citizens but also individuals who participate in decision-making processes, engage in critical thinking, and contribute to social cohesion (Kıncal & Işık, 2003; Westheimer & Kahne, 2004). Therefore, an active citizen should not merely be an informed individual but one who possesses and effectively applies higher-order thinking skills**.** In this context, a crucial question arises regarding how well the new curriculum reflects the definition and objectives of active citizenship**.** A review of the existing literature revealed that no studies have yet examined whether the new curriculum incorporates active citizenship principles or fosters higher-order thinking skills**.** However, İneç (2024) conducted a study evaluating the new curriculum from a children's rights perspective**.** This highlights the need for further research investigating whether the 2024 curriculum integrates active citizenship and employs higher-order cognitive skills**.** Program evaluation is a systematic process used to determine the effectiveness of educational programs, identify strengths and weaknesses, and implement necessary improvements (Stufflebeam & Shinkfield, 2007). This process involves various data collection and analysis methods (Fitzpatrick, Sanders, & Worthen, 2011). One of the primary tools used for evaluating curricula is the examination of learning outcomes (Demirel, 2012; Gültekin & Burak, 2019). Various techniques can be employed to assess programs based on learning outcomes, with Bloom's Taxonomy being one of the most widely used models (Bümen, 2006).

Bloom's Taxonomy**,** originally developed in 1956, classifies learning objectives into three domains: cognitive, affective, and psychomotor (Bloom, 1956). However, due to advancements in educational sciences, it was revised **by** Anderson and Krathwohl (2001) to form the Revised Bloom's Taxonomy**,** which provides a more dynamic approach to assessing learning processes.

Revised Bloom's Taxonomy consists of two main components**:**

1. Cognitive Process Dimension: This dimension categorizes learning into six levels:
- Remembering**:** Retrieving previously learned information.
- Understanding**:** Comprehending, explaining, or interpreting information.
- Applying**:** Using knowledge in different contexts.

- Analyzing**:** Breaking down information to identify relationships.
- Evaluating**:** Assessing the accuracy or validity of information.
- Creating**:** Generating new ideas or solutions based on existing knowledge (Anderson & Krathwohl, 2001).

2. Knowledge Dimension: This dimension classifies learning content into four categories:

- Factual Knowledge: Terminology, specific facts, and basic details.
- Conceptual Knowledge: Principles, models, and relationships between theories.
- Procedural Knowledge: Methods, techniques, and problem-solving strategies.
- Metacognitive Knowledge: Awareness and regulation of one's learning processes (Krathwohl, 2002).

By analyzing curriculum learning outcomes through Revised Bloom's Taxonomy, researchers can determine the distribution of cognitive processes and knowledge types within educational programs. This analysis is crucial for understanding whether a curriculum fosters lower-order cognitive skills (remembering, understanding, and applying) or higher-order thinking skills (analyzing, evaluating, creating) (Büyükalan Filiz & Yıldırım, 2019; Doğan & Burak, 2018; Erol, 2021; Gökçek & Korkmaz, 2018; Öztürk & Demir, 2019; Türkmen & Dönmez, 2020). A review of the literature reveals numerous studies examining learning outcomes from various curricula using Revised Bloom's Taxonomy**.**

For example, Benli-Özdemir, Yılmaz, and Selvi (2024) compared the 2018 and 2024 Science Curricula in terms of environmental education, concluding that the 2024 curriculum includes more higher-order thinking objectives**.** Similarly, Yaralı (2024) analyzed 2023 Life Skills I and II courses and found that they predominantly focus on lower-order cognitive skills. Likewise, Oçak and Uzel (2024) examined the 2018 Biology Curriculum and determined that its learning outcomes were primarily centered on lower-order cognitive processes. Additionally, studies in various subject areas such as Social Studies, Turkish, Religious Education, and Mathematics have conducted similar analyses (Burak, 2017; Büyükalan Filiz & Yıldırım, 2019; Doğan & Burak, 2018; Erol, 2021; Gökçek & Korkmaz, 2018; Gültekin & Burak, 2019; Öztürk & Demir, 2019; Türkmen & Dönmez, 2020). Specifically, in the context of Human Rights, Citizenship, and Democracy**,** Burak and Topkaya (2021) examined the 2018 curriculum, concluding that most learning outcomes targeted lower-order cognitive skills**.**

Given the lack of research evaluating the 2024 Human Rights, Citizenship, and Democracy Curriculum based on Revised Bloom's Taxonomy**,** this study aims to contribute to curriculum evaluation efforts in light of the Türkiye Yüzyılı Maarif Modeli. Additionally, the findings of this study are expected to provide guidance for curriculum designers, educators, and policymakers in structuring effective citizenship education that aligns with the active citizenship framework. This study seeks to answer the following research questions:

- How are the learning outcomes in the 2024 Human Rights, Citizenship, and Democracy Curriculum distributed across the Cognitive Process Dimension?
- How are the learning outcomes in the 2024 Human Rights, Citizenship, and Democracy Curriculum distributed across the Knowledge Dimension?

Methodology

Research Design

This study was designed using a qualitative research approach and the document analysis technique, in line with the study's purpose and research questions. Document analysis is a qualitative research method that involves systematically examining written materials related to the phenomenon under investigation based on specific criteria (Yıldırım & Şimşek, 2014). The implementation of this technique followed the document analysis stages proposed by Yıldırım and Şimşek (2014), ensuring a structured research process. Accordingly, the research process was conducted in two main phases, adhering to Foster's (1995) five-stage model for document analysis:

- Accessing Documents
- Verifying Authenticity
- Understanding and Interpreting Documents
- Analyzing Data
- Using Data
- The study was carried out in two main stages:
- Accessing and Defining the Characteristics of the Documents
- Examining and Analyzing the Documents
- Each stage of the research process is described in detail below.

Accessing Documents and Document Characteristics

This phase was conducted following Foster's (1995) approach to document analysis, which includes accessing documents, verifying their authenticity, and understanding and interpreting them. The primary document used in this study was the 2024 4th Grade Human Rights, Citizenship, and Democracy Curriculum, officially released by the Ministry of National Education (MoNE) in Turkey. The document was obtained from MoNE's Türkiye Yüzyılı Maarif Modeli online system on February 2, 2024 (https://tymm.meb.gov.tr/upload/program/2024programvat4Onayli.pdf).

The curriculum consists of four learning domains containing 13 learning outcomes. Within these learning domains, 34 process components are defined (MoNE, 2024). Unlike previous curricula, where learning outcomes were explicitly stated, the updated 2024 curriculum introduces the term process components instead of traditional learning outcomes. In this study, these 34 process components were considered as learning outcomes and served as the primary data source for analysis.

Document Examination and Data Analysis

The 34 process components included in the 2024 Human Rights, Citizenship, and Democracy Curriculum were analyzed using Revised Bloom's Taxonomy, focusing on both the Cognitive Process Dimension and the Knowledge Dimension. The analysis was conducted using the two-dimensional matrix developed by Anderson and Krathwohl (2001) (see Table 1).

Table 1.
Two-Dimensional Matrix of Knowledge and Cognitive Process Dimensions

	Cognitive Process					
Knowledge	Remembering	Understanding	Applying	Analyizng	Evaluating	Creating
Factual	A1	A2	A3	A4	A5	A6
Conceptual	B1	B2	B3	B4	B5	B6
Procedural	C1	C2	C3	C4	C5	C6
Metacognitive	D1	D2	D3	D4	D5	D6

Anderson and Krathwohl's (2001) two-dimensional matrix enables a systematic classification of learning outcomes based on cognitive processing levels and knowledge types. The first dimension of the matrix categorizes the cognitive processing skills targeted by the learning outcomes into six hierarchical levels:

- Remembering (retrieving previously learned information)
- Understanding (comprehending and interpreting information)

- Applying (using knowledge in practical situations)
- Analyzing (breaking down concepts into components)
- Evaluating (judging the validity of information)
- Creating (generating new ideas or solutions)

The second dimension of the matrix classifies knowledge types into four categories:

- Factual Knowledge (basic concepts, terminology, and specific details)
- Conceptual Knowledge (principles, theories, and relationships between concepts)
- Procedural Knowledge (methods, strategies, and techniques)
- Metacognitive Knowledge (awareness and control of one's learning processes)

Using this matrix, a learning outcome can be simultaneously classified in terms of both the cognitive skills it requires and the knowledge type it addresses. In this study, the 34 process components (considered as learning outcomes) in the Human Rights, Citizenship, and Democracy Curriculum served as the units of analysis. These process components were examined using the Revised Bloom's Taxonomy matrix developed by Anderson and Krathwohl (2001). A descriptive approach was adopted in the analysis, ensuring that learning outcomes were classified according to their cognitive process and knowledge dimensions.

During the analysis, a semantic examination of each process component was conducted.

- The action verb in the learning outcome was categorized based on the cognitive process dimension.
- The remaining context of the statement was classified under the knowledge dimension (Burak & Topkaya, 2021).

Following this classification, the final categorizations were determined based on inter-coder agreement among the researchers, ensuring the validity of the analysis. The detailed categorization of each process component is presented in Appendix 1.

Findings

In this study, the 2024 4th Grade Human Rights, Citizenship, and Democracy Curriculum learning outcomes were analyzed using Revised Bloom's Taxonomy. The distribution of learning outcomes across the cognitive process dimension and knowledge dimension is presented in Table 2.

Table 2.
Distribution of Learning Outcomes in the Human Rights, Citizenship, and Democracy Course across the Knowledge and Cognitive Process Dimensions

	Cognitive Process					
Knowledge	**Remembering**	**Understanding**	**Applying**	**Analyizng**	**Evaluating**	**Creating**
Factual	İHVD.4.2.1.a İHVD.4.2.1.b	İHVD.4.1.3.b İHVD.4.2.3.c İHVD.4.3.1.b İHVD.4.3.4.a İHVD.4.4.2.a	İHVD.4.4.1.b İHVD.4.4.1.c	İHVD.4.1.3.a İHVD.4.2.3.a İHVD.4.3.4.b İHVD.4.4.3.b	İHVD.4.4.2.d	İHVD.4.4.3.c

Conceptual	İHVD.4.1.2.c İHVD.4.2.2.b İHVD.4.2.3.b İHVD.4.4.3.a	İHVD.4.2.1.c	İHVD.4.1.2.a İHVD.4.2.2.a İHVD.4.3.1.a İHVD.4.4.2.b	İHVD.4.2.1.ç İHVD.4.2.1.d	İHVD.4.3.4.c
Procedural		İHVD.4.4.1.a			
Metacognitive	İHVD.4.1.3.c İHVD.4.2.2.c İHVD.4.3.1.c			İHVD.4.4.2.ç	İHVD.4.1.2.b İHVD.4.4.2.c

As shown in Table 2, the 34 learning outcomes are distributed across all four knowledge dimensions. Specifically, 15 learning outcomes fall under the Factual Knowledge category, 12 outcomes are classified as Conceptual Knowledge, only 1 outcome is categorized under Procedural Knowledge, and 6 outcomes belong to the Metacognitive Knowledge dimension.

In terms of the cognitive process dimension, the analysis indicates that 2 learning outcomes correspond to Remember, 12 outcomes to Understand, 4 outcomes to Apply, 8 outcomes to Analyze, 4 outcomes to Evaluate, and 4 outcomes to Create. This distribution demonstrates that the majority of learning outcomes focus on lower-order cognitive processes, with fewer instances of outcomes that encourage higher-order thinking skills. The descriptive findings regarding the distribution of learning outcomes across these dimensions are presented in Table 3.

Table 3.
Descriptive Distribution of Learning Outcomes in the Human Rights, Citizenship, and Democracy Course across Knowledge and Cognitive Process Dimensions

Cognitive Process	**Knowledge**									
	Factual		**Conseptual**		**Procedural**		**Metacognitive**		**Total**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Remembering	2	5.9	-	-	-	-	-	-	2	5.9
Understanding	5	14.8	4	11.7	-	-	3	8.9	12	35.1
Applying	2	5.9	1	2.9	1	2.9	-	-	4	11.7
Analyzing	4	11.7	4	11.7	-	-	-	-	8	23.8
Evaluating	1	2.9	2	5.9	-	-	1	-	4	11.7
Creating	1	2.9	1	2.9	-	-	2	5.9	4	11.7
Total	15	44.1	12	35.1		2.9	6	17.9	34	100

As presented in Table 3, the distribution of learning outcomes across the cognitive process dimension reveals that 5.9% (n=2) fall under Remember, 35.1% (n=12) under Understand, 11.7% (n=4) under Apply, 23.8% (n=8) under Analyze, 11.7% (n=4) under Evaluate, and 11.7% (n=4) under Create. This indicates that 53.7% (n=18) of the learning outcomes focus on lower-order cognitive processes, while 46.3% (n=16) target higher-order cognitive processes.

In terms of the knowledge dimension, 44.1% (n=15) of the learning outcomes are categorized as Factual Knowledge, 35.1% (n=12) as Conceptual Knowledge, 2.9% (n=1) as Procedural Knowledge, and 17.9% (n=6) as Metacognitive Knowledge.

Conclusion and Discussion

In this study, the learning outcomes of the 2024 4th Grade Human Rights, Citizenship, and Democracy Curriculum were examined based on Revised Bloom's Taxonomy to evaluate their

distribution across cognitive process and knowledge dimensions. The analysis of the 34 learning outcomes in the cognitive process dimension revealed that the majority were concentrated in the "Understand" category. According to Anderson and Krathwohl (2001), the Understand level involves grasping, explaining, or interpreting information. This indicates that the curriculum places greater emphasis on fostering students' comprehension, explanation, interpretation, and providing examples in the context of human rights, citizenship, and democracy. Furthermore, more than half of the outcomes in the cognitive process dimension were categorized under lower-order thinking skills—Remember, Understand, and Apply. However, 46% of the learning outcomes were found to be at the higher-order cognitive levels, including Analyze, Evaluate, and Create. This suggests a relatively balanced distribution between lower- and higher-order cognitive skills. Notably, a significant portion of the higher-order thinking skills was concentrated in the Analyze category, indicating that the curriculum effectively aligns with its stated goal of cultivating critical-thinking and questioning individuals (MoNE, 2024).

The distribution of learning outcomes in the knowledge dimension shows that most were categorized as Factual Knowledge (44.1%) and Conceptual Knowledge (35.1%). In contrast, Procedural Knowledge (2.9%) and Metacognitive Knowledge (17.9%) were represented to a much lesser extent. The limited presence of procedural and metacognitive knowledge outcomes suggests that the curriculum may not sufficiently support students' ability to regulate their own learning processes and engage in deep thinking. However, Human Rights, Citizenship, and Democracy is not the sole subject responsible for citizenship education. In this regard, a more comprehensive analysis in conjunction with the Social Studies curriculum—which also aims to develop well-informed and responsible citizens (Gültekin & Burak, 2019)—could provide a more holistic perspective. Additionally, the strong emphasis on factual and conceptual knowledge may reflect an intentional pedagogical approach, prioritizing the acquisition of fundamental concepts and factual information. A review of the literature reveals that Burak and Topkaya (2021) conducted a similar analysis of the 2018 Human Rights, Citizenship, and Democracy curriculum, reporting that the majority of learning outcomes were concentrated in the Understand category, with a strong focus on lower-order cognitive processes and a similar emphasis on factual and conceptual knowledge. Compared to the previous program, the increase in higher-order thinking skills in the 2024 curriculum suggests a positive shift aligned with the Türkiye Yüzyılı Maarif Model. However, the knowledge dimension distribution in both studies remained consistent, indicating a continued focus on factual and conceptual learning in both curricula.

When comparing the findings of this study with previous research analyzing other subject curricula (Burak, 2017; Büyükalan Filiz & Yıldırım, 2019; Doğan & Burak, 2018; Erol, 2021; Gökçek & Korkmaz, 2018; Gültekin & Burak, 2019; Öztürk & Demir, 2019; Türkmen & Dönmez, 2020), it is evident that the 2024 Human Rights, Citizenship, and Democracy curriculum places a greater emphasis on higher-order thinking skills. While most prior studies examined the 2018 curricula, the findings suggest that the Türkiye Yüzyılı Maarif Model represents a shift toward promoting critical and creative thinking. This underscores the need for further research and analysis to fully understand the impact of the new educational framework. However, based on the current findings, it can be argued that the new curriculum places greater emphasis on fostering analytical, evaluative, and creative thinking skills, reinforcing the Türkiye Yüzyılı Maarif Model's commitment to nurturing inquisitive, innovative, and research-oriented individuals.

Recommendations

Based on the findings of this study, the following recommendations are proposed for the future development and implementation of the Human Rights, Citizenship, and Democracy curriculum:

1. **Enhancing Higher-Order Thinking Skills**
    - Future revisions of the curriculum should further strengthen learning outcomes that promote higher-order cognitive skills such as Evaluation and Creation.
    - More learning activities that foster critical thinking, problem-solving, and decision-making should be incorporated into the curriculum.
2. **Expanding Metacognitive and Procedural Learning Opportunities**

- The curriculum should be updated to include more learning outcomes that develop procedural and metacognitive skills, enabling students to reflect on their learning processes and apply their knowledge to real-world scenarios.
- Activities that promote self-regulated learning, inquiry-based approaches, and experiential learning should be encouraged.

3. **Interdisciplinary Integration with Social Studies**
   - Given that citizenship education is a multidisciplinary field, Human Rights, Citizenship, and Democracy should be analyzed in conjunction with the Social Studies curriculum to ensure a comprehensive approach to civic education.
   - Future research should explore the alignment between these subjects and their combined impact on students' civic knowledge and competencies.
4. **Further Research and Comparative Analyses**
   - Comparative analyses between the 2018 and 2024 curricula should be conducted across different disciplines to assess the overall impact of the Türkiye Yüzyılı Maarif Model.
   - Additional studies should evaluate the effectiveness of the new curriculum's implementation in classrooms.
5. **Teacher Training and Professional Development**
   - Given that teachers will begin implementing the updated curriculum in the coming years, professional development programs should be organized to support them in effectively integrating student-centered teaching strategies (e.g., collaborative learning, case studies, project-based learning, and alternative assessment methods).
   - Workshops, seminars, and in-service training sessions should be designed to familiarize teachers with the revised curriculum and equip them with innovative pedagogical strategies to maximize student engagement.

In summary, while the 2024 curriculum reflects a positive shift toward developing higher-order thinking skills, it still maintains a strong emphasis on factual and conceptual knowledge acquisition. To further enhance the curriculum, future revisions should focus on integrating more metacognitive and procedural learning objectives, interdisciplinary collaboration with Social Studies, and ongoing teacher training programs.

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Appendix 1

İHVD.4.1.1. Çocuk olmanın özelliklerini belirleyebilme
İHVD.4.1.2. Çocuk haklarıyla ilgili kanıta dayalı olarak oluşturduğu ürünü paylaşabilme
İHVD.4.1.2.a Verilen kanıtlara dayanarak çocuk haklarına ihtiyaç duyulma sebeplerini tespit eder. (B4)
İHVD.4.1.2.b Tespitleri bağlamında kendi çocuk hakları sözleşmesini oluşturur. (D6)
İHVD.4.1.2.c Çocuk Hakları Sözleşmesi'nin maddelerini sözlü veya görsel olarak yeniden ifade eder. (B2))

İHVD.4.1.3. İnsan olmanın getirdiği temel hak ve özgürlükleri yorumlayabilme
İHVD.4.1.3.a İnsan olmanın getirdiği temel hak ve özgürlükleri örnekler üzerinden inceler. (A4)
İHVD.4.1.3.b İnsan olmanın getirdiği temel hak ve özgürlükleri bağlamdan kopmadan yazılı veya sözlü olarak ifade eder. (A2)
İHVD.4.1.3.c İnsan olmanın getirdiği temel hak ve özgürlükleri kendi cümleleri ile ifade eder. (D2)

İHVD.4.2.1. Eşitlik kavramının anlamını sorgulayabilme
İHVD.4.2.1.a Eşitlik kavramı ile ilgili merak ettiklerini tanımlar. (A1)
İHVD.4.2.1.b Eşitlik kavramı hakkında sorular sorar (5N1K). (A1)
İHVD.4.2.1.c Eşitlik hakkında farklı kaynaklardan bilgi toplar. (B3)
İHVD.4.2.1.ç Eşitlik hakkında edindiği bilgilerin doğruluğunu kontrol eder. (B5)
İHVD.4.2.1.d Eşitlik hakkında topladığı bilgiler üzerinden çıkarım yapar. (B5)

İHVD.4.2.2. Adalet ve eşitlik arasındaki ilişkiyi yorumlayabilme
İHVD.4.2.2.a Adalet ve eşitlik kavramları arasındaki ilişkiyi inceler. (B4)
İHVD.4.2.2.b Adalet ve eşitlik kavramları arasındaki ilişkiyi bağlamdan kopmadan, sözlü veya görsel olarak ifade eder. (B2)
İHVD.4.2.2.c Adalet ve eşitlik kavramlarını kendi hayatından örnekler vererek ifade eder. (D2)

İHVD.4.2.3. Fırsat eşitliğinin anlamını yorumlayabilme
İHVD.4.2.3.a Fırsat eşitliğine ilişkin durumları inceler. (A4)
İHVD.4.2.3.b Fırsat eşitliğinin önemini sözlü, yazılı veya görsel olarak ifade eder. (B2)
İHVD.4.2.3.c Fırsat eşitliği ile ilgili yakın çevresinden örnekler verir. (B2)

İHVD.4.3.1. Vatandaş olmanın getirdiği hak ve özgürlükleri yorumlayabilme
İHVD.4.3.1.a Vatandaş olmanın getirdiği hak ve özgürlükleri örnekler üzerinden inceler. (B4)
İHVD.4.3.1.b Vatandaş olmanın getirdiği hak ve özgürlükleri sözlü, yazılı, görsel vb. şekillerde ifade eder. (A2)
İHVD.4.3.1.c Vatandaş olmanın getirdiği hak ve özgürlükleri kendi hayatından örnekler kullanarak yeniden açıklar. (D2)

İHVD.4.3.2. Etkin vatandaş olmanın gerektirdiği sorumlulukları belirleyebilme
İHVD.4.3.3. Dijital vatandaşlığın gerektirdiği özellikleri belirleyebilme
İHVD.4.3.4. Etkin bir vatandaş olarak toplumsal yardımlaşma faaliyetleri ile ilgili fikir üretebilme
İHVD.4.3.4.a Toplumsal yardımlaşma faaliyetlerinin önemini fark eder. (A2)
İHVD.4.3.4.b Toplumsal yardımlaşma faaliyetlerine ilişkin örnekleri inceler. (A4)
İHVD.4.3.4.c Toplumsal yardımlaşma faaliyetleriyle ilgili fikir üretir. (B6)

İHVD.4.4.1. Grup çalışmalarında karar alma süreçlerine katılarak grup dinamiğini sağlayabilme
İHVD.4.4.1.a Yakın çevresindeki dâhil olduğu grup ile aldığı ortak kararlar doğrultusunda görev paylaşımı yapar. (C3)
İHVD.4.4.1.b Dâhil olduğu grupta aldığı görevleri yerine getirerek gruba katkı sağlar. (A3)
İHVD.4.4.1.c Dâhil olduğu grupta ekibin diğer üyelerine yardım ederek gruba katkıda bulunur. (A3)

İHVD.4.4.2. Grup arkadaşları ile farklı fikirler hakkında müzakere edebilme
İHVD.4.4.2.a Yakın çevresinde dâhil olduğu gruplarda yer alan üyelerin kendisinden farklı düşünebileceğini fark eder. (A2)
İHVD.4.4.2.b Yakın çevresinde dâhil olduğu gruplarda yer alan üyelerin düşüncelerindeki ortaklıkları ve farklılıkları karşılaştırır. (B4)
İHVD.4.4.2.c Yakın çevresinde dâhil olduğu gruplarda yer alan üyelerin farklı görüş ve düşünceleri doğrultusunda ortak amaç üzerinde uzlaşmak için çözüm arar. (D6)
İHVD.4.4.2.ç Yakın çevresinde dâhil olduğu gruplarda yer alan üyelerin farklı görüş ve düşüncelerini dikkate alarak ortak amaca göre kendi görüşünü gözden geçirir. (B5)
İHVD.4.4.2.d Yakın çevresinde dâhil olduğu gruplarda yer alan üyelerin farklı görüş ve düşüncelerini dikkate alarak grubun ortak amaçlarını savunur. (B5)

İHVD.4.4.3. Seçme ve seçilme hakkı konusunda fikir üretebilme
İHVD.4.4.3.a Seçme hakkının toplumsal yaşam için önemini fark eder. (B2)
İHVD.4.4.3.b Seçme ve seçilme hakkıyla ilgili yakın çevresindeki deneyimleri inceler. (A4)
İHVD.4.4.3.c Seçme ve seçilme hakkının yaşantısındaki farklı alanlara uygulanması hususunda fikir üretir. (A6)

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Exploring Science Teachers' Views on Design Thinking Oriented STEM Education Practices

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***Abstract*:** This study aims to explore science teachers' perspectives on the implementation of STEM (Science, Technology, Engineering, and Mathematics) applications through a Design Thinking (DT) approach. Employing a qualitative case study design, semi-structured interviews were conducted with 11 science teachers selected via maximum variation sampling, a purposive sampling strategy. Data were analyzed through content analysis. The findings reveal that science teachers generally perceived DT-based STEM applications positively, particularly in terms of enhancing instructional effectiveness. Participants reported that these practices supported both their professional and personal growth, fostered greater classroom interaction, and improved student motivation. Additionally, the teachers emphasized a strong connection between STEM activities and the development of computational thinking skills—especially in fostering algorithmic thinking, problem-solving, and systematic analysis. Despite these benefits, several implementation challenges were noted, including time constraints, curriculum overload, limited resources, classroom management issues, and occasional lack of student engagement. Overall, the study concludes that the design-based thinking approach serves an integrative function in embedding creative and computational thinking within STEM education, offering multifaceted benefits for both students and educators.

***Keywords**:* STEM education, Design-based thinking, and Science teachers.

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Introduction

The social, technological, and economic transformations of the 21st century demand not only that individuals possess knowledge, but also that they use this knowledge creatively, integrate it with problem-solving skills, and generate products that add value to society. Accordingly, one of the fundamental goals of education systems is to raise students as analytically, creatively, and cognitively equipped individuals. STEM education is viewed as a key vehicle for achieving this goal, aiming to cultivate interdisciplinary thinking, critical analysis, productivity, and digital competence among students (Wingard et al., 2022). However, the effective implementation of STEM requires the development of pedagogical approaches that are participatory, inclusive, transformative, and aligned with contemporary needs.

In this context, the Design Thinking (DT) approach adds a creative, solution-focused, and student-centered dimension to STEM education, offering a structure that deepens the learning process both cognitively and affectively (Goldman et al., 2014; Wu et al., 2019). Emphasizing elements such as empathy, iterative prototyping, and the framing of real-world problems, DT stands out as a strong instructional framework that supports both creative and cognitive development (Goldman et al., 2014; Elwood & Jordan, 2022). Research has shown that DT enhances students' creative tendencies and innovation capacities while strengthening their engagement with complex and socially meaningful problems (He et al., 2023; Mahil, 2016; Frear & Fillip, 2019). Furthermore, DT has been associated with the development of STEM-related competencies across a wide range of students, from early childhood to adolescence (Yalçın & Erden, 2021; Ho, 2025; Wingard et al., 2022).

The design thinking approach can also be utilized to facilitate collaboration among teachers from different disciplines, owing to its collaborative and interdisciplinary nature. In this context, the DT approach has the potential to serve as a convergence point for integrating all disciplines in STEM education. Additionally, it can function as a problem-solving method to tackle STEM challenges (Öztürk, 2020). In this regard, it is important to reveal science teachers' knowledge, emotions, thoughts, and experiences related to STEM applications based on the design-based thinking approach. Teachers' perceptions of DT-based STEM processes, their classroom reflections, the challenges they encounter, and their views on the impact of these practices on students will provide significant insights into the scalability of such applications. Accordingly, this study aims to analyze in detail science teachers' views on STEM applications implemented through the design-based thinking approach. It is anticipated that the findings from this research will contribute to the dissemination of DT- and STEM-based practices in education and help shape teacher professional development programs.

Methodology

This research is a qualitative study aimed at examining science teachers' views on STEM applications implemented through the design-based thinking approach in depth. The case study method was chosen as the research design. Within the scope of the study, the case study method, one of the qualitative research methods, was employed. A case study is a qualitative research approach that enables in-depth examination of a subject or phenomenon within a certain time frame (Creswell, 2013). This feature was influential in choosing the case study method for this research. Additionally, the case study contributes methodologically to the research by offering the opportunity to examine specific, multiple, or thematic events in depth.

Working Group

The study group consisted of 11 science teachers selected from various provinces, representing a range of professional backgrounds and levels of expertise. Their teaching experience spans between 10 and 20 years. Notably, many participants have served as coordinators or trainers in TÜBİTAK-supported projects and have been actively involved in STEM-based educational practices. For confidentiality, each participant was assigned a code (e.g., P1, P2, P3, etc.).

Table 1. Demographics of the participants

Participant Code	**Gender**	**Place of Duty**	**Experience (Years)**	**STEM Experience**	**Type of Interview**
Participant Code	Gender	Institution	Experience (Years)	STEM Experience	Interview Type
P1	Female	Public Middle School	16	10 years	Online
P2	Female	BILSEM	12	5 years	Face-to-face
P3	Male	Public Middle School	20	8 years	Online
P4	Female	BILSEM	14	7 years	Face-to-face
P5	Male	Public Middle School	15	5 years	Online
P6	Female	Public Middle School	13	4 years	Online
P7	Male	BILSEM	17	10 years	Online
P8	Female	Public Middle School	18	6 years	Face-to-face
P9	Female	BILSEM	16	9 years	Online
P10	Male	Public Middle School	11	3 years	Face-to-face
P 11	Female	BILSEM	19	10 years	Online

Upon examining Table 1, it is observed that the professional experience of the participating science teachers ranges between 11 and 20 years. The institutions where participants work include public middle schools and science and art centers, which is significant for ensuring teacher diversity. The duration of experience with STEM applications ranges from 3 to 10 years. This variation in participants' levels of experience with the subject allows for the collection of richer and more multidimensional data. Additionally, 7 of the interviews were conducted online, while 4 were conducted face-to-face, reflecting a flexible approach to data collection. The gender distribution of the participants indicates a predominance of female teachers. This diversity contributes to gathering teacher opinions from different contexts and enhances the validity of the findings.

Regarding adherence to ethical principles, participants' identities were kept confidential, and the data were used solely for scientific purposes. Voluntary participation forms were obtained from the participants, and all data were processed in accordance with confidentiality principles.

Data Collection Tool

The data for this study were collected using a semi-structured interview form developed by the researcher and structured based on the opinions of field experts. The interview form consists of 13 open-ended questions focusing on STEM applications based on the design-based thinking approach. These questions were structured around five main themes to reveal participants' general evaluations of the applications, their relationship with computational thinking, their contributions to creative thinking, the challenges encountered during the process, and the impacts on classroom practices and personal development. Interviews were conducted

both online and face-to-face, with each interview lasting approximately 30 to 45 minutes. Audio recordings were made with participants' consent and were later transcribed in detail. Below are the 13 different interview questions addressed under 5 main themes in the study:

Table 2. Interview Questions

Main Theme	Interview Questions
General Questions about Design-Based Thinking	What are your thoughts on STEM education applications based on the design-based thinking approach? Please explain. (Positive aspects, negative aspects, evaluation from the perspectives of teachers and students)
	How did you feel while implementing STEM education applications based on the design-based thinking approach in your lessons? Please explain.
Questions about Computational Thinking	Thinking about the STEM applications you have previously implemented, how do you use STEM applications to solve a problem during STEM activities? Please explain.
	How frequently do you use different strategies in your lessons? Do you prefer strategies that you have not used before in the problem-solving process? Please explain.
	What are your thoughts on the role of computational thinking in STEM education applications? What do you think about the role of STEM education applications in helping students develop computational thinking skills? Do STEM applications raise awareness of computational thinking? Please explain.
Questions about Creative Thinking	Are STEM activities implemented through the design-based thinking approach effective in developing creative solutions? At which stage of design-based thinking do you think it contributes? How does it contribute? Please explain.
	How do you encourage children to generate original ideas during the activities you conduct in your classroom? Please explain.
	Do you think STEM education applications affect or encourage creative thinking? Please explain.
Benefits of Design-Based Thinking STEM Applications for Students	Do you think STEM activities implemented through the design-based thinking approach affect students' perspectives on other subjects? Please explain.
	What challenges have you encountered in these applications? What challenges have your students faced? What solutions did you implement for these challenges? Please explain.
Feedback on Design-Based Thinking STEM Applications	Do you think STEM applications implemented through the design-based thinking approach contribute to your personal development and classroom practices? Please explain.
	How free or constrained do you feel during STEM activities implemented through the design-based thinking approach? Please explain.
	What suggestions do you have for improving STEM activities implemented through the design-based thinking approach? Please explain.

Data Analysis

The collected data were analyzed using content analysis techniques. Content analysis is a qualitative data analysis method aimed at systematically dividing data into meaningful categories by coding texts according to predetermined rules (Büyüköztürk et al., 2012). In the content analysis process, the interview transcripts were first carefully read to identify meaningful expressions, and appropriate codes were assigned to these expressions. For example, a participant's statement, "I observed that students developed different perspectives and contributed with original ideas during the activity" (P3), was associated with the code "development of original ideas" under the creative thinking theme. Subsequently, similar codes were grouped to form sub-themes and main themes. To enhance the reliability of coding, a comparison was made with a second researcher, and consensus was reached on any

discrepancies. The researcher ensured that participants were free to express their views during the interviews and made efforts to avoid leading questions. To minimize bias during the analysis process, coding was performed independently at least twice, and verification was ensured through comparisons between researchers. Teachers were included in different codes by giving more than one answer.

Reliability and Validity

Various measures were taken to ensure the reliability of the research. First, the semi-structured interview form used as the data collection tool was reviewed and finalized based on the opinions of three field experts. Researcher triangulation was employed during the data analysis process, increasing consistency by having multiple researchers perform coding and compare interpretations. To support the accuracy and transparency of the findings, direct quotes from participants' statements were included. Additionally, to ensure internal validity, the data were described in detail and contextually; and to support external validity, participants with different demographic characteristics were included in the study based on the principle of maximum variation sampling.

Furthermore, to determine inter-coder reliability, coding conducted by two independent researchers was compared, and the agreement index was calculated using the formula suggested by Miles and Huberman (1994) (Agreement / [Agreement + Disagreement]). As a result of this calculation, an agreement rate of 90% was achieved, which is considered a high level of reliability for qualitative research. Data on which researchers disagreed were discussed and necessary adjustments were made.

Findings

During the research process, 13 questions were asked across five different categories. These included general questions, questions related to computational thinking, questions related to creative thinking, questions regarding the benefits of STEM applications for students, and questions about STEM studies implemented through the design-based thinking approach.

In the first part of the research, the sub-themes and codes related to the General Questions about Design-Based Thinking are presented in the table. The content analysis of the teachers' responses to the question "What are your thoughts on STEM education applications based on the design-based thinking approach? Please explain. (Positive aspects, negative aspects, evaluation from the perspectives of teachers and students)" is provided in Table 3.

Table 3. Teachers' Views on STEM Education Applications Based on the Design-Based Thinking Approach

Theme	Code	n	Participant
Positive Views	Creativity	6	P1, P10, P4, P6, P8, P9
	Problem Solving	4	P2, P6, P8, P9
	Scientific Thinking	4	P2, P6, P8, P9
	Interdisciplinary Learning	3	P1, P2, P9
	21st Century Skills	4	P11, P3, P6, P8
	Student-Centered Learning	5	P11, P2, P4, P8, P9
Negative Views	Time Management Issues	7	P1, P10, P11, P2, P4, P6, P8
	Lack of Infrastructure	4	P10, P11, P4, P5
	Teacher Competency	4	P10, P11, P3, P6
	Classroom Management Difficulty	3	P10, P11, P3
	Evaluation Challenges	3	P11, P6, P7

	Exam Pressure	2	P10, P11

Upon examining Table 3, the statements of the teachers regarding STEM applications based on the design-based thinking (DBT) approach were classified under the themes of positive views and negative views. Under the positive views theme, a total of six different codes were developed by the participants. Particularly, there was an emphasis on high-level skills such as creativity (n=6), problem-solving (n=4), scientific thinking (n=4), and student-centered learning (n=5). This demonstrates that the applications possess a structure that enhances cognitive depth and student engagement. Sample statements are provided below:
P1: "Their creativity is developing, and they're coming up with original ideas."
P9: "Their analytical thinking has improved, and we're progressing with scientific foundations."
P4: "There was more participation in class, and students worked eagerly."

Additionally, participants indicated that they acquired gains in line with contemporary educational approaches, such as 21st-century skills (n=4) and interdisciplinary learning (n=3). On the other hand, the negative views predominantly highlighted structural challenges of the applications. The most frequently mentioned issue was time management (n=7). Participants expressed concerns about the insufficient planning of time for the activities. Furthermore, issues related to the learning environment, such as lack of infrastructure (n=4), teacher competency (n=4), and classroom management difficulties (n=3), were also emphasized. Sample statements are provided below:
P1: "The activities take a lot of time, and we struggle to keep up with the schedule."
P11: "In crowded classes, it's very difficult to attend to all groups."
P6: "I don't have enough experience with such activities; we need training."

In addition, systemic issues such as evaluation challenges (n=3) and exam pressure (n=2) were also mentioned by participants. These findings indicate that although the applications are found beneficial, the educational system is not yet fully prepared for such innovative approaches.

The content analysis of teachers' responses to the question "How did you feel while implementing STEM education applications based on the design-based thinking approach in your lessons? Please explain." is presented in Table 4.

Table 4. Teachers' Views on Their Feelings While Implementing STEM Education Applications Based on the Design-Based Thinking Approach

Theme	**Code**	**n**	**Participant**
Positive Emotions	Excitement	4	P1, P2, P6, P9
	Success	4	P1, P11, P7, P9
	Learner Guidance Role	3	P2, P8, P9
	Increased Motivation	6	P1, P11, P4, P6, P7, P9
Challenging Emotions	Stress and Time Pressure	5	P1, P10, P11, P3, P5
	Feelings of Inadequacy	4	P10, P11, P3, P5
	Lack of Interest	2	P11, P5

Upon examining Table 4, it is seen that the emotions experienced by teachers during STEM applications based on the design-based thinking (DBT) approach were categorized into two main themes: positive emotions and challenging emotions. Under the positive emotions theme, four key codes stand out. In particular, the codes of increased motivation (n=6), success (n=4), and excitement (n=4) demonstrate that the applications created a positive atmosphere for the teachers. Sample statements are provided below:
P6: "As participation increased, my motivation also increased."
P1: "Creating with the students excited me a lot."

Additionally, the learner guidance role (n=3) code indicates that teachers internalized their role not just as knowledge transmitters but also as guides in the learning process.
In the challenging emotions theme, teachers highlighted the difficulties encountered during the implementation process. Specifically, the codes of stress and time pressure (n=5) and feelings of inadequacy (n=4) reflect that teachers faced various systemic and personal challenges while implementing these applications. This indicates that while teachers want to adopt innovative approaches, some external and internal factors make this process more difficult. Sample statements are provided below:
P3: "I had difficulty implementing the activities as planned; time was insufficient."
P11: "While trying to implement activities with students, I felt I wasn't sufficiently equipped."

Furthermore, the code of lack of interest (n=2) shows that DBT-based applications do not always generate the same level of interest among all students, which can create an emotional burden for teachers.

The sub-themes and codes for the second main theme, Questions about Computational Thinking, are presented next. The content analysis of teachers' responses to the question "Thinking about the STEM applications you have previously implemented; how do you use STEM applications to solve a problem during STEM activities? Please explain." is presented in Table 5.

Table 5. Teachers' Views on the Applications Used to Solve Problems during STEM Education Applications Based on the Design-Based Thinking Approach

Theme	**Code**	**n**	**Participant**
Problem Solving	Problem Definition	5	P1, P11, P2, P4, P7
	Ideation	5	P1, P11, P3, P4, P7
	Prototyping	6	P1, P11, P3, P4, P7, P9
	Interdisciplinary Integration	8	P1, P10, P2, P4, P5, P7, P8, P9

Upon examining Table 5, it is observed that teachers' views on the problem-solving process during STEM applications based on the design-based thinking approach were categorized under four main codes: "problem definition" (n=5), "ideation" (n=5), "prototyping" (n=6), and "interdisciplinary integration" (n=8). Sample statements are provided below:
P1: "After designing and creating a prototype, we gather feedback from other students."
P13: "As a group, we conduct brainstorming and division of tasks to develop solution proposals."

The content analysis of teachers' responses to the question "How frequently do you use different strategies in your lessons? Do you prefer strategies that you have not used before in the problem-solving process? Please explain." is presented in Table 6.

Table 6. Teachers' Views on the Applications Used When Preferring Different Strategies During STEM Education Applications Based on the Design-Based Thinking Approach

Theme	**Code**	**n**	**Participant**
Strategy Preference	Student Needs	3	P11, P5, P8
	Methodological Flexibility	7	P1, P10, P11, P6, P7, P8, P9
	Project-Based Applications	3	P11, P3, P5

Upon examining Table 6, it is seen that teachers' views were expressed under the "strategy preference" theme with the codes of student needs (n=3), methodological flexibility (n=7), and project-based applications (n=3). The codes indicate that teachers identified different strategies based on students' needs during design-based thinking STEM applications,

emphasized the importance of methodological diversity, and frequently incorporated project-based activities in their practices. Sample statements are provided below:
P1: "Strategies I haven't used before keep the teaching process fresh and dynamic."
P11: "I try new strategies based on students' needs."

The content analysis of teachers' responses to the question "What are your thoughts on the role of computational thinking in STEM education applications? What do you think about the role of STEM education applications in helping students develop computational thinking skills? Do STEM applications raise awareness of computational thinking? Please explain." is presented in Table 7.

Table 7. Teachers' Views on the Role of STEM in Computational Thinking during STEM Applications Based on the Design-Based Thinking Approach

Theme	Code	n	Participant
The Role of STEM in Computational Thinking	Algorithmic Thinking	4	P1, P10, P6, P9
	Decomposing Problems	4	P1, P11, P4, P9
	Interdisciplinary Alignment	4	P10, P2, P4, P9
	Awareness Gained	8	P1, P10, P11, P4, P5, P6, P8, P9

Upon examining Table 7, it is seen that teachers' views were expressed under the theme of "the role of STEM in computational thinking" with the codes of algorithmic thinking (n=4), decomposing problems (n=4), interdisciplinary alignment (n=4), and awareness gained (n=8). Looking at the codes, it is evident that teachers generally agreed that STEM applications contributed to computational thinking, with a particular emphasis on expressions highlighting awareness gained. Sample statements are provided below:
P9: "Computational thinking helps develop the ability to break down and analyze problems."
P10: "Computational thinking and STEM complement each other."

The sub-themes and codes for the third main theme, Questions about Creative Thinking, are presented next. The content analysis of teachers' responses to the question "Are STEM activities implemented through the design-based thinking approach effective in developing creative solutions? At which stage of design-based thinking do you think it contributes? How does it contribute? Please explain." is presented in Table 8.

Table 8. Teachers' Views on the Contributions of Creative Thinking during STEM Applications Based on the Design-Based Thinking Approach

Theme	Code	n	Participant
Contributions of Creative Thinking	Ideation	7	P1, P2, P3, P5, P6, P7, P8
	Prototyping	6	P2, P3, P5, P6, P7, P9
	Empathy	5	P1, P3, P8, P9, P10

Upon examining Table 8, it is seen that teachers' views were expressed under the theme of "contributions of creative thinking" with the codes of ideation (n=7), prototyping (n=6), and empathy (n=5). Looking at the codes, it is clear that teachers expressed that design-based thinking STEM applications supported creative thinking processes, with the contribution being particularly strongly felt during the ideation stage. Sample statements are provided below:
P8: "The processes of empathizing and defining the problem lay the groundwork for producing creative solutions."
P7: "During the ideation stage, students discover different solution pathways."

The content analysis of teachers' responses to the question "How do you encourage children to generate original ideas during the activities you conduct in your classroom? Please explain." is presented in Table 9.

Table 9. Teachers' Views on the Contributions of Creative Thinking in Classroom Practices during STEM Applications Based on the Design-Based Thinking Approach

Theme	Code	n	Participant
Creativity in Classroom Practices	Creating a Free Environment	5	P1, P3, P4, P7, P11
	Brainstorming and Feedback	4	P3, P6, P7, P8

Table 10. Teachers' Views on the Impact of STEM on Creative Thinking during STEM Applications Based on the Design-Based Thinking Approach

Theme	Code	n	Participant
Impact of STEM on Creative Thinking	Interdisciplinary Creativity	5	P1, P2, P5, P9, P11
	Problem-Based Approach	7	P3, P4, P5, P6, P7, P9, P10
	Collaborative Learning	3	P6, P9, P11

Upon examining Table 10, it is seen that teachers' views were expressed under the theme of "impact of STEM on creative thinking" with the codes of interdisciplinary creativity (n=5), problem-based approach (n=7), and collaborative learning (n=3). The codes indicate that teachers believe STEM applications encourage creative thinking, especially through problem-solving processes and collaborative activities that contribute to the development of creative ideas. Sample statements are provided below:

P6: "STEM offers an open-ended process, providing students with plenty of opportunities to develop ideas."

P11: "I observe an increase in students' confidence when they work in groups."

Table 11. Teachers' Views on the Contributions of Design-Based Thinking STEM Applications to Students

Theme	Code	n	Participant
Contributions to Students	Increased Interdisciplinary Interest	1	P11
	Creativity	2	P1, P9
	Communication	2	P8, P9

Upon examining Table 11, it is seen that teachers' views were expressed under the theme of "contributions to students" with the codes of increased interdisciplinary interest (n=1), creativity (n=2), and communication (n=2). The codes indicate that teachers believe STEM activities based on the design-based thinking approach enhance students' interest in different subjects, develop their creativity, and positively impact their communication skills. Sample statements are provided below:

P11: "It fosters a positive attitude towards subjects like mathematics and makes learning easier."

P8: "The design process improves students' skills in presenting ideas and collaborating."

Table 12. Teachers' Views on Challenges and Solution Suggestions during Design-Based Thinking STEM Applications

Theme	Code	n	Participant
Challenges Encountered	Time Constraints	6	P1, P2, P4, P6, P7, P11
	Lack of Materials	6	P1, P3, P4, P5, P6, P11
	Student Motivation	5	P1, P3, P6, P9, P10
	Classroom Management Difficulty	4	P3, P6, P10, P11
Solution Suggestions	Use of Low-Cost Alternatives	3	P1, P4, P9
	Student Roles and Group Support	2	P1, P8

	Individual Support and Flexible Planning	1	P8

Upon examining Table 12, it is seen that teachers' views were categorized into two themes: challenges encountered and solution suggestions. Under challenges encountered, the prominent codes are time constraints (n=6), lack of materials (n=6), student motivation (n=5), and classroom management difficulty (n=4). Under solution suggestions, the codes include use of low-cost alternatives (n=3), student roles and group support (n=2), and individual support and flexible planning (n=1). The codes indicate that teachers tried to find solutions to various structural and pedagogical issues encountered during implementations, particularly by focusing on strategies such as resource utilization, collaboration, and flexible approaches. Sample statements are provided below:
P11: "I often can't complete everything due to time constraints."
P3: "Classroom management is challenging due to large class sizes."
P1: "I made the projects more sustainable by using recycled materials."
P8: "I supported some processes with homework or group work."

Table 13. Teachers' Views on the Contributions of Design-Based Thinking STEM Applications to Personal Development

Theme	**Code**	**n**	**Participant**
Personal Development	Professional Development	1	P2
	Creativity Development	2	P4, P1
Classroom Contributions	Student Participation and Interaction	2	P1, P5

Upon examining Table 13, it is seen that teachers' views were categorized into two themes: personal development and classroom contributions. Under personal development, the codes include professional development (n=1) and creativity development (n=2), while under classroom contributions, the code of student participation and interaction (n=2) stands out. The codes indicate that teachers believe STEM applications enhance their individual professional competencies and strengthen their interactions with students in the classroom. Sample statements are provided below:
P2: "Using theses and articles supports my professional development."
P1: "Group work has a positive impact on classroom dynamics."

Table 14. Teachers' Views on Freedom and Constraints during Design-Based Thinking STEM Applications

Theme	**Code**	**n**	**Participant**
Freedom	Creativity and Flexibility	2	P1, P4
Constraints	Time and Curriculum	4	P4, P6, P7, P10

Upon examining Table 14, it is seen that teachers' views were categorized into two themes: freedom and constraints. Under freedom, the code of creativity and flexibility (n=2) appears, while under constraints, the code of time and curriculum (n=4) stands out. The codes indicate that some teachers felt free to engage in creative thinking and flexible implementation during STEM activities, while others expressed feeling constrained by time limitations and the existing curriculum structure. Sample statements are provided below:
P10: "The tight curriculum schedule restricts me."
P1: "I feel completely free to generate new ideas."

Table 15. Teachers' Views on Suggestions for the Development of Design-Based Thinking STEM Applications

Theme	Code	n	Participant
Development Suggestions	Teacher Training	2	P2, P3
	Resources and Infrastructure	2	P1, P3
	Student-Centered Practices	3	P1, P2, P3

Upon examining Table 15, it is seen that teachers' views were expressed under the "development suggestions" category with the codes of teacher training (n=2), resources and infrastructure (n=2), and student-centered practices (n=3). The codes indicate that teachers emphasized the need to strengthen student-centered approaches, increase teacher competencies, and improve physical facilities to enhance design-based thinking STEM applications. Sample statements are provided below:

P3: "I think there should be more teacher training."

P2: "Students should identify real-life problems themselves."

Discussion

The findings of this study reveal that STEM applications implemented through the design-based thinking (DBT) approach have a transformative influence on both students and teachers. The participating science teachers consistently emphasized that DBT-STEM practices foster deeper student engagement, creativity, and problem-solving, while also enhancing their own sense of professional fulfillment and pedagogical innovation.

According to the teachers, one of the most significant benefits of DBT-based STEM activities is the freedom it affords students to express their creativity. Activities rooted in real-life contexts allowed students to approach open-ended problems from multiple perspectives, leading to original and personally meaningful solutions. Teachers reported that the DBT stages—empathizing, defining, ideating, prototyping, and testing—enabled students to think beyond rote answers, internalize problems, and design user-centered, practical solutions. This design cycle also gave structure to creativity, guiding students in transforming abstract ideas into tangible products. Teachers described how classroom techniques like brainstorming sessions, open-ended questioning, and the use of creative drama reinforced these skills and encouraged a culture of exploration and risk-taking.

Teachers particularly noted the development of computational thinking skills as a standout gain from integrating STEM with DBT. Students were observed applying algorithmic reasoning, systematic problem-solving, and modeling approaches with increasing proficiency. Several teachers commented that this type of thinking emerged organically during design tasks, especially when students had to break complex problems into manageable steps or translate their ideas into structured, logical prototypes. These observations are consistent with the findings of Batı et al. (2017) and Sarı & Karaşahin (2020), who highlight the capacity of STEM education to enhance cognitive skill development and motivation.

Beyond student gains, the research underscores that DT-STEM practices prompted a shift in the professional identity and roles of the participating teachers. Many reported becoming more reflective and adaptive in their teaching practices. They felt more like facilitators and co-creators than traditional instructors, which contributed to a more democratic, student-centered classroom atmosphere. Teachers expressed that witnessing students' growth in such an active learning environment instilled a sense of excitement and rejuvenation in their own teaching careers.

Nevertheless, the transition was not without challenges. Teachers candidly discussed structural barriers such as time constraints, curriculum rigidity, lack of resources, and overcrowded classrooms. These obstacles often led to frustration and fatigue, threatening the sustainability of DT-STEM practices. As some teachers noted, the pressure to "cover content"

sometimes clashed with the more exploratory, iterative nature of design thinking. These concerns reflect limitations identified in previous studies (Çakır & Altun Yalçın, 2020; Çınar & Terzi, 2021; İnançlı & Timur, 2018), where the institutional environment was shown to significantly influence the success of innovation in practice.

Despite these constraints, many teachers displayed resilience and agency by modifying lesson plans, using recycled or low-cost materials, and collaborating with peers to adapt the curriculum to better accommodate DBT-STEM practices. This aligns with Margot and Kettler's (2019) finding that success is more likely when the curriculum is flexible and aligned with engineering- and design-focused learning goals. Teachers in this study similarly stressed the need for systemic support, such as professional development, administrative encouragement, and infrastructure upgrades, to make DBT-STEM applications more sustainable.

In terms of classroom dynamics, the teachers observed not only cognitive growth but also social and emotional development among students. They highlighted students' improved communication, teamwork, and leadership skills, as well as greater willingness to participate and take initiative in group settings. As noted by one participant, "Students who rarely spoke before now lead group discussions during the prototyping phase." This observation echoes the findings of Çakır and Altun Yalçın (2020), who reported improvements in students' emotional engagement, willingness to participate, and ability to differentiate and articulate their ideas.

Conclusion

In conclusion, science teachers' reflections underscore the dual benefit of DBT-integrated STEM applications: fostering students' creative and computational thinking skills, while simultaneously promoting pedagogical renewal among teachers. However, the findings also highlight the need to address systemic challenges through targeted teacher training, improved school resources, and the curricular integration of DBT principles. For DBT-STEM practices to become a sustainable and scalable innovation, structural and institutional support must align with the pedagogical shifts teachers are already striving to implement.

Recommendations

Based on the findings obtained from this research, the following recommendations are made to ensure that STEM applications implemented through the design-based thinking approach become more effective, sustainable, and widespread:

- Strengthening teacher training programs is of great importance for design-based thinking and STEM applications to have an effective place in the education system. Therefore, in-service training programs aimed at enhancing teachers' methodological knowledge and application competencies should be expanded.
- Workshop areas suitable for STEM applications should be created in schools, essential material kits should be provided, and computer and internet infrastructure should be improved.
- Flexibility in terms of time and curriculum alignment should be ensured for the successful implementation of design-based and project-based applications. In this regard, a framework curriculum structure could be preferred for courses such as science practices.

Contributors

The authors declare that they have contributed equally to the conception, design, data analysis, and writing of this article.

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Teaching the Particulate Nature of Matter with Augmented Reality: A Study on Students' Attitudes and Motivation

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Abstract: Understanding abstract concepts in chemistry education is often a challenging process for students. Augmented reality (AR) technology stands out as an important tool that facilitates learning by visualizing abstract chemistry concepts. The aim of this study is to examine the effects of teaching the topic "The Particulate Nature of Matter" to 6th-grade students using the augmented reality application "VIDEOAR" via mobile devices on students' attitudes towards AR technology and their motivation to learn science. Using a quasi-experimental design, this study was conducted with 54 middle school students during the 2022-2023 academic year. The results of the study indicate that the group experiencing the AR application showed a significant increase in their attitudes towards AR technology and their motivation to learn science compared to the control group. In addition, no significant difference was found in attitudes and motivation based on gender. As a result, it was determined that AR technology enhances students' interest in the course and positively affects their motivation towards science learning in courses involving abstract subjects such as chemistry. The significant effect of integrating AR technology into education in terms of attitude and motivation, regardless of gender, is thought to stem from today's learners' interest in technology and represents an important finding for classroom practices. In this regard, it is suggested that AR applications be more widely integrated into science courses and that this technology be utilized in other subjects as well.
Keywords*:* Augmented Reality (AR), Attitudes, Motivation, Chemistry Education, Abstract Concepts, Educational Technology.

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Introduction

While education undergoes a continuous transformation driven by technological advancements, significant changes are also occurring in learning methods. The increasing number and diversity of technologies used in educational settings have necessitated that educators adapt to these developments (Çolak Yazıcı & Erkoç, 2023). In particular, it is crucial for teachers to stay up to date with these advancements and integrate the most appropriate technological tools into their lessons to foster 21st-century skills. The primary advantages of technology-based instructional materials include enhancing students' ability to comprehend learning content, supporting individual learning capacities, and providing learners with unlimited opportunities for repetition by offering a learning environment independent of time and space (Adewoye & Akinde, 2023; Qomaruddin et al., 2024). The challenges faced by individuals born in the digital age regarding face-to-face communication necessitate the integration of individualized learning materials into educational environments, enabling students to work independently. In this context, the integration of technology into education addresses these needs by providing teachers with effective and functional resources (Çolak Yazıcı, 2024). Studies on Generation Z, who constitute today's students, indicate that students actively demand the integration of technology into traditional teaching methods (Chan & Lee, 2023; Granitz et al., 2021; Nazar et al., 2024). Students' perceptions of learning environments, their abilities, and the teaching strategies employed have a significant impact on their learning approaches and academic outcomes (Chan & Hu, 2023). Students who perceive the learning environment positively, demonstrate high levels of motivation and positive attitudes, and feel confident in their abilities are more likely to achieve desirable learning outcomes.

Today, Web 2.0 tools are frequently used in education, and recent advancements have led to a new transformation driven by artificial intelligence in educational settings (Feldman-Maggor et al., 2024). One of the prominent technologies utilized in education is Augmented Reality (AR) (Mahadzir & Phung, 2013). AR is defined as a technology that integrates computer-generated virtual images into the real world, enabling interaction with both physical and virtual objects (Azuma, 1997). This technology enhances students' engagement with educational materials in a more interactive and meaningful manner while also supporting their learning processes (Nazar et al., 2024).

Milgram and Kishino (1994) defined augmented reality as a continuum between reality and virtuality, stating that AR is a tool that integrates both real and virtual elements. Mazzuco et al. (2022) emphasized that AR systems should seamlessly merge virtual elements with the real environment, enable interactive and real-time processing, and be designed in three dimensions. Consequently, AR is a technology that bridges the real and virtual worlds, allowing users to engage in physical interactions within a real environment enhanced by virtual elements (Ripsam & Nerdel, 2024). The significance of AR in education lies in its ability to enhance the concretization of concepts and promote student-centered learning by providing a more motivating, effective, and interactive learning environment. AR, which supports practical applications in education, has the potential to enrich learning processes, particularly by fostering student-centered experiences, and, like other technological tools integrated into education, supports individualized learning (Jiang et al., 2025). The integration of AR into education plays a crucial role in facilitating students' conceptual understanding, particularly by enabling the visualization of abstract concepts, thereby increasing their motivation for the course and significantly improving their academic achievement.

Embodiment plays a crucial role in the teaching of concepts, especially in chemistry topics. Interacting with virtual objects and conducting experiments during lessons helps students better understand these abstract concepts and has a significant impact on students' attitudes and motivation towards the course. Cheng et al., (2024) emphasized that AR-enriched materials

enhance students' attitudes and motivation towards science. Research by Kadıoğlu and Özyalçın Oskay (2025) also demonstrates that AR applications improve students' attitudes towards chemistry lessons and increase their engagement in the learning process.

The use of AR in subjects such as chemistry, which involves numerous abstract concepts, plays a significant role in helping students better understand these complex ideas (Nazar et al., 2024). Chemistry education is typically challenging for students due to the simultaneous need to comprehend the symbolic, microscopic, and macroscopic chemical worlds (Olim et al., 2024; Saidin et al., 2019). It is well-established that students often struggle to relate the chemical processes they observe in the laboratory to molecular-level phenomena. In this context, AR technology provides supportive learning materials that help students visualize invisible molecular structures and chemical bonds (Bullock et al., 2024). Aw et al. (2020) also emphasized that three-dimensional models enhance the understanding of chemical processes at the atomic level. These models facilitate the comprehension of complex chemical concepts, which are otherwise inaccessible through sensory experiences, and help to develop students' cognitive and spatial abilities.

Studies on the impact of AR technology in chemistry education have shown that AR facilitates the teaching process in topics such as molecular structures, chemical reactions, chemical bonds, and organic chemistry (Bullock et al., 2024; Karnishyna et al., 2024). In a study conducted by Bullock et al. (2024), teaching the electrophilic aromatic substitution mechanism in an AR environment enabled students to better grasp the topic and increased their positive attitudes toward the use of technology. Similarly, Hoai et al. (2024) demonstrated that teaching chemical bonding through AR simulations helped students better understand these concepts and engage more actively in the learning process. Numerous studies have highlighted that the use of AR technology in education enhances the quality of the teaching process and yields positive outcomes (Cheng et al., 2024; Mazzuco et al., 2022; Usta et al., 2016).

Yıldırım (2018) found that mobile AR applications had positive effects on students' science learning attitudes and academic performance. This study demonstrates that AR applications facilitate students' understanding of course topics by concretising abstract concepts. Similarly, Güngördü (2018) highlighted that AR has a positive impact on student achievement and attitudes in science subjects.

In conclusion, AR technology offers significant advantages for students, particularly in chemistry courses where abstract and complex concepts are taught. AR serves as a technological teaching tool that aids students in better understanding abstract chemical concepts by enabling their visualisation and concretisation. By providing an interactive and motivating learning environment, this technology enhances students' attitudes and motivation towards science. Research on the use of AR in education suggests that this technology increases both student achievement and engagement in lessons.

Importance of the Research

Although studies on the effects of AR technology on different materials in education for teaching chemistry subjects are included in the literature, there is a need for more comprehensive studies addressing these effects in different grade levels, learning areas and contexts. In the literature, it has been found that AR technology increases students' motivation (İbili & Şahin, 2015; Küçük et al., 2014) and positively affects their interest in the course (Akkiren, 2019; Sırakaya & Alsancak Sırakaya, 2018; Yıldırım, 2018). Especially its contribution to the concretization of abstract concepts in science courses (Abdüsselam & Karal, 2012) further increases the importance of AR technology in education. This technology makes abstract concepts more permanent by structuring them in visual ways.

It is noteworthy that AR technology has been widely researched in the field of science, especially in physics, but such studies are less common in other disciplines. In this context, the current study aims to teach the subject of 'The Particulate Nature of Matter', which is difficult to understand with traditional teaching methods, to 6th grade students using augmented reality technology. The study aims to examine the effect of AR technology on students' attitudes towards this technology and their motivation to learn science. Motivation is the force that moves an individual towards a certain goal. In other words, motivation is the sum of all efforts to continuously mobilise individuals or groups towards a certain ideal or goal. Attitude and motivation are concepts that play a critical role in the success and effectiveness of learning processes. In the research conducted by Chen (2024), it was concluded that students' motivation, class participation, perception and achievement were related (Liu, 2024). Therefore, the selection of attitudes and motivation in this study aims to provide an in-depth understanding of the affective and cognitive effects of AR technology on learning. Although there are numerous studies in the literature on the effects of attitude and motivation on learning, these concepts need to be further examined in the context of AR technology (Yang et al., 2024). In addition, the gender variable was selected to investigate the differences in the literature regarding the effects of gender on attitudes and motivation towards technology. The contribution of the gender variable to this study is to provide an opportunity to compare the effects of AR technology on different demographic groups. It is believed that this will contribute to the development of a more comprehensive and inclusive understanding of the use of AR technology in education by addressing a gap in the literature.

Purpose of the Study

The purpose of this study is to examine the effects of teaching the "Particle Nature of Matter" topic to 6th-grade students using the AR application 'VIDEOAR' via mobile devices on students' attitudes towards AR technology and their motivation to learn science. In this study, the impact of technology integration on students' engagement in the lesson and its implications for their motivation levels were examined in detail.

In this context, the study seeks to answer the following research questions:

1. Is there a significant difference between the pre-test and post-test scores of the experimental and control groups in terms of their motivation towards learning science?
2. Is there a significant difference between the pre-test and post-test scores of the experimental and control groups in terms of their attitudes towards augmented reality technology?
3. Do students' motivations towards learning science significantly differ according to the gender variable?
4. Do students' attitudes towards augmented reality technology significantly differ according to the gender variable?

Method

Research Design

The research method and design play a critical role in achieving the purpose of the study. The quasi-experimental design is a method that provides the most appropriate and reliable answers to research questions in cases where random assignment is not possible (Johnson & Christensen, 2014). In this context, the effects of AR activities on students' attitudes and motivation were examined by administering pre-tests and post-tests to the experimental and control groups. While augmented reality activities were implemented in the experimental group, traditional teaching methods were employed in the control group. This approach aims to clearly observe

the effects of AR technology on the dependent variables. To enhance the validity and reliability of the research, a pre-test post-test design was used, and external influences were minimized.

Population and Sample of the Study

The population and sample of the study consist of 6th-grade students attending a secondary school in the central district of Düzce during the 2022-2023 academic year. In the sampling process, the criteria of a homogeneous gender distribution, similar class sizes, and having the same teacher were taken into consideration. Accordingly, the experimental group was selected from the 6/A class, which consisted of 27 students in total, including 12 girls and 15 boys, while the control group was selected from the 6/C class, comprising 13 boys and 14 girls. Random assignment was not employed in the selection of the classes; rather, it was ensured that the class characteristics were aligned with the purpose of the research.

Data Collection Tools and Analysis

Two different data collection tools were used in the study.

Augmented Reality Technology Attitude Scale:

The "Augmented Reality Attitude Scale," developed by Küçük et al. (2014), was used to measure students' attitudes towards augmented reality (AR) technology. This 15-item, 5-point Likert-type scale is composed of three factors: "Satisfaction with Use," "Anxiety about Use," and "Willingness to Use." The scale was administered to students in both the experimental and control groups as a pre-test and post-test.

The construct validity of the scale was comprehensively evaluated by the developers. Through factor analysis, the scale was found to exhibit a three-factor structure, supporting its construct validity. Additionally, the items of the scale demonstrated the ability to accurately represent the intended concepts, confirming the scale's content validity.

In terms of reliability, the Cronbach's Alpha reliability coefficient of the scale was calculated as 0.84 by the developers. According to the literature, a Cronbach's Alpha value above 0.80 indicates that the scale is reliable (Ursachi et al., 2015). These findings demonstrate the validity and reliability of the scale. Additionally, as the scale is widely utilized in educational research, no further validation study was deemed necessary in this context.

Motivation Scale for Learning Science:

The "Motivation Scale for Learning Science," developed by Dede and Yaman (2008), was used to measure students' motivation towards learning science. This 5-point Likert-type scale, consisting of 23 items, includes four sub-dimensions: "Motivation for Research," "Motivation for Performance," "Motivation for Communication," and "Motivation for Collaboration." The developers reported a Cronbach's Alpha internal consistency coefficient of 0.80 for the overall scale, indicating a high level of reliability.

SPSS 25.0 (Statistical Package for the Social Sciences) was used for data analysis, and all analyses were conducted at a 5% significance level. To test the normality of the data, the Shapiro-Wilk Test was applied. According to the results, the data were normally distributed ($p>0.05$) (Pallant, 2017). Upon confirming the normality assumption, both independent samples t-test and paired samples t-test were utilized to analyze the data. The independent samples t-test was used to examine the differences between the experimental and control groups, while the paired samples t-test was conducted to evaluate the pre- and post-test changes within each group. These two tests enabled a comprehensive examination of the effects of AR implementation on motivation to learn science and attitudes towards AR technology, considering both within-group and between-group differences.

Normality Test Results

According to the Shapiro-Wilk normality test results, the pre-test and post-test scores from the motivation and attitude scales towards learning science for students in the experimental and control groups were normally distributed ($p > 0.05$). For the motivation scale, the pre-test p-value of the experimental group was 0.882 and the post-test p-value was 0.100, while the control group's pre-test p-value was 0.283 and the post-test p-value was 0.119. Similarly, for the attitude scale, the experimental group's pre-test p-value was 0.560 and the post-test p-value was 0.438, whereas the control group's pre-test p-value was 0.147 and the post-test p-value was 0.417.

Since all of these p-values exceed 0.05, it can be concluded that the data meet the normality assumption. Therefore, parametric analysis methods were employed to examine the differences between the groups, and the independent samples t-test was applied.

Application

Application Process of the Experimental Group

The implementation process for the experimental group started with pre-tests to measure students' attitudes towards AR technology and their motivation to learn science. These tests were applied at the beginning of the course to evaluate the effect of AR activities. In addition to the 6 class hours allocated for the teaching of the 'The Particulate Nature of Matter' topic in the curriculum, 2 more class hours were added for the students to learn and use the AR application effectively. This process, which was carried out in 8 class hours for a total of 2 weeks, aimed to improve both the students' understanding of the subject and their experiences with AR technology. Unlike the control group, which was taught the same subject by the same teacher, the experimental group students also participated in augmented reality applications during the lesson. In this process, the students in the experimental group were asked to install the mobile augmented reality application named 'VIDEOAR' on their mobile phones before the lesson. The purpose of using the application is to make the particulate, porous, and dynamic structure of matter more concrete and to facilitate students' understanding of these abstract concepts.

In the lessons, using sample substances in solid, liquid, and gaseous states in the classroom, these substances were examined with the 'VIDEOAR' application. Thanks to AR technology, students were able to observe the atomic structure of these substances and how this structure moved. Especially in these abstract and challenging subjects, the 'VIDEOAR' application is thought to help students better understand the concepts (Langitasari et al., 2024). In this way, it was aimed to increase students' interest in the subject and to ensure their more active participation in the learning process.

At the end of the implementation process, the augmented reality attitude scale and the motivation scale for learning science were administered to the students as post-tests. It was aimed to examine the difference between the initial and post-tests and the extent to which the AR application influenced students' motivation towards science learning and their attitude towards AR technology.

Application Process of the Control Group

In the experimental and control groups, the scales were pre-printed and distributed to the students. In the control group, the implementation process started with pre-tests measuring students' attitudes towards AR technology and their motivation to learn science. However, the students in this group were educated with traditional teaching methods, and no AR application was used in the lessons.

In the control group, the topic 'The Particulate Nature of Matter' was taught using the textbook recommended by the Ministry of National Education. Throughout the lesson, the teacher generally used the direct instruction method and aimed to help students understand the concepts better by giving examples from daily life in some parts of the subject. Students were encouraged to take notes on the important parts of the subject, and traditional methods were preferred throughout the teaching process.

In the control group, at the end of 8 class hours of training lasting for 2 weeks, the attitude scale towards AR technology and the motivation scale for learning science were re-applied to the students as post-tests. These tests were used to determine the effect of traditional teaching methods on students.

Finding

The findings obtained within the scope of the research are presented below.

Table 1
Dependent sample t-test results for the pre-test and post-test findings of students' motivation and attitude scales for science learning

Scale	Group	Test	N	$\bar{X}$	SS	SD	*t*	*p*
Motivation Scale	**Experimental Group**	Pre-test	27	42.29	5.61	26	18.40	0.00
		Post-test	27	75.96	7.75			
	Control Group	Pre-test	27	50.22	9.07	26	2.45	0.02
		Post-test	27	51.81	10.06			
Attitude Scale	**Experimental Group**	Pre-test	27	41.92	4.14	26	-5.09	0.00
		Post-test	27	47.81	3.75			
	Control Group	Pre-test	27	44.62	8.40	26	-1.20	0.24
		Post-test	27	45.25	8.39			

A statistically significant difference was found between the motivation to learn science pre-test ($\bar{X}$ = 42.29) and post-test ($\bar{X}$ = 75.96) scores of the Experimental Group students ($t=18.40$; $p<0.05$). This result shows that AR applications increased the motivation of the Experimental Group students. A statistically significant difference was also found between the motivation pre-test ($\bar{X}$ = 50.22) and post-test ($\bar{X}$ = 51.81) scores of the Control Group students ($t=2.45$; $p<0.05$). However, it was found that this difference was at a lower level compared to the Experimental Group.

A significant difference was found between the Attitude Scale pre-test ($\bar{X}$ = 41.92) and post-test ($\bar{X}$ = 47.81) scores of the Experimental Group students ($t=-5.09$; $p<0.05$). This shows that the AR application positively affected the attitudes of the students.

In the Control Group, no significant difference was found between the Attitude Scale pre-test ($\bar{X}$ = 44.62) and post-test ($\bar{X}$ = 45.25) scores (t=-1.20; p>0.05).

Table 2
Independent sample t-test results for the pre-test and post-test findings of students' motivation and attitude scales for science learning

Scale	Test	Group	N	$\bar{X}$	SS	SD	*t*	*p*
Motivation Scale	Pre-test	Experimental Group	27	42.29	5.61	52	9.87	0.00
		Control Group	27	50.22	9.07			
	Post-test	Experimental Group	27	75.96	7.75	52	-3.85	0.00
		Control Group	27	51.81	10.06			
Attitude Scale	Pre-test	Experimental Group	27	41.92	4.14	52	-1.50	0.14
		Control Group	27	44.62	8.44			
	Post-test	Experimental Group	27	47.81	3.75	52	1.44	0.16
		Control Group	27	45.25	8.39			

A significant difference was found between the Motivation Scale pre-test scores of the Experimental and Control Group students (t=9.87; p<0.05). The mean score of the Control Group ($\bar{X}$ = 50.22) was higher than the mean score of the Experimental Group ($\bar{X}$ = 42.29).

In the post-test scores, a statistically significant difference was found between the Experimental Group ($\bar{X}$ = 75.96) and the Control Group ($\bar{X}$ = 51.81) (t=-3.85; p<0.05). In the light of the results obtained, it is thought that AR-supported education is effective in increasing the motivation of students.

When the Attitude Scale pre-test scores were analyzed, no significant difference was found between the Experimental Group ($\bar{X}$ = 41.92) and the Control Group ($\bar{X}$ = 44.62) (t=-1.50; p>0.05). There was no significant difference between the Experimental Group ($\bar{X}$ = 47.81) and the Control Group ($\bar{X}$ = 45.25) in post-test scores (t=1.44; p>0.05). This shows that the difference between the attitudes of both groups is not statistically significant.

Table 3
Independent sample t-test results of motivation and attitudes towards AR technology according to gender

Scale	Test	Group	Gender	N	$\bar{X}$	S.S	S.D	*t*	*p*
Motivation Scale	Pre-test	Experimental Group	Female	13	39	5.01	13	-3.51	0.002
			Male	14	45.35	4.34	14		
	Post-test		Female	13	75.46	6.91	13	-0.319	0.749
			Male	14	76.42	8.7	14		
	Pre-test	Control Group	Female	12	51.15	10.8	12	-0.32	0.75
			Male	15	52.42	9.6	15		
	Post-test		Female	12	49.76	10.5	12	-0.25	0.81
			Male	15	50.64	7.9	15		
Attitude Scale	Pre-test	Experimental Group	Female	13	42.38	3.81	13	0.551	0.587
			Male	14	41.5	4.51	14		
	Post-test		Female	13	48.46	3.4	13	0.865	0.396
			Male	14	47.21	4.07	14		
	Pre-test	Control Group	Female	12	45.3	8.53	12	0.397	0.694
			Male	15	44	8.54	15		
	Post-test		Female	12	45.92	8.68	12	0.39	0.7
			Male	15	44.64	8.39	15		

There was no statistically significant difference between the Motivation Scale post-test scores of female ($\bar{X}$ = 75.46) and male ($\bar{X}$ = 76.42) students in the Experimental Group (t = -.319, p > 0.05).

There was no statistically significant difference between the pre-test and post-test motivation scores of male and female students in the Control Group (p > 0.05). It can be said that traditional teaching methods do not create a difference based on gender.

In the Experimental Group, there was no statistically significant difference between the pre-test and post-test attitude scores of male and female students ($p > 0.05$). This indicates that AR applications did not make a difference in the attitudes of the students based on gender.

Discussion

AR technology stands out as an effective tool that provides meaningful learning and enriches learning processes by enabling students to concretize abstract concepts in teaching chemistry concepts. In this study, the effects of teaching the Particulate Nature of Matter subject using AR technology on students' attitudes towards AR technology and their motivation towards science learning were examined. The findings supported that AR technology increased the participation of the students in the Experimental Group in the learning process and their level of understanding of the concepts in the teaching of an abstract and conceptually dense course such as chemistry. While more limited learning experiences were provided with traditional teaching methods in the Control Group, it would be appropriate to infer that the visual and interactive content provided by AR technology supported students' learning by making complex concepts more concrete, which affected the findings obtained. Integration of technologies in education facilitates making teaching materials interactive and meaningful to meet the individual learning needs of students (Çolak Yazıcı & Erkoç, 2023; Adewoye & Akinde, 2023).

AR facilitates students' comprehension of abstract chemistry concepts more effectively, thereby supporting their learning processes. This distinction was reflected in more significant positive changes in the attitudes and motivation of the students in the Experimental Group. Nazar et al. (2024) state that AR technology plays a crucial role in concretizing abstract concepts, fostering students' active engagement in the learning process. The literature also highlights that the individualised learning environments provided by AR technology enable students to regulate their learning pace more effectively (Chan & Lee, 2023; Granitz et al., 2021).

This finding supports the argument that AR technology has a positive impact on students' attitudes towards courses and enhances their engagement in learning processes, as highlighted in the findings of Bullock (2024). Specifically, AR technology is believed to transform an abstract subject such as the "The Particulate Nature of Matter" into a more comprehensible form through visual modeling and dynamic, interactive simulations. This process enabled the students in the Experimental Group to engage in deeper learning experiences by constructing meaning from the concepts. Mazzuco et al. (2022) underscore that AR facilitates students' understanding of abstract chemical processes by visualizing them through three-dimensional modeling. This process has contributed to the development of students’ positive attitudes towards AR technology and has led to a significant increase in their motivation for science learning. In Hoai et al.'s (2024) study, it was found that teaching chemical bonding using AR technology enhanced students’ conceptual understanding and motivation. In this context, AR is recognized as a tool that positively contributes to student achievement by providing both individualized and interactive learning opportunities.

Similarly, Bullock et al. (2024) highlight that AR plays a crucial role in the concretization of abstract concepts in disciplines such as chemistry and facilitates students’ comprehension of these concepts. In particular, the visual representation of abstract topics such as the "particle structure of matter" enables students to grasp these concepts more effectively. In this study, it was observed that the students in the Experimental Group were able to comprehend this abstract subject more easily and engaged actively in the learning process due to the

interactive content delivered through AR technology. Conversely, in the Control Group, it was determined that students lacked a similar visualization experience as a result of traditional teaching methods, which in turn led to more limited effects on motivation and attitude. Furthermore, the studies of Özdemir (2021) and Chan & Lee (2023) demonstrate that AR enhances cognitive development in teaching abstract topics and positively influences learning processes.

The analysis of motivation showed that the students in the Experimental Group demonstrated a higher level of motivation towards science learning in comparison to the students in the Control Group, who were taught with traditional methods. AR technology enhanced the interest of the students in the Experimental Group in the lesson and provided an interactive approach to teaching abstract chemistry concepts. As a result, the students' capacity to make sense of abstract concepts was strengthened, leading to a more significant increase in their motivation towards the lessons. Although there was a limited increase in the motivation level of the students in the Control Group, this increase was less pronounced compared to the Experimental Group. Demir and Başer (2020) assert that AR enriches students' learning processes in science and fosters their interest in the lessons. This finding aligns with the view that AR facilitates students' understanding of abstract concepts and enhances their motivation for learning. The findings of Güneş and Yıldırım (2020) and Mahadzir and Phung (2013) also corroborate the results of this study. Moreover, it is frequently highlighted in the literature that AR supports self-paced learning by providing individualized learning opportunities, thereby improving students' academic achievement (Qomaruddin et al., 2024).

The findings related to the gender variable indicate that AR technology does not lead to gender-based differences. No statistically significant difference was found between male and female students in both the experimental and control groups regarding their attitudes and motivation towards AR technology. This finding suggests that AR serves as an equally effective tool for both genders and that its accessibility ensures equal learning opportunities for Generation Z students, regardless of gender. This result aligns with Güngördü's (2018) study, which asserts that AR is equally effective across all student groups, irrespective of gender. The fact that Generation Z students demonstrate a gender-independent predisposition to technology reinforces AR technology's role as an equally effective learning tool for both genders (Chan & Lee, 2023; Granitz et al., 2021). This finding is considered particularly significant in terms of the use of AR in education.

In conclusion, AR technology has been found to offer significant advantages in courses that involve abstract and complex concepts, such as chemistry. When evaluated through a holistic approach alongside findings from other studies in the literature, it can be inferred that AR technology aids students in enhancing their conceptual understanding and boosting their motivation for learning by enabling the visualisation and concretisation of abstract concepts. The AR technology used in the Experimental Group facilitated students' comprehension of course content, supported them in overcoming conceptual difficulties, and encouraged active participation in the learning process. In contrast, in the Control Group, the absence of AR technology indicated that learning processes remained restricted to traditional methods, which had a more limited impact on student attitudes and motivation. As highlighted in the studies by DiSerio, Ibanez, and Kloos (2013) and Sarıoğlu (2021), AR technology serves as a powerful tool in science education and is an effective method for positively influencing students' attitudes and motivation towards lessons. Research on the integration of AR in education consistently demonstrates that this technology enhances student achievement and reinforces engagement in learning (Chan & Hu, 2023). Based on these findings, it is strongly recommended that AR technology be widely adopted, particularly for the teaching of chemistry concepts.

Recommendations

The results of this study show that AR technology can enhance students' comprehension of scientific concepts by improving their attitudes and motivation towards science. In this context, it is recommended that AR-based instructional materials be developed and that the integration of this technology into classroom applications be expanded.

The effective implementation of AR technology in education necessitates that teachers acquire sufficient knowledge regarding its use. Therefore, it is recommended that training programs on AR technology be designed and implemented for teachers.

This study is limited to the topic of the particulate structure of matter; thus, it is recommended to extend research to different subject areas and to investigate additional variables, such as analytical thinking skills and academic achievement.

To maximize the effective use of AR technology in education, schools' technological infrastructure must be improved. Providing the necessary devices and technical support in schools is essential to enhance students' access to AR applications.

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What Is The Impact of Disruptive Innovative Transformation? In Economic Education *

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***Abstract*:** Disruptive Innovative Transformation (DIT) is reshaping economic education by integrating technological advancements and new pedagogical models. This study examines the impact of DIT on economic literacy and workforce preparedness, emphasizing the shift from traditional teaching methods to digital learning ecosystems. The research adopts a qualitative approach, analysing previous studies and literature on digital transformation in education. Findings indicate that digital platforms, MOOCs and personalized driven learning, enhance accessibility and engagement. However, challenges remain, including digital inequality and the need for teacher training. The study suggests that integrating innovative economic education strategies, supported by policy reforms and industry collaboration, can enhance students' adaptability to evolving economic landscapes. The implications highlight the necessity for a flexible curriculum that aligns with technological and economic shifts.
***Keywords**:* Disruptive Innovation, Educational Transformation, Economic Education, Digital Learning.

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Introduction and Theoretical Background on Disruptive Innovative Transformation

Disruptive Innovative Transformation (DIT) refers to changes in the systems often due to technical innovations together with progress in the business principles and social structures. DIT replaces old systems with entirely new frameworks, while resilience focuses on keeping systems functioning during disruptions by managing risks. In today's fast evolving world, industries and institutions are struggling to overcome the unprecedented economic, technological and social challenges and the significance of Disruptive Innovative Transformation increases. Being reactive to disruptive forces and adapting your behaviour results into both competitiveness and sustainable growth for an organization. DIT is governing businesses and employees to adapt to change by developing innovative solutions for evolving work environments.

DIT is changing those economic frameworks and social systems extant all through the world. Again, with economic change such as global expansion and robotic labour force shift economies (Birdi et al., 2023), schools should come to develop complex educational approaches and workforce preparation methods. Institutions that deliver new knowledge in a changing economic environment need to support student success with adaptable educational systems. The improvement of economic education by enhancing proper policy decisions and educational strategies with more comprehensive curriculum and pedagogical formats can produce students who will succeed in today's economics framework.

Through Disruptive Innovative Transformation (DIT), fundamental scalar transformations take place in existing systems and industries and across market dynamics. It opens up a way of structural disruption where new technologies produce not only business model implications and social dynamics, but by adding they disrupt the structure itself. Systemic evolution is producing new organizational frameworks that establish critical operational approaches for organizations as well as their related industries and sociological patterns. DIT brings about a competitive shift that results in abandoned old ways and ground for new market entrants. The fundamental structural shifts resulting from DIT exceed incremental development work since they push users towards adapting across multiple operational levels. The evolution of disruptive innovative technologies occurs by random means, combining technological advances with economic evolutions and changing customer demands. Both industrial and corporate entities need to approach disruption in a forward direction to discover new potential over potential risks. Implementation of innovative thinking, strategic future vision capabilities, and effective adoption of emerging strategic trends stand as mandatory requirements for reaching success in DIT.

Resilience and DIT have a shared focus on the concept of 'change', but they pursue different core goals and different procedural paths and, in fact, use the same terms in various senses. Resilience is the ability of organizations and systems, and societies and their environments, to bear disturbances and return to stability (Frigotto et al., 2022). This approach allows for stability while enabling continuous operation susceptible to economic declines, technological shifts, and environmental emergencies. Managing resilience is mainly achieved through risk control and operational recovery plans, focusing on protecting protected structures. It serves this from the DIT perspective to surpass stability maintenance and install new operational systems that tolerate change as an agent of progression. To be able to embrace the abandonment of past methods for revolutionary solutions and build out new enterprise paths, organizations have to cultivate a mindset that sees the acceptance of the abandonment of good things. Resilience refers to the capacity of individuals or communities to recover, essentially finding ways to climb out of the metaphorical hole. In contrast, DIT examines the structure and

experience of that so called hole itself: how it came to be, what it feels like to live within it, and how to reimagine and reconstruct alternatives to it through transformative change. It seeks to create pathways out of both old and newly formed holes through 'revolution'.

DIT is crucially dependent upon junctures to be drivers for transformation and creative practices. Therefore, with an understanding of major events disrupting stable systems, stakeholders are encouraged to revisit platforms and business practices at the juncture to compel recording and understanding. From multiple drivers such as economic turmoil, political transition and societal movements to technical development, multiple critical junctures arise. At critical liaisons, organizations are forced to choose between transformation through innovation or becoming irrelevant over time. More significantly, the media sectors and retail operations that were an integral part of the late twentieth century marked the twenty first century as digital technology being an essential stepping stone. This means that traditional companies in media sphere, like Blockbuster and newspapers were so tightly regulated within their business because there was no digital transformation, whereas digital transformation companies like Amazon and Netflix were able to do so with ease. Opportunities for sustainable power systems and decentralized supply networks, as well as advanced governance frameworks, emerge from existing global disruptions, such as climate change and geopolitical challenges, which drive the emergence of new disruptive innovations. Several factors determine the success of a DIT's capacity to respond successfully, which include leadership vision, organizational agility, and stakeholder collaboration ability. Regions and business areas are encouraged to extract beneficial opportunities based on active recognition and response to emerging disruptions, creating enduring transformations.

One of the most dominant theoretical models of DIT to stay new competitors toward existing industry leaders is Christensen's Theory of Disruptive Innovation which explains how new entrants can challenge industry leaders by offering simpler, lower-cost solutions that initially appeal to niche or overlooked market segments. According to Christensen (1997), disruptive innovations typically emerge in specialized market spaces where established companies prioritize their core, high-margin markets, leaving these niches underserved. Over time, the product or service evolves, improves, and gains broader appeal, ultimately transforming the market and redefining entire industries. Additionally, when viewed through the lens of systems thinking and complexity theory, disruption is understood as an inherent outcome of interconnected and dynamically evolving systems, where changes in one part of the system can ripple through and reshape the entire structure. Adaptable leadership from the perspective of the paradigm of experimental methods and cooperation between different industries to achieve meaningful transformation. According to Secundo et al. (2020), the objective literature suggests that DIT success entails full recognition of technological fundamentals, as well as social and financial metrics. Research into economic and organizational studies currently studies how ecosystems support the Digital Information Technology advancement. Using the Quadruple Helix model, researchers' detail that components of governmental forces and corporate sectors, educational institutions, and social collectives work together to aid in innovative and resilient development techniques. The picture is of stakeholders working together to get profound change that addresses problems like economic inequality and climate change in this framework.

Practical Example of Disruptive Innovative Transformation

The suitable example of disruptive innovative transformation in (economic) education could be the rise of digital learning ecosystems. Traditionally, education relied on in-person instruction and physical materials until the advent of digital technology and shifting societal needs dramatically transformed teaching and learning practices. The transformation of economic education through digital learning ecosystems exemplifies a disruptive innovative transformation process, reshaping traditional educational models. A critical juncture emerged with the rapid advancements in digital technologies and the global shift towards remote learning

during the Covid-19 pandemic. This disruption forced educational institutions to abandon traditional classroom-based teaching methods and adopt digital platforms to ensure continuity in learning (Turnbull et al., 2021; Babbar, & Gupta, 2022). In the context of Covid-19 and the shift to internet-based learning, it has become evident that transformative innovation occurs when governments, educators, and industries form collaborative partnerships that emphasize open communication, shared expertise, and joint efforts, enabling the development and implementation of solutions tailored needed in fast changing society. The significant gaps in educational delivery systems, particularly the lack of infrastructure and digital readiness in certain regions were exposed, challenging the resilience of these systems to adapt to sudden shocks (Pokhrel, & Chhetri, 2021). In response, institutions integrated technology into curricula by adopting tools like learning management systems such as Moodle or Canvas, virtual classrooms, and collaborative platforms, e.g., Microsoft Teams, Zoom. These platforms not only facilitated remote teaching but also enabled student-centred approaches, such as gamified learning and personalized feedback mechanisms. The introduction of Massive Open Online Courses (MOOCs) democratized access to high-quality economic education globally, allowing learners from diverse socioeconomic backgrounds to acquire skills that were previously inaccessible (Tiwari et al., 2020). Comprehensive online university programmes are now offered not only by lesser-known institutions but also by highly regarded and prestigious universities. This transformation went beyond technological adoption to influence pedagogical practices. Essential to achieving sustainable long-term development and ongoing relevance is the combination of digital transformation investments and workforce skill development initiatives (Pang & Wang, 2024). Educators shifted from being sole knowledge providers to facilitators of learning, leveraging data analytics to track student progress and adjust instructional strategies accordingly. The emphasis on skills such as critical thinking, data interpretation, and real-world problem-solving aligned economic education with the demands of rapid-changing and knowledge economy (Terentev et al., 2024). Their recent mixed-methods study found that students exposed to active digital learning environments, particularly simulations and gamified economics tasks, performed significantly better in critical thinking and application tasks than those taught through traditional lectures. This empirical evidence underscores how DIT-driven methods improve learning outcomes in economic education. The transition also highlighted disparities in digital equity, prompting educational policymakers to address infrastructure gaps and invest in teacher training to enhance digital competencies (Goffe, 2024). For instance, students in rural areas often lack stable internet access or up-to-date devices, which limits their participation in online learning. Additionally, some teachers may lack the training to use digital tools effectively. The disruptive innovative transformation in economic education in some way redefined learning environments, enabling more personalized, scalable, and globally accessible education. It underscores the importance of technological readiness, stakeholder collaboration, and adaptability in navigating critical junctures and shaping sustainable, inclusive educational futures. This process demonstrates how systemic innovation in response to disruption can elevate the effectiveness and accessibility of economic education. Furthermore, educational institutions could in future partner up with industry and government to develop digital ecosystems that bridged the gap between academic content and real-world economic scenarios, enhancing the relevance of economic education.

Application of Disruptive Innovative Transformation to Economic Education Research

One important aspect that seems relevant to the research on disruptive innovation in economic education include the idea of creative destruction, where old systems give way to new, innovative ones. While we should be aware that this concept does not fully apply to the educational environment, it highlights the need for (gradual) integration of innovative teaching methods and technologies. From the literature and discussions on Disruptive Innovative Transformation (DIT) and the challenges posed by turbulent times, several key insights emerged. DIT is not merely about technological advancements but also about systemic changes

that demand shifts in organizational structures, education, and societal norms. The adoption of DIT for example in education, especially in economic literacy, emphasizes the need to integrate innovative practices to meet contemporary challenges effectively. It is critical to attempt for preparing students and professionals to thrive in increasingly dynamic and unpredictable economic environments. The research could explore how critical junctures, such as the global shift during and post Covid-19, impact economic literacy, highlighting the importance of resilience in educational systems. Designing economic education curricula that integrate real-world applications, such as financial crises or market simulations, would ensure practical relevance and better engagement.

Disruptive transformations help economic literacy research because they open doors to modernize standard programs of teaching and efficient instructional methods (Grol et al., 2017). The education sector, on the other hand, must transform itself at the speed of technology because it is about the training of students with basic economic capabilities that would help them move around the dynamic, volatile global economy. The research shows why critical junctures are drivers for transformation and illustrates concepts that are immediately applicable to economic literacy education. Pivotal junctures give rise to the emergence of new educational methods that resonate with contemporary economic concerns, such as financial crises, technological advances, and policy shifts. An academic system is needed that goes beyond teaching theoretical economics and bridges economic knowledge with practical exposure to real-world applications. According to Morawska-Jancelewicz (2021), the Quadruple Helix model can serve as a basis for economic literacy research to form partnerships between educators and policymakers, financial institutes and local community stakeholders, bringing together government, industry, and academia to bring about a complete economic education framework.

Modern education research shows that routine memorization with abstract theoretical structures instruction approach is not standardized critical thinking and problem-solving capabilities of today's standard economy (Johnson & Meder, 2024). Now, the present educational approach involves the integration of DIT-based technical approaches into case studies and technological applications along with practical training methods. Real-world economics simulation case studies, such as economic breakdowns and market data, improve the extension between the abstract economic theory and actual practice relations (Pühringer & Bäuerle, 2019) for students based on the research on stakeholders. Digital platforms have been found to be an instrument for facilitating greater public access to economic information. Through interactive economic modelling complemented with gamified economics learning tools paired with a personalized online learning platform (Paşa, 2020), students increase their academic success. Educational innovations open the doors for teachers to shed the use of standardized learning approaches by devising personal training strategies that meet each student's learning predisposition. According to studies, the early teaching of decision-making skills is still important as they indicate that economic literacy equates to a person's future financial health (Maier & Ruder, 2024). The use of DIT principles in education, such as continuous innovation and adaptability, fosters the needed competencies in students to thrive in an ever-changing economic systems.

Technological disturbances inspire new ways to increase economic literacy levels by means of digital platforms and experiential learning models or through innovative teaching approaches. Platforms like Coursera and Khan Academy have made economics easy to learn during times that work for them. With these education platforms, students can manage their own pace of learning and access worldwide resources and up-to-the-minute economic data for a more prosperous educational result than what is possible in traditional classroom instruction. Now, academic progress in artificial intelligence (AI) and big data analytics offers customized learning sessions tailored to students' learning needs. Through virtual stock market simulations, blockchain exercises, and augmented reality education spaces, students obtain practical

experience (Bucea-Manea-Țoniș et al., 2021). Through direct ″hands-on″ learning, complex economic concepts are learned with teachers-designed experiential techniques to maintain student's interest. The wave of technological change has deployed data analytics tools for educators to track how far their students have progressed in schooling and can pinpoint empty spaces in the knowledge and reconfigure the course of curriculum delivery to yield better results. The benefits of technological advances bring forward problems like digital inequality as well as a need for basic computer competency among learners and educational professionals. Public schools, together with policymakers, need to deliver sufficient technology facilities and training support to students to attain equal educational opportunities through technology-enabled economic instruction (Wunder et al., 2009). Schools need to manage DIT implementation carefully since it should combine technological development to ensure inclusive educational opportunities.

Strategies for Managing Disruptive Innovative Transformation in Educational Settings

Educational institutions need to carry out disruptive innovative transformation (DIT) by using planned forward-thinking methods that follow shifts in economic conditions and technology. Flexible curricular models show promise as they align their content structure with the dynamic changes happening in economies (EENEE, 2023). The curriculum must incorporate modern technological subjects connected to economics subjects (such as financial data science), and worldwide economic trends so students develop appropriate knowledge foundations. Educational institutions require a culture that nurtures innovation at its core. When teachers, along with students, support experimental approaches and critical thinking and problem-solving through education, they will develop an environment that embraces disruption instead of resisting it (Ahmad et al., 2020). Online simulations combined with data-driven decision tools and virtual classrooms will help teachers deliver engaging economic literacy training to meet the needs of different learners.

Effective addressing of disruptive changes through economic literacy education requires ongoing teacher training along with educational programs to build student capabilities. Teachers need specialized training about new economics concepts and digital literacy in addition to unique teaching methodologies to present content effectively with relevancy. A flexible mindset is needed, as well as technological and economic decision-making expertise for educators and students. Educational knowledge comes from workshops in combination with digital training sessions and partnerships with industry experts to train instructors to handle evolving educational needs. An environment that supports experimentation alongside innovation and creates conditions for developing a growth mindset stands to empower students to see disruptive practices as growth opportunities. Project-based assignments combined with economic literacy boot camps and interactive economic simulations allow students to acquire better economic comprehension while practicing active personal growth (Cohen, 2023). The development of digital competence is due to modern educational success.

Government officials have a crucial task to create policies that will build both innovative educational systems and include diverse learners across the field of economics. Governments need to support new infrastructure that gives every student equitable access to digital learning resources alongside incentives for schools to implement innovative educational methods. Economic literacy education achieves impact and real-world relevance through joint alliances between industry leaders and financial institutions, which bridge theory and practice (Varcoe & Fitch, 2003). Successful DIT implementation in economic literacy education needs collaboration among different stakeholders, called the Quadruple Helix model, including governmental institutions and industrial players, together with educators and social constituents. Through policy initiatives, Governments demonstrate essential influence by backing creative

teaching methods while investing in technological frameworks and creating equal educational resource accessibility.

Conclusions and Suggestions

Disruptive Innovative Transformation (DIT) analysis shows the crucial influence on educational development for economic literacy. Theoretically, DIT offers a framework to understand how technological change, policy reform, and market shifts reshape traditional educational systems. Resilience and transformation clearly demonstrate the disconnectedness between academic institutions and disruptions, which need to transform their practices simultaneously. Some practical studies, such as those that portray (economic) education disruptive transformation, demonstrate that undertaking modern strategic adjustment is sometimes needed. Real world application of digital platforms and experiential learning in future economic literacy education is the need for students to develop the needed skills to navigate modern economic complexity (Goffe & Wolla, 2023). Success depends on collaboration across government, industry, education, and society, as outlined in the Quadruple Helix model.

This suggests key directions for how economic literacy should be taught moving forward. Education systems have to continue adapting to technological disruptions and incorporate increased responsiveness and inclusion via agile formats. Future economic literacy curricula should include the latest financial technologies alongside world economy analysis using disciplines of more than one to teach students the true economic realities of today (Nanda et al., 2024). Consequently, educational instructors need to adopt new teaching approaches, which involve working on reducing digital inequalities to prepare students online through various learning styles. More funding needs to be directed to educational infrastructure improvements and teaching professional development programs that support teacher competence in making these changes correctly by political leaders.

More extensive analysis needs to be conducted surrounding the implementation of DIT-based educational models in regard to how they influence student learning of economic principles and, more importantly, the skill set that students attain in terms of their economic competency. Comparative studies across learning environments can highlight effective strategies and reveal areas for instructional improvement. It is, therefore, desirable that the development of total frameworks become a policy focus because these frameworks will address collaboration between stakeholders and equal opportunity for quality education, thereby merging digital and economic education into standard curricula. It will be essential now to have educational programs that support lifelong learning because they will be able to help students achieve higher levels of economic literacy, which will be beneficial from personal and also societal perspective.

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Social Studies Teachers' Self-Efficacy Levels in Creating Digital Materials

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Abstract**:** The change and transformation in the world of technology also affect the field of education. This effect has brought about changes in the teaching materials used by teachers in their classes. Teachers can design effective teaching materials more easily by using the opportunities offered by technology. This study aims to examine social studies teachers' self-efficacy levels in creating digital materials in terms of various variables. The research was designed according to the survey design, one of the quantitative research designs. A convenience sampling method was used to determine the participants. In the study, the digital material creation competences of 208 (121 female, 87 male) social studies teachers were evaluated according to the variables of gender, age, professional seniority, and region of assignment. The Teachers' Self-Efficacy Scale for Creating Digital Materials was used as a data collection tool. Independent Samples t-test and One-Way ANOVA were used to analyse the data obtained from this scale. The findings show that teachers generally have self-efficacy above the average. No significant difference was found in terms of gender, age and professional seniority variables. This result shows that social studies teachers have similar self-efficacy levels in terms of gender, age and professional seniority variables. However, in terms of the region of assignment, the self-efficacy levels of teachers working in the Black Sea Region were higher than in some regions (Marmara, Central Anatolia, Eastern Anatolia, and South-eastern Anatolia). These findings suggest that regional disparities may influence the degree of technology integration in educational practices. The researchers suggest that professional development programmes to increase teachers' digital material development skills should be expanded.
Keywords**:** Social Studies, Teacher, Digital Material, Self-Efficacy.

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Introduction

In the contemporary era, characterised by accelerated transformation in the domain of technology, individuals find themselves navigating a dynamic and evolving landscape. This rapid change and transformation have a profound effect on both daily life and educational processes. Technological advances and innovations have accelerated transformations in the contemporary educational environment. In particular, the radical changes in Information and Communication Technologies (ICT) such as computers, mobile phones and the internet have led to a renaissance in educational technologies (Escueta et al., 2017). Concurrently, the internet has been a catalyst for substantial change by establishing a substantial and novel technological domain for teaching and learning processes over the past two decades (Kalaian, 2017). In recent years, mobile technologies, virtual and augmented realities, simulations, collaborative learning platforms, social networks, cloud computing, flipped classroom applications, and the diversity of different devices have been increasing rapidly (Huang, Spector & Yang, 2019).

Technological developments today offer significant opportunities in the field of education, as in many other areas (Kaya, 2008). In order to make effective use of these opportunities, technology is being integrated into teaching processes in various disciplines. One of the fundamental goals of contemporary educational approaches is to nurture individuals who can keep pace with rapid changes in science and technology. In this regard, progressivism (Kaya, 2020), one of the prominent approaches, envisages teaching programmes with a more integrated structure by supporting interdisciplinary cooperation (Erginer, 2021). In this context, the social studies course, which is designed with an interdisciplinary perspective, constitutes a concrete reflection of this understanding. According to Farris (2015), technology functions as one of the fundamental elements of interdisciplinary education and makes significant contributions to social studies education by integrating content from different disciplines around a common goal.

As Martorella (1997) noted, technology has been described as a “sleeping giant” in the context of social studies education programmes. This metaphor draws attention to the untapped potential of technology in the context of social studies teaching and learning. As posited by Swan and Hofer (2008), this metaphor signifies that the potential of technology in the field of education is not being fully realised. Doolittle and Hicks (2003) posited that this sleeping giant has been waiting to be awakened for a considerable period of time. The National Council for Social Studies (NCSS) (1994) advocates the integration of technology into social studies classrooms, emphasising that such integration has the potential to add new dimensions to student learning. However, despite the NCSS’s advocacy for this approach, for many years it has been observed that no substantial progress has been made in this domain, with various impediments persisting (Doolittle & Hicks, 2003; Whitworth & Berson, 2002).

In recent years, there has been an increased focus among researchers on the integration of technology into social studies education (Bariham, 2022; Çetin & İşçi, 2022; Friedman & Hicks, 2006; Underwood, 2022). Adler (2008) has demonstrated a correlation between the increase in research in this area and the proliferation of teacher training programmes and technology-related studies. However, research in the field of technology integration in social studies education has not yet achieved the desired level of advancement. Consequently, the integration of technology into social studies education is of significant importance. This is because such integration can facilitate the development of both students and teachers (Torrez, 2010). In addition technology offers an exciting opportunity for proponents of change in social studies education to transition towards student-centred pedagogical approaches (Beck & Eno, 2012).

Research conducted in the field has emphasised the significance of integrating technology into social studies teaching programmes (Bennett, 2005; Berson & Balyta, 2004; Byker, 2014; Crowe, 2004; Cuban, 2001; Mason et al., 2000; Stobaugh & Gandy, 2014).The effective integration of technology into the social studies curriculum has been demonstrated to enhance pedagogical practices, thereby increasing student motivation and equipping individuals with the knowledge, skills, and values necessary to become good citizens. This aligns with the fundamental objectives of social studies, as outlined by Heafner (2004).

Social studies teachers are among the most significant agents in the integration of technology in the social studies curriculum. The fundamental purpose of teaching and learning social studies is to assist students in reflecting on their current identity and future potential as citizens (Duplass, 2020). Technology plays a significant role in this process with regard to citizenship education. The utilisation of educational technologies by social studies teachers in their classrooms facilitates the establishment of constructivist learning environments and the cultivation of 21st-century skills (Kormos, 2019). The integration of technology into the social studies classroom has the potential to stimulate diverse forms of student development. As Chai and Kong (2017) emphasised, critical thinking, problem-solving and communication skills are all at higher levels in social studies classrooms where technology use is intensive. The increasing accessibility of technology has the potential to engender a major transformation in social studies education. The integration of technology into social studies lessons can be facilitated by the utilisation of digital materials. In the contemporary context, the pedagogy of social studies incorporates not only tangible materials but also technological resources. This is since technological materials have been shown to enhance students' interest and motivation in social studies classes (Bass & Rosenzweig, 1999). Suryani et al. (2021) determined that digital learning materials in the field of social studies education are more effective in developing students' social skills than printed textbooks. Furthermore, it has been observed that digital materials have the capacity to enhance critical thinking skills in social studies lessons (Khoiron et al., 2021). In another study, social studies teachers highlighted that digital teaching materials effectively support teaching and learning processes (Sariyatun et al., 2018).

The acquisition of digital materials for use in social studies lessons is typically undertaken by teachers either through the creation of original content or the utilisation of pre-existing materials. However, it is imperative to acknowledge that ready-made materials require constant updating to maintain alignment with the evolving curriculum and the shifting levels of students. Consequently, educators must possess the competencies to both create and revise digital materials, whether they are original or obtained from pre-existing sources. In this context, ascertaining the levels of self-efficacy among social studies teachers in the creation of digital materials is of critical importance in comprehending the present status of technology integration in education and in identifying teachers' professional development requirements. Digital material development competence encompasses not only technology use skills but also pedagogical knowledge and digital content creation skills. Consequently, an examination of social studies teachers' self-efficacy levels in creating digital materials in terms of various variables will contribute significantly to the enhancement of future teacher education programmes and the more effective implementation of digital transformation in education. In this regard, the purpose of this study is to ascertain the levels of self-efficacy concerning the creation of digital materials exhibited by social studies teachers. In this context, answers to the following questions were sought.

• What is the level of social studies teachers' self-efficacy in creating digital materials?
• Does the level of social studies teachers' self-efficacy in creating digital materials differ according to gender?
• Does the level of social studies teachers' self-efficacy in creating digital materials differ according to age?

• Do social studies teachers' levels of self-efficacy in creating digital materials differ according to the region where they work?
• Do social studies teachers' levels of self-efficacy in creating digital materials differ according to their professional seniority?

Method

This study examines the self-efficacy levels of social studies teachers in creating digital materials. The research was designed according to the survey model, one of the quantitative research methods. In this non-experimental design, the aim is to measure certain characteristics of the group under investigation or to reveal an existing situation (Atalmış, 2021). Surveys allow for gathering information about a broader population using data obtained from a systematically determined sample (Rossi et al., 2013). While survey studies measure the variables in question, they also help analyse the relationships between these variables, make predictions about them, and understand how subgroups vary (Christensen et al., 2015). Since this study aimed to determine the self-efficacy levels of social studies teachers in creating digital materials and to reveal how these levels vary according to certain predetermined variables, the research was conducted using a survey design.

Sample

The study included 208 social studies teachers, comprising 121 females and 87 males. The research employed convenience sampling as the sampling method. This approach, which enhances the speed and practicality of the study, is based on including the most easily accessible units from which data can be collected (Altındiş & Ergin, 2018; Yıldırım, 2021). Participants included social studies teachers from different geographical regions, with varying years of professional experience, representing different age groups and genders. The demographic characteristics of the participating teachers are presented in Table 1.

Table 1. Demographic Characteristics of Social Studies Teachers

Category	**Subcategory**	**f**	**%**
Gender	Female	121	58.2
	Male	87	41.8
	Total	208	100.0
Age	25-35 years	102	49.0
	36-45 years	48	23.1
	46-55 years	45	21.6
	56+ years	13	6.3
	Total	208	100.0
Geographic Region	Marmara Region	64	30.8
	Aegean Region	40	19.2
	Mediterranean Region	28	13.5
	Central Anatolia Region	17	8.2
	Southeastern Anatolia Region	14	6.7
	Eastern Anatolia Region	31	14.9
	Black Sea Region	14	6.7
	Total	208	100.0
Professional Seniority	1-5 years	96	46.2
	6-10 years	54	26.0
	11-15 years	34	16.3
	16+ years	24	11.5

Total	208	100.0

Data Collection Tool

For data collection, the Teachers' Self-Efficacy Scale for Creating Digital Materials (TSES-CDM), developed by Uzun and Akay (2021), was employed as the measurement instrument. The scale consists of 26 items and demonstrated excellent reliability in this study, with a Cronbach's alpha coefficient of .973, indicating it can be considered a highly reliable data collection tool.

Items on the TSES-CDM are scored on a 0–100-point scale with 10-point increments, where 0 represents "No confidence at all" and 100 represents "Complete confidence".

The data collection instrument was administered to participating teachers via Google Forms. All 208 social studies teachers in the sample completed the scale in its entirety. The responses were then digitised and prepared for statistical analysis.

Data Analysis

For data analysis in this study, the SPSS statistical software package was utilised. Normality tests revealed that the data were normally distributed. The results of the normality tests are presented in Table 2.

Table 2. *Kolmogorov-Smirnov, Skewness, and Kurtosis Values for the TSES-CDM*

Skewness		**Kurtosis**	
Skewness	Std. Error	Kurtosis	Std. Error
0.584	0.169	-0.967	0.336

As seen in Table 2, while the skewness and kurtosis values of the data obtained with the Teachers' Self-Efficacy Scale for Creating Digital Materials fell within the normal distribution range (Tabachnick, 2007). Consequently, parametric tests were employed for data analysis. The Independent Samples t-test was used to examine differences between two groups on a given variable, while the One-Way ANOVA test was applied for comparisons among three or more groups.

Findings

The research data were analysed to evaluate social studies teachers' self-efficacy levels in creating digital materials across variables of professional experience, age, gender, and geographic region. According to descriptive statistics from the TSES-CDM (Teachers' Self-Efficacy Scale for Creating Digital Materials), participants (208 teachers) had a mean score of 178.269.

To determine whether social studies teachers' scores on the Teachers' Self-Efficacy Scale for Creating Digital Materials (TSES-CDM) differed significantly by gender, an Independent Samples t-test was conducted. The analysis results are presented in Table 3.

Table 3. Independent Samples t-Test Results for TSES-CDM Scores by Gender

Gender	**n**	$\bar{x}$	**Sd**	**df**	**t**	**p**
Female	121	180,3223	44,83474	206	835	.405

Gender	n	x̄	Sd	df	t	p
Male	87	175,4138	37,16323			

Findings from Table 3 reveal that social studies teachers' self-efficacy in creating digital materials, as measured by the TSES-CDM (t_{206} = .835, p > .05), did not show statistically significant differences by gender. To determine whether social studies teachers' scores on the Teachers' Self-Efficacy Scale for Creating Digital Materials differed significantly by age group, a One-Way ANOVA was conducted. The analysis results are presented in Table 4.

Table 4. *One-Way ANOVA Results for TSES-CDM Scores by Age Group*

Groups	*Sum of Squares*	df	Mean Square	F	*p*
Between Groups	49040,075	3	1646,692	,943	.421
Within Groups	356272,849	204	1746,436		
Total	361212,923	207			

As presented in Table 4, the One-Way ANOVA revealed no statistically significant differences in TSES-CDM scores based on age (F3-204=943, p = .421). To determine whether social studies teachers' scores on the Teachers' Self-Efficacy Scale for to examine whether creating digital materials differed significantly by geographic region, a one-way ANOVA was conducted. The analysis results are presented in Table 5.

Table 5. *One-Way ANOVA Results for TSES-CDM Scores by Geographic Region*

Groups	Sum of Squares	df	Mean Square	F	p	Post-hoc Differences
Between Groups	44486,069	6	7414,345	4,705	.000	Black Sea > Marmara, Central Anatolia, Eastern Anatolia, Southeastern Anatolia
Within Groups	316726,854	201	1575,755			
Total	361212,923	207				

As shown in Table 5, TSES-CDM scores showed statistically significant differences by geographic region (F6-201=4,705, p=000). Post-hoc comparisons revealed that teachers working in the Black Sea region had significantly higher TSES-CDM scores than those in the Marmara, Central Anatolia, Eastern Anatolia, and Southeastern Anatolia regions (p < .05). Participants were divided into five groups based on 5-year intervals of teaching experience. To examine whether social studies teachers' self-efficacy in creating digital materials differed significantly by professional experience, One Way ANOVA was conducted. The results are presented in Table 6.

Table 6. *One-Way ANOVA Results for TSES-CDM Scores by Professional Seniority*

Groups	*Mean Squares*	df	Mean Square	*F*	*P*
Between Groups	2573,090	3	857,697	,488	.691
With in Groups	358639,833	204	1758,038		
Total	361212,923	207			

As shown in Table 6, the One-Way ANOVA revealed no statistically significant differences in the TSES-CDM scores of social studies teachers across professional seniority groups ($F_{3\text{-}204}$=,488, p = .691).

Conclusion, Discussion and Recommendations

The present study examines the levels of self-efficacy of social studies teachers with regard to the creation of digital materials. The findings indicate that social studies teachers have above-average competence in creating digital materials. Gökbulut et al. (2021) found that teachers' competence levels in the design of digital materials were moderate. A parallel investigation revealed that educators' competencies in the design of digital materials were found to be at a commendable level (Demircioglu & Yurt, 2024). A further study established that Science and Art Centres teachers demonstrated a high level of digital material design competence (Gökbulut & Keserci, 2024). This finding suggests that social studies teachers can produce digital materials by keeping up with technological developments.

The present study examined teachers' self-efficacy in creating digital materials according to the variables of professional seniority, age, gender and region of employment. The findings indicated that these variables did not generate a substantial discrepancy in teachers' self-efficacy in creating digital materials. In their 2024 study, Gökbulut and Keserci concluded that there was no significant difference in the material design competencies of teachers from Science and Art Centres based on gender and professional seniority variables. This data is consistent with the results of the present study. This finding suggests that social studies teachers demonstrate a homogeneous profile in terms of technology use and possess analogous competencies in the creation of digital materials.

The finding of marked differences concerning the region in which the research was conducted suggests that regional disparities may have an impact on access to technology and usage habits. In this context, it is noteworthy that the self-efficacy of teachers working in the Black Sea Region in creating digital materials is higher than in some other regions (Marmara, Central Anatolia, Eastern Anatolia, and South-eastern Anatolia). The present situation may be associated with the professional development opportunities available to teachers in the region, the infrastructure facilities available to them, or the individual efforts they make. Kaya (2008) emphasises that in order to effectively utilise technological developments in education, it is essential to enhance teachers' competencies. Consequently, there is a necessity to undertake a review of teacher education programmes to take regional differences into account.

In conclusion, it is recommended that professional development programmes be expanded to further improve social studies teachers' self-efficacy in creating digital materials that strategies be developed to address regional differences, and that technological infrastructure be improved. Furthermore, it would be useful for future research to examine in depth the relationship between self-efficacy in creating digital materials and teachers' classroom practices.

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Academic Procrastination Behavior, Test Anxiety and Self-Handicapping As Predictors of Academic Achievement*

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Abstract: In this study, it was aimed to analyze the relationship between university students' academic achievement, test anxiety, academic procrastination behaviors and self-handicapping tendencies. The sample of the study consisted of 502 university students studying in different faculties of Erciyes University. "Academic Procrastination Scale", "Self-Handicapping Scale", "Westside Test Anxiety Scale" and "Personal Information Form" were used in the study. Descriptive statistics, t test, ANOVA, Tukey test, correlation and regression analysis methods were used to analyze the data obtained. According to the analyses, students' academic procrastination behavior, test anxiety, self-handicapping and academic achievement levels are at modarete level. It was seen that male students resorted to academic procrastination more than female students, experienced more test anxiety and sabotaged themselves more, and it was concluded that academic achievement did not vary according to gender. It is seen that academic achievement, test anxiety, academic procrastination behavior and self-handicapping level of students do not differ according to age. It was concluded that academic achievement and academic procrastination differed according to grade level, while test anxiety and self-handicapping did not differ according to grade level. Apart from this, it is seen that academic achievement, test anxiety, academic procrastination behavior and self-handicapping variables differ significantly according to the faculties of study. According to the results of the correlation analysis, there was a negative relationship between academic achievement and test anxiety, academic procrastination behavior and self-handicapping. It was also observed that there was a positive correlation between self-handicapping, test anxiety and academic procrastination behavior and that these variables predicted academic achievement. These results were discussed by considering other studies in the literature and some suggestions were given.

Keywords: Academic Achievement, Test Anxiety, Academic Procrastination, Self-handicapping

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Introduction

People strive to achieve their goals and want to be rewarded for their efforts. The reward for these efforts is achieving one's goals and being successful. In this context, success is achieving the desired goal and realizing that goal (Sarıer, 2016). Although the concept of success makes its presence felt in all areas of life, it is mostly used in business and education life. The part of success related to educational life is called academic achievement. Academic achievement is defined as the extent to which the desired goals can be achieved as a result of the education received by individuals and the average of the grades received by students as a result of the evaluation of the courses given for this education (Onuk, 2007).

Although being academically successful is something that most students want, achieving this success depends on the scores obtained as a result of the exams. Students desire to finalize these exams in the way they want and to be successful, while avoiding failure. Being successful or unsuccessful are situations that students may encounter due to the nature of exams. Individuals who are afraid of not being successful and the effects of this may experience test anxiety (Aydın, 2010). According to Spielberg and Vagg (1995), test anxiety is a state of emotion experienced during an official exam, which prevents the individual from revealing his/her true potential, creates stress in the individual, and disturbs the individual (as cited in Bacanlı & Sürücü, 2006). When the literature is examined, it is seen that many different studies have been realized about test anxiety. Aba (2018) stated that having a moderate level of test anxiety is a normal and necessary situation, and exceeding this level negatively affects the success of individuals and can prevent the desired performance, Başkal (2019) stated that students who study regularly experience less test anxiety and are more academically successful, while Aydın (2010) and Yurttaş (2018) stated that test anxiety significantly predicts academic achievement. Soğuksu (2020) stated that there is a positive relationship between irrational beliefs and test anxiety, and that the test anxiety levels of students in different faculties are different. Therefore, when the literature is analyzed, it is seen that there are many studies analyzed the relationship between test anxiety and different concepts. When the studies examining the relationship between test anxiety and academic achievement are examined (Bozkurt, 2012; Kapkıran, 2012), it is stated that there is a negative relationship between these two variables.

In addition to test anxiety, another concept that affects academic achievement is procrastination (Wadkins, 1999; as cited in Uzun Özer, 2009). Knaus (2002) states that almost everyone shows procrastination behavior even once in their lives (as cited in Demir, 2018). Procrastination behavior can manifest itself in different areas of life. Postponing a meeting with friends, postponing studying for midterm or final exams, postponing a project we need to prepare, or postponing school-related responsibilities are some of them. School-related procrastination is analyzed under the title of academic procrastination. Academic procrastination is defined as postponing academic tasks for different reasons (Akbay & Gizir, 2010). Individuals who resort to academic procrastination can sometimes make this problem chronic and are involved in a process called the procrastination cycle (Çakıcı, 2003). This situation negatively affects the success of the individual. Considering the research on this subject, it is seen that there is a negative relationship between academic achievement and academic procrastination behavior (Balkıs & Duru, 2010), there is a positive relationship between academic procrastination behavior and fear of failure and external locus of control (Nurlu, 2019), there is a positive relationship between cheating tendency and academic procrastination and a negative relationship with academic achievement (Duran, 2020), and there is a negative relationship between academic procrastination and academic motivation (Yun, 2019). In addition, it is stated that academic motivation and depressive symptoms predict

academic procrastination behavior (Karadeniz, 2020) and males procrastinate their academic tasks more (Balkıs, 2006; Duran 2020). Considering all these studies, it can be said that the concept of academic procrastination is related to different variables and with the increase in the frequency of academic procrastination behavior, a decrease in the level of academic achievement will occur.

Another concept related to academic achievement is self-handicapping. Self-handicapping is an individual's ambivalence about whether he/she can overcome a task even though he/she is capable of performing a task and his/her effort to protect his/her self by making excuses for being inadequate (Üzar, Özçetin & Hiçdurmaz, 2016). The individual can make excuses or put obstacles in front of him/her in cases where he/she will fail. Examples include taking drugs before an exam that the individual thinks he/she will not be successful or not studying for the exam by dealing with an unnecessary job. As a result, the individual fails, wants to leave his/her education in half or wants to move away from educational environments (Midgley & Urdan, 2001). Rather than working hard and not being successful, the student prefers to put obstacles in front of him/her and not being successful, thus securing his/her self (Anlı, 2011). When the studies on self-handicapping are examined, it is seen that there is a negative relationship between self-handicapping and positive perfectionism (Akar, Doğan & Üstüner, 2018), academic self-efficacy and optimism (Yılmazer, 2019) and narcissistic tendencies (Çelik, 2019), while there is a positive relationship between perfectionism and self-compassion and self-handicapping (Alaloğlu, 2020). In addition, it is stated that people who self-handicapping may become substance addicts in the future (Zuckerman & Tsai, 2005). Based on these studies, it can be said that the concept of self-handicapping is related to variables such as perfectionism, self-efficacy and narcissistic tendencies. In addition, there are studies indicating that there is a negative relationship between academic success and self-handicapping (Gündoğdu, 2013; Kalyon, Dadancı & Yazıcı, 2016; Karner, 2014). Therefore, it can be stated that the concept of self-handicapping is a concept associated with academic achievement and different variables.

Today, being academically successful is a goal that many students want to achieve. In addition, parents, educators and educational systems also expect students to be academically successful. If students are academically successful, they think that they have achieved their goals and feel happy, whereas if they are not successful, they may feel inadequate. Like all students, university students also desire to be academically successful and to complete their university education and reach their desired goals. Therefore, university students also focus intensely on academic achievement and want to reach the opportunities that this success will bring. In this respect, it is important to conduct studies on academic achievement, which is valued by students and education systems, and to determine the factors related to academic achievement in order to increase students' academic achievement. In this study, the prediction level of test anxiety, academic procrastination and self-handicapping variables on academic achievement was tried to be determined. It is expected that the results obtained and the suggestions based on these results will guide the relevant parties in increasing the academic achievement of university students.

In this study, the main problem was determined as "Is there a significant relationship between university students' academic achievement, test anxiety, academic procrastination behaviors and self-handicapping tendencies?". In this regard, the answers to the following sub-problems were investigated;

- ✓ At what level are university students' academic achievement, test anxiety, academic procrastination behaviors and self-handicapping tendencies?
- ✓ Do university students' academic achievement, test anxiety, academic procrastination behaviors and self-handicapping tendencies differ significantly according to gender, age, grade and faculty variables?

- ✓ Is there a significant relationship between university students' academic achievement, test anxiety, academic procrastination behaviors and self-handicapping tendencies?
- ✓ Do university students' test anxiety, academic procrastination behaviors and self-handicapping tendencies predict academic achievement?

Methodology

In this study, the correlational survey model was used because the relationship between academic achievement, test anxiety, academic procrastination behavior and self-handicapping tendencies of university students was examined. The relational survey model is a research model that helps to determine the change of more than one variable according to each other and the amount of change (Savaşan, 2019).

Population and Sample

The population of this study consists of 42000 students studying in different faculties of Erciyes University in the 2019-2020 academic year. In this study, convenience sampling method was used as the sampling method. In this sampling method, easy accessibility and economy are taken into consideration (Büyüköztürk et al., 2014). The sample of the study consisted of 511 university students who volunteered to participate in the study. Nine students who participated in the study were not included in the study because they left some of the questions in the scale blank. Therefore, the data obtained from 502 university students were analyzed. Demographic information about the students who participated in the study is shown in Table 1.

Table 1
Frequency analysis results regarding the distribution of demographic information of the participants

Variables		**N**	**%**
Age	18-20	89	17,7
	21-23	342	68,1
	23+	71	14,1
Gender	Male	246	49,0
	Female	256	51,0
Grade	1st grade	40	8,0
	2nd grade	144	28,7
	3rd grade	196	39,0
	4th grade	122	24,3
Faculty	Economics&Administrative Sciences	47	9,4
	Engineering	119	23,7
	Communication	44	8,8
	Literature	61	12,2
	Aeronautics&Astronautics	59	11,8
	Theology	65	12,9
	Sport sciences	68	13,5
	Health sciences	39	7,8

When the distribution of the students participating in the study is analyzed according to age groups, the rate of those in the 18-20 age group is 17,7%, the rate of those in the 21-23 age group is 68,1%, and the rate of those in the 23+ age group is 14,1%. When the distribution according to gender is analyzed, the rate of males is 49% and the rate of females is 51%. When the distribution according to grades is analyzed, the rate of those in the first grade is 8%, the rate of those in the second grade is 28,7%, the rate of those in the third grade is 39% and the rate of those in the fourth grade is 24,3%. When the distribution according to faculties is analyzed, the rate of Faculty of Economics and Administrative Sciences students is 9,4%, the rate of Faculty of Engineering students is 23,7%, and the rate of Faculty of Communication students is 8,8%. The rate of the Faculty of Literature students is 12,2%, the rate of the Faculty of Aeronautics

and Astronautics students is 11,8%, the rate of the Faculty of Theology students is 12,9%, the rate of the Faculty of Sports Sciences students is 13,5%, and the rate of the Faculty of Health Sciences students is 7,8%.

Data Collection Tools

Self-handicapping scale, westside test anxiety scale, academic procrastination behavior scale and personal information form were used to collect the data.

Personal Information Form: In the personal information form, students were asked to write their grade point average (GPA), age, gender, class and faculty of study.

Westside Test Anxiety Scale*:* Westside test anxiety scale was developed by Driscoll (2007). It was adapted into Turkish by Totan and Yavuz (2009). The scale is a one dimensional scale consisting of 11 items. The highest score that can be obtained from the scale is 55 and the lowest score is 11. Totan and Yavuz (2009) reported the Cronbach's alpha internal consistency coefficient of the scale as 0,89. In this study, the Cronbach's alpha value of the scale was calculated as 0,82.

Academic Procrastination Scale: Academic procrastination scale was developed by Çakıcı (2003). There are 19 items in the scale, 12 of these items consist of negative and 7 of them consist of positive expressions. A high score obtained from the scale indicates a high level of academic procrastination. Çakıcı (2003) states that the scale has two dimensions, but it can also be used as a one-dimensional scale. The highest score that can be obtained from the scale is 95 and the lowest score is 19. Çakıcı (2003) found the Cronbach alpha value of the scale to be 0,92. In this study, Cronbach alpha value was calculated as 0,79.

Self-handicapping Scale*:* The Self-handicapping scale developed by Jones and Rhodewalt (1982) was used to measure the self-handicapping tendency. The scale was adapted into Turkish by Akın (2012). The scale has 25 items in total. The highest score that can be obtained from the scale is 150 and the lowest score is 25. Items 3, 5, 6, 10, 13, 20, 22 and 23 are reverse coded and the scale has no sub-dimensions. The scale is a 6-point Likert type. A high score on the scale indicates a high level of self-handicapping (Akın, 2012). In this study, Cronbach's alpha value was calculated as 0,74.

Data Collection

In data collection, firstly, the scales used in the study were determined and permission was obtained from the owners of these scales. Then, study permission was obtained from Erciyes University. After the permissions were obtained, the permission documents were shown to the faculties affiliated to Erciyes University and the scales were distributed to the students who volunteered to participate in the study and the scales were applied. The scales were applied between February 10 and March 14, 2020, and it took approximately 15 minutes for a student to answer the scale.

Data Analysis

SPSS 23.0 was used to analyze the data. First, kurtosis and skewness values were calculated to examine whether the data were normally distributed. The kurtosis and skewness values of the scale data are (0,145; -0,654) for academic achievement, (0,298; -0,577) for test anxiety, (-0,011; -0,990) for academic procrastination and (0,193; -0,340) for self-handicapping. The fact that the skewness and kurtosis values are between -1/+1 indicates that the data conform to the normal distribution (Tabachnick & Fidell, 1996). Therefore, while analyzing the data of this study, it was taken into consideration that they conform to normal distribution. In addition, the correlation values between the variables were examined to determine whether there was a multicollinearity problem. Correlation values of 0,90 and above indicate that there is a

multicollinearity problem (Tabachnick & Fidell, 1996). When the correlation values between the variables in the current study are examined, it can be stated that there is no multicollinearity problem since there is no correlation value of 0,90 and above. Since the study showed normal distribution, parametric tests were applied. Whether academic achievement, test anxiety, academic procrastination behavior and self-handicapping tendency differed significantly according to gender variable was examined by t-test in independent groups; whether they differed significantly according to age, grade and faculty variables was examined by one-way analysis of variance (ANOVA). In case of a significant difference as a result of one-way analysis of variance (ANOVA), pairwise comparisons (Tukey test) were made to determine between which groups the difference was between. The relationships between self-handicapping, test anxiety, academic procrastination and academic achievement were analyzed by correlation analysis. In addition, regression analysis was conducted to determine the predictive effect of test anxiety, academic procrastination and self-handicapping variables on academic achievement. The significance level was taken as 0,05.

Findings

The highest and lowest scores, arithmetic mean and standard deviation values of university students' test anxiety, academic procrastination and self-handicapping scales and the highest and lowest scores, arithmetic mean and standard deviation values of students' weighted year-end grade point averages are as shown in Table 2.

Table 2
Descriptive results for academic achievement, test anxiety, academic procrastination behavior and self-handicapping variables

Variables	**N**	**Min.**	**Max.**	$\bar{x}$	**Sd**
Academic achievement	502	1,14	3,95	2,6	0,5
Test anxiety	502	11,0	55,0	29,7	10,0
Academic procrastination	502	19,0	93,0	53,7	17,8
Self-handicapping	502	34,0	134,0	78,7	21,7

According to Table 2, it is seen that the weighted year-end average ($\bar{x}$) of the students is 2,6. According to this finding, it can be said that the academic achievement level of the students participating in the study is at a moderate level. The mean points ($\bar{x}$) of the students on the test anxiety scale was 29,7. Considering that the highest point that can be obtained from the test anxiety scale is 55, it can be stated that the students have moderate test anxiety. In addition, the mean point ($\bar{x}$) of the students' academic procrastination scale was 53,7. Considering that the highest point that can be obtained from the academic procrastination scale is 95, it can be said that students' academic procrastination behaviors are at a moderate level. The mean point ($\bar{x}$) of the students' self-handicapping scale is 78,7. Considering that the highest point that can be obtained from the self-handicapping scale is 150, it can be stated that students' self-handicapping tendencies are at a moderate level.

The t-test results examining the change in the academic achievement, test anxiety, academic procrastination behavior and self-handicapping levels of university students according to male and female students are shown in Table 3.

Table 3
T-test results examining academic achievement, test anxiety, academic procrastination behavior and self-handicapping according to gender variable

Variables	Gender	N	$\bar{x}$	Sd	t	p
Academic achievement	Male	246	2,4	0,5	59,448	2,327
	Female	256	2,7	0,5		
Test anxiety	Male	246	31,1	9,8	10,251	0,000*
	Female	256	28,3	10,1		
Academic procrastination	Male	246	58,2	17,9	33,285	0,000*
	Female	256	49,3	16,5		
Self-handicapping	Male	246	83,4	23,1	23,403	0,000*
	Female	256	74,3	19,2		

*p<0,05

According to Table 3, self-handicapping (t= 23,403; p<0,05), test anxiety (t= 10,251; p<0,05) and academic procrastination (t= 33,285; p<0,05) of university students vary significantly according to gender. When the arithmetic averages are analyzed, it is noteworthy that the self-handicapping, test anxiety and academic procrastination levels of males are significantly higher than females. Therefore, it can be said that males experience more test anxiety, delay their academic responsibilities more, and exhibit self-handicapping behaviors more than females. It was observed that the level of academic achievement (t= 59,448; p>0,05) did not differ significantly according to gender. In another words, it can be said that the academic achievement levels of male and female students are similar to each other.

ANOVA results examining whether university students' academic achievement, test anxiety, academic procrastination behavior and self-handicapping levels vary according to age variable are as shown in Table 4.

Table 4
ANOVA results examining academic achievement, test anxiety, academic procrastination behavior and self-handicapping according to age variable

Variables	Age	N	$\bar{x}$	Sd	F	p
Academic achievement	18-20	89	2,5	0,5	0,244	0,784
	21-23	342	2,6	0,5		
	23+	71	2,6	0,5		
Test anxiety	18-20	89	31,0	10,2	1,356	0,259
	21-23	342	29,2	9,6		
	23+	71	30,3	11,6		
Academic procrastination	18-20	89	53,8	18,0	0,008	0,992
	21-23	342	53,7	17,4		
	23+	71	53,5	19,6		
Self-handicapping	18-20	89	79,9	22,3	0,760	0,468
	21-23	342	78,0	21,5		
	23+	71	81,1	22,2		

According to Table 4, academic achievement ($F_{(2-499)=}$ 0,244; p>0,05), test anxiety ($F_{(2-499)=}$ 1,356; p>0,05), academic procrastination behavior ($F_{(2-499)=}$ 0,008; p>0,05) and self-handicapping ($F_{(2-499)=}$ 0,760; p>0,05) levels of university students do not differ significantly according to age variable. In other words, it can be said that the self-handicapping, test anxiety, academic procrastination behaviors and academic achievement levels of university students in different age groups are similar to each other.

ANOVA results indicating whether the academic achievement, test anxiety, academic procrastination behavior and self-handicapping levels of university students vary according to the grade variable are as shown in Table 5.

Table 5
ANOVA results examining academic achievement, test anxiety, academic procrastination behavior and self-handicapping according to the grade variable

Variables	Grade	N	$\bar{x}$	Sd	F	p	Tukey Test
Academic achievement	1st grade	40	2,6	0,6	3,978	0,008*	3>2 3>4
	2nd grade	144	2,5	0,6			
	3rd grade	196	2,7	0,5			
	4th grade	122	2,5	0,5			
Test anxiety	1st grade	40	31,1	10,7	2,325	0,074	-
	2nd grade	144	30,0	10,0			
	3rd grade	196	28,3	9,6			
	4th grade	122	31,0	10,4			
Academic procrastination	1st grade	40	50,4	18,2	4,242	0,006*	4>1 4>3
	2nd grade	144	54,0	18,1			
	3rd grade	196	51,3	17,0			
	4th grade	122	58,1	17,7			
Self-handicapping	1st grade	40	79,2	21,9	2,470	0,061	-
	2nd grade	144	79,5	22,7			
	3rd grade	196	75,8	20,1			
	4th grade	122	82,4	22,4			

*p<0,05

According to Table 5, while self-handicapping ($F_{(3-498)=}$ 2,47; p>0,05) and test anxiety ($F_{(3-498)=}$ 2,325; p>0,05) levels of university students do not vary significantly according to the grade variable, academic procrastination ($F_{(3-498)=}$ 4,242; p<0,05) and academic achievement ($F_{(3-498)=}$ 3,978; p<0,05) levels vary significantly according to the grade variable. According to the pairwise comparisons made to determine between which groups the difference is within the scope of the academic procrastination variable; it was seen that the academic procrastination level of the 4th graders was significantly higher than the academic procrastination levels of the 3rd and 1st graders. Therefore, it can be said that senior students procrastinate their academic duties and responsibilities more. According to the results of the analysis conducted within the scope of academic achievement, it was concluded that the academic achievement average of the 3rd grade students was significantly higher than the academic achievement average of the 2nd and 4th grade students. According to this result, it can be stated that 3rd grade students are more successful than 2nd and 4th grade students.

ANOVA results examining whether university students' levels of self-handicapping, test anxiety, academic procrastination behavior and academic achievement vary according to faculties are as shown in Table 6.

Table 6
ANOVA results examining academic achievement, test anxiety, academic procrastination behavior and self-handicapping according to faculty variable

Variables	Faculty	N	$\bar{x}$	Sd	F	P	Tukey Test
Academic achievement	1. Economics & Adm.	47	2,5	0,5	13,629	0,000*	4-8>1-2-5 3-7>2-5 1>2 6>1-2-4-5-7
	2. Engineering	119	2,3	0,5			
	3. Communication	44	2,7	0,5			
	4. Literature	61	2,7	0,5			
	5. Aeronautics&Astronautics	59	2,4	0,6			
	6. Theology	65	2,9	0,4			

	7. Sports Sciences	68	2,7	0,5			
	8. Health Sciences	39	2,8	0,4			
Test anxiety	1. Economics & Adm.	47	29,3	9,1	5,445	0,000*	2-4-5>8
	2. Engineering	119	31,9	9,3			
	3. Communication	44	27,7	10,6			
	4. Literature	61	31,6	12,0			
	5. Aeronautics&Astronautics	59	32,9	9,4			
	6. Theology	65	28,4	9,8			
	7. Sports Sciences	68	27,6	9,3			
	8. Health Sciences	39	23,2	7,7			
Academic procrastination	1. Economics & Adm.	47	52,9	16,7	5,228	0,000*	2-5>8-6 5>3
	2. Engineering	119	57,5	16,8			
	3. İletişim	44	47,4	19,6			
	4. Literature	61	53,7	17,2			
	5. Aeronautics&Astronautics	59	61,4	17,7			
	6. Theology	65	47,7	16,4			
	7. Sports Sciences	68	54,0	19,4			
	8. Health Sciences	39	47,3	12,7			
Self-handicapping	1. Economics&Adm.	47	81,0	21,6	6,427	0,000*	1-2-3-4-5-6-7>8 2-5>6
	2. Engineering	119	84,2	20,4			
	3. Communication	44	78,0	25,5			
	4. Literature	61	80,2	15,8			
	5. Aeronautics&Astronautics	59	85,4	22,0			
	6. Theology	65	70,8	17,1			
	7. Sports Sciences	68	77,1	26,4			
	8. Health Sciences	39	63,7	15,6			

*p<0,05

According to Table 6, academic achievement ($F_{(7-494)=}$ 13,629; p<0,05), test anxiety ($F_{(7-494)=}$ 5,445; p<0,05), academic procrastination ($F_{(7-494)=}$; 5,228 p<0,05), and self-handicapping ($F_{(7-494)=}$ 6,427; p<0,05) levels of university students differ significantly according to faculties. According to the pairwise comparisons made to determine from which group the difference originated, it was seen that the academic achievement levels of the Faculty of Literature and Health Sciences students were significantly higher than the academic achievement levels of the Faculty of Economics and Administrative Sciences, Engineering and Aeronautics and Astronautics students, while the academic achievement levels of the Faculty of Sports Sciences and Communication students were significantly higher than the academic achievement levels of the Faculty of Engineering, Aeronautics and Astronautics students. It was concluded that the academic achievement level of the Faculty of Economics and Administrative Sciences students was significantly higher than the Faculty of Engineering students, and the academic achievement level of the Faculty of Theology students was significantly higher than the academic achievement level of the Faculty of Economics and Administrative Sciences, Engineering, Literature, Aeronautics and Astronautics and Sports Sciences students. It was concluded that the level of exam anxiety experienced by the students of the Faculty of Literature, Engineering and Aerospace Sciences was significantly higher than the level of exam anxiety experienced by the students of the Faculty of Health Sciences. It was concluded that the academic procrastination levels of the Engineering and Aerospace Sciences and Aeronautics and Astronautics Faculty students were significantly higher than the academic procrastination levels of the Health Sciences and Theology Faculty students, in addition, the academic procrastination levels of the Aerospace Sciences and Aeronautics Faculty students were significantly higher than the academic procrastination levels of the Communication Faculty students. It was seen that the self-handicapping levels of the Faculty of Health Sciences students were significantly lower than the self-handicapping levels of the other faculties, while the self-handicapping levels of the Faculty of Engineering and the Faculty of Aeronautics and

Astronautics students were significantly higher than the self-handicapping levels of the Faculty of Theology students.

The results of the correlation analysis examining the relationship between self-handicapping, test anxiety, academic procrastination behavior and academic achievement of university students are shown in Table 7.

Table 7
Correlation analysis results for academic achievement, test anxiety, academic procrastination behavior and self-handicapping variables

Variables	**1**	**2**	**3**	**4**
1.Academic achievement	1			
2.Test anxiety	-0,591**	1		
3.Academic procrastination	-0,757**	0,698**	1	
4.Self-handicapping	-0,726**	0,709**	0,800**	1

**p<0,01

According to Table 7, a negative, moderate and significant relationship was found between university students' academic achievement and test anxiety (r=-0,591; p<0,01). According to these results, it can be said that there may be a decrease in academic achievement with an increase in test anxiety. In other words, an increase in test anxiety may lead to a decrease in academic achievement. A negative, high level and significant relationship was found between academic achievement and academic procrastination behavior (r=-0,757; p<0,01). According to these results, it can be said that a decrease in academic achievement may occur with an increase in students' academic procrastination behaviors. In other words, it can be stated that students' delaying their academic tasks may negatively affect their academic achievement. There was a negative, high level and significant relationship between academic achievement and self-handicapping tendency (r= -0,726; p<0,01). According to these results, it can be said that as students' self-handicapping levels increase, their academic achievement may decrease. Therefore, excessive use of self-handicapping behavior may negatively affect students' academic achievement. There was a positive, high level and significant relationship between test anxiety and academic procrastination behavior (r= 0,698; p<0,01). According to these results, it can be said that students' academic procrastination behavior increases with the increase in test anxiety or students' test anxiety levels may increase with the increase in academic procrastination behaviors. In other words, individuals with high test anxiety may postpone their academic tasks more or individuals who delay their academic tasks may experience higher levels of test anxiety. A positive, high and significant relationship was found between test anxiety and self-handicapping tendency (r= 0,709; p<0,01). According to these results, it can be said that as students' self-handicapping levels increase, their test anxiety may also increase or as their test anxiety increases, their tendency to self-handicapping may also increase. In other words, it can be said that the excessive level of anxiety that students experience about exams may cause them to sabotage themselves more, to put obstacles in front of themselves before the exam, or to constantly put obstacles in front of themselves, which may cause them to experience higher levels of test anxiety. A positive, high level and significant relationship was found between academic procrastination behavior and self-handicapping tendency (r= 0,800; p<0,01). According to these results, it can be said that as students' self-handicapping levels increase, their academic procrastination behaviors also increase or as students' academic procrastination behaviors increase, their self-handicapping levels may also increase. In other words, self-handicapping individuals may delay their academic duties and responsibilities more or students who do not fulfill their academic duties on time may sabotage themselves more.

The regression analysis conducted to examine whether exam anxiety, academic procrastination behavior and self-handicapping tendency of university students have an effect on academic achievement is as shown in Table 8.

Table 8
Regression results to determine the effect of test anxiety, academic procrastination behavior and self-handicapping on academic achievement

Model		B	S.E.	β	t	p
Academic achievement	Constant	4,024	0,057		70,783	0,000*
	Test anxiety	-0,001	0,002	-0,028	-0,674	0,501
	Academic procrastination	-0,015	0,001	-0,481	-9,861	0,000*
	Self-handicapping	-0,008	0,001	-0,321	-6,487	0,000*

R= 0,7835; R^2=0,614; F=264,096 ; p<0,05

According to Table 8, the model is significant (F= 264,096; p<0,05). The rate of independent variables explaining the dependent variable is 61%. When the significance level of the parameters in the model is examined, it is seen that self-handicapping and academic procrastination have a significant effect on academic achievement, while test anxiety does not have a significant effect on academic achievement. When the coefficients of the significantly affecting parameters are investigated, it is seen that academic procrastination and self-handicapping have a negative effect on academic achievement. When we examined which variable affected academic achievement more, it was concluded that academic procrastination behavior was more effective on academic achievement than self-handicapping.

Discussion, Conclusions and Suggestions

In this study, the relationship between academic achievement, academic procrastination behavior, test anxiety and self-handicapping tendency in university students was investigated. Moreover, it was investigated whether these variables differed according to gender, age, class and faculty variables.

It was concluded that university students have a moderate level of academic achievement. In other words, it can be said that the general achievement means of the students participating in the study are at an average level. It is thought that these results will be different in different study groups. It was concluded that university students experience moderate test anxiety. In Soğuksu's (2020) study, which examined exam anxiety and was conducted with the participation of 395 individuals, and in Ayrık's (2018) study, which was conducted with 181 students and examined students' exam anxiety, social anxiety and perfection behaviors, similar findings to the results of this study were found. According to this result obtained from the study, it can be said that university students have moderate anxiety in exams. Contrary to the findings of the study, Lakot (2019) concluded that the students' level of exam anxiety was below moderate. It was concluded that the academic procrastination levels of university students were at a moderate level. Therefore, it can be said that university students delay approximately half of their school-related responsibilities. When the studies of Seyfi (2019), Toy (2014), Ulukaya (2012), Uzun Özer (2009), Uzun Özer (2011) regarding academic procrastination are examined, it is seen that the results support the findings of this study. Therefore, it can be said that this result is consistent with other studies in the literature. It was concluded that university students sabotage themselves at a moderate level. Akar, Çelik, and Karataş (2019), Midgley et al. (1996) and Yıldırım (2015) also reached findings supporting this result in their studies.

Academic achievement of university students does not differ significantly according to gender. Based on this result, it can be said that the academic achievement levels of female and

male students are similar to each other or that the differentiation of gender does not create a change on academic achievement. Aba (2018), Güney et al. (2014), İkiz (2000) and Tatar and Kuru (2006) stated in their studies that academic achievement does not differ according to gender. Accordingly, it can be said that the results of this study are similar to the studies in the literature. Moreover, it was also observed that there are studies that concluded that female students are more successful (Akdemir, 2013; Bozkurt, 2012). It was concluded that the exam anxiety experienced by university students differed significantly according to gender and that males experienced more exam anxiety than females. When the literature is examined, it is seen that although there are studies indicating that exam anxiety does not differ significantly according to gender (Aba, 2018; Ayrık, 2018; Küçüker, 2018; Savaşan, 2019; Tekbaş, 2009), there are more studies indicating that females experience more exam anxiety (Çankaya, 1997; Erzen & Odacı, 2014; Onuk, 2017; Önem, 2011; Sazak & Ece, 2004). Therefore, it is seen that the result of the current study contradicts the literature. It is thought that the reason for this result is that males start to attach more importance to exams. In addition, considering that academic procrastination and self-handicapping are more common in males, the literature supports this result, and there is a positive correlation between self-handicapping, academic procrastination and test anxiety, it can be said that this result is normal. It was concluded that the academic procrastination levels of university students differed significantly according to gender and the academic procrastination levels of male students were higher than female students. According to this result, it can be said that male students delay and postpone their academic tasks more. In other words, it can be said that female students act more meticulously than male students in order to complete their academic tasks on time. When the literature is examined, it is seen that there are studies supporting this result (Arslan, 2013; Balkıs et al., 2006; Çakıcı, 2003; Jackson, 2002; Seyfi, 2019 and Tufan & Gök, 2009). In addition, in Yıldız's (2015) study, which investigated the procrastination levels of university students and conducted with 401 university students, it was concluded that male students showed more academic procrastination behavior. Yiğit and Dilmaç (1993) stated that there was no significant difference between males and females in terms of academic procrastination. Therefore, the results of this study are in parallel with many other studies. It is stated that the fact that females are busy with some work to be done at home since childhood and that there is more pressure on them, while males are left more flexible by their families and are not given less responsibility affects their future lives (Yıldırım, 1997), and accordingly, males delay their responsibilities more (Arslan, 2013). For this reason, it is an expected result that females who are raised in a disciplined manner fulfill their duties on time. It was concluded that the self-handicapping tendencies of university students differed significantly according to gender and that the self-handicapping levels of males were higher than females. Therefore, it can be said that male students can prevent themselves more by developing a strategy to protect their ego when faced with a task that they think they cannot do. When the literature is examined, it is seen that there are studies indicating that males sabotage themselves more than females. (Anlı et al., 2015; Anlı, 2011; Mccrea et al., 2008; Hirt et al., 2003; Sertel, 2019; Yu & McLellan, 2019). Berglas and Jones (1978), who conducted the first studies on the concept of self-handicapping, stated that males sabotage themselves more. It is also stated that males use behavioral self-handicapping more, while females use verbal self-handicapping (Üzbe, 2013). In Turkish culture, as in most cultures, the idea that men are strong and that it is unacceptable for them to be weak has been promoted to the individual from childhood. It is thought that boys who grow up with this way of thinking put more obstacles in front of themselves when they think that they will fail in the future.

Academic achievement does not vary significantly according to the age variable. In other words, it can be said that the achievement levels of university students in different age ranges are similar. In Aba's (2018) study, which examined exam anxiety and academic achievement and was conducted with 100 students, it was concluded that the academic achievement level did not differ according to gender. The exam anxiety of university students

does not differ significantly according to the age variable. In other words, the levels of test anxiety experienced by university students in different age ranges are similar. When the literature is analyzed, it is noteworthy that the studies conducted have results that are compatible with this study (Aba, 2018; Civil, 2008; Gençdoğan, 2006; Kilit, 2019; Soğuksu, 2020). Academic procrastination behavior does not vary significantly according to age variable. When the literature is examined, it is seen that similar results were obtained in Çakıcı's (2003) study examining procrastination behavior in high school and university students, Sarıoğlu's (2011) study examining academic procrastination and perfectionism levels of Faculty of Education students, and Yıldırım's (2015) study conducted with 380 students in 9th, 10th and 11th grades and examining the psychological symptoms of these students, their perception of social support and their postponement of academic tasks. In contrast to these results, Balkıs (2006) stated that the frequency of postponing academic tasks increased with advancing age. Therefore, when the studies are examined, it is seen that there are different results in the relationship between age variable and academic procrastination behavior. The self-handicapping tendency does not vary significantly according to age. In other words, it can be said that the self-handicapping levels of students in different age ranges are similar to each other. When the studies on this subject are examined, it is seen that similar results are obtained with the results of this study (Coşar, 2012; Civan, 2016, Çelik, 2019; Sertel, 2019).

The academic achievement of university students differs significantly according to their grades. According to this result, it is seen that students in the 3rd grade are significantly more successful than students in the 2nd and 4th grades, and more successful than students in the 1st grade, even if not at a significant level. It can be said that 3rd grade students are more successful than 1st and 2nd grade students because they adapt to the university environment better, have a better command of the lessons, and know the lecturers and their lecturing and exam methods better. The reason why 3rd graders are more successful than 4th graders is thought to be due to the increase in the time that senior students allocate to extracurricular activities and as a result, they do not study sufficiently. Apart from this, it can be said that studying for the public personnel selection exam and spending more time on internship practices due to being in the last grade negatively affect the lessons at school. It was concluded that the exam anxiety experienced by university students did not differ significantly according to the grade levels, but that the 1st and 4th grades experienced more exam anxiety than the 3rd and 2nd grades, even if not significantly. In other words, although the level of test anxiety experienced by 1st, 2nd, 3rd and 4th grade students is similar, 1st and 4th graders experience slightly more test anxiety. It is thought that such a result is encountered due to the fact that senior students are preparing for a series of exams, while 1st grade students have just passed the university entrance exam. When the studies on this subject are examined, it is seen that there is no consensus. According to the study conducted by Başduvar and Üredi (2017) with 302 pre-service teachers, it was concluded that the exam anxiety experienced by classroom teachers differed significantly according to the grade variable. Yenilmez and Özabacı (2003) and Bozkurt (2012) stated that there was no significant difference between grade level and test anxiety. Boyacıoğlu (2010) concluded that 3 sub-dimensions of test anxiety differed significantly according to the grade variable, while 1 dimension did not differ. It is seen that the academic procrastination levels of university students vary significantly according to the grades and that the students studying in the 4th grade show more academic procrastination behavior than the students studying in the 1st and 3rd grades, and more academic procrastination behavior than the students studying in the 2nd grade, even if it is not significant. These results are similar to the results of studies conducted by Akdoğan (2013), Çelik (2014), Çelik and Odacı (2015), Çetin (2016), Ekşi and Dilmaç (2010) and Yeşir and Şahan (2012). Therefore, it can be stated that 4th grade students delay their academic duties and responsibilities more than other grades. Students who break away from high school life and start university take care to study more disciplinedly in the first years of university because they do not know exactly what kind of education they will encounter at university, they are afraid of failing, they study intensively for the exam ahead of them and they

cannot get out of this tempo at once. As the time they spend at the university increases and the rate of adaptation increases, students can relax themselves a little more and neglect their academic duties more (Ferrari & Schaz, 2000; as cited in Çelik & Odacı, 2015). In addition, it is thought that senior students who will leave the school and their friends show more academic procrastination behavior compared to other grades because they spend their time on extracurricular activities. In addition, students in the 4th grade think that they are in their last year and that they should start their professional life. Students who are aware that it is now more difficult to find a job after graduation may become anxious, despair and change their perspective on life. It is thought that this pessimistic mood also affects the student's school life, and this situation causes a tendency to be reluctant to fulfill academic tasks or to delay these tasks. Balkıs (2006) concluded that academic procrastination behavior increases with increasing grade level. It was concluded that the self-handicapping tendencies of university students did not differ significantly according to the grade level. Based on these results, it can be said that the self-handicapping levels of students studying in different grades are close to each other. In other words, it can be said that although the grades of individuals studying at the university are different, their levels of self-handicapping are similar. When the studies on this subject are examined, it is seen that different results are reached. In the study conducted by Üzbe (2013), self-handicapping did not vary according to grade levels, while Çingöz (2015) concluded that the level of self-handicapping differed according to the grade variable and that 4th grade students sabotaged themselves less than 1st and 3rd grade students.

Academic achievement of university students differs significantly according to faculties. Accordingly, Faculty of Theology students have higher academic achievement than the students of Faculty of Sports Sciences, Faculty of Engineering, Faculty of Literature, Faculty of Aeronautics and Astronautics and Faculty of Economics and Administrative Sciences. In addition, it was concluded that students from the Faculty of Communication and Sports Sciences have higher academic achievement than students from the Faculty of Engineering and Aeronautics and Astronautics, students from the Faculty of Literature and Health Sciences have higher academic achievement than students from the Faculty of Economics and Administrative Sciences, Faculty of Aeronautics and Astronautics and Faculty of Engineering, and finally, students from the Faculty of Economics and Administrative Sciences have higher academic achievement than students from the Faculty of Engineering. It was concluded that the exam anxiety experienced by university students differed significantly according to the faculty. It was concluded that the students of the Faculty of Literature, Engineering and Aeronautics and Astronautics experienced more exam anxiety than the students of the Faculty of Health Sciences. Considering that the courses of the students of the Faculty of Engineering and the Faculty of Aeronautics and Astronautics are more intense compared to other faculties, it can be said that these students have difficulty in fulfilling their responsibilities and therefore apply to procrastination behavior more. It was seen that the academic procrastination levels of university students differed significantly according to the faculty. It was concluded that the academic procrastination levels of the students of the Faculty of Engineering and the Faculty of Aeronautics and Astronautics were higher than the students of the Faculty of Health Sciences and the Faculty of Theology, and that the students of the Faculty of Aeronautics and Astronautics delayed their academic tasks more than the students of the Faculty of Communication. Çeri, Çavuşoğlu, and Gürol (2015) also stated in their study that Engineering Faculty students delayed their school-related tasks more than other faculties. It is thought that the fact that the students of the Faculty of Engineering and the Faculty of Aeronautics and Astronautics have numerical courses and that these courses are more difficult than other faculties causes them to postpone academic tasks more. In the study conducted by Balkıs (2007) on this subject, it was concluded that students in the departments with numerical courses postpone their academic tasks more. It was concluded that self-handicapping tendencies of university students differed significantly according to faculties. Accordingly, it was observed that the self-handicapping tendency of the students of the Faculty of Health Sciences was

significantly lower than the self-handicapping tendency of the students of other faculties. In addition, it was concluded that the self-handicapping tendencies of the students of the Faculty of Engineering and the Faculty of Aeronautics and Astronautics were significantly higher than the self-handicapping tendencies of the students of the Faculty of Theology. Health is undoubtedly a very important branch of science and serious consequences can be encountered if mistakes are made. For this reason, students in the Faculty of Health Sciences need to study their lessons completely. Therefore, it is an expected result that these students are less likely to resort to self-handicapping behavior. Considering that the students of the Faculty of Engineering and the Faculty of Aeronautics and Astronautics are more likely to fail academically compared to other faculties, it is thought that they put more obstacles in front of themselves in order not to show themselves as an inadequate individual.

It was observed that there was a moderate, negative and significant relationship between academic achievement and test anxiety of university students. According to this result, it can be said that as the test anxiety level increases, there will be a decrease in academic achievement. When the studies examining the relationship between test anxiety and academic achievement are examined (Aydın, 2010; Bozkurt, 2012; Cassady & Johnson, 2002; Gündoğdu, 1994; Kapıkıran, 2002), similar results are obtained. Therefore, it can be said that intense test anxiety can negatively affect an individual's academic achievement, and with the decrease in this anxiety, the success level will increase. It can also be thought that students who are successful in exams may experience less test anxiety as their self-confidence increases. Alyaprak (2006) and Çakmak (2007) also stated in their studies that students' test anxiety decreased with the increase in their achievement. It has been observed that there is a high, negative and significant relationship between academic achievement and academic procrastination behaviors of university students. It is seen that similar results were obtained in the study of Çeri, Çavuşoğlu, and Gürol (2015) investigating academic procrastination in university students, in the study of Balkıs et al. (2006) examining university students' delaying their academic tasks, in the study of Balkıs and Duru (2010) investigating academic achievement, academic procrastination and self-esteem, and in the studies of Anthony and Owens (1997) and Fritzsche, Young, and Hickson (2003). Students' disrupting and delaying the tasks they are supposed to do causes them to submit these tasks incompletely or fail to submit them, and this situation causes them to be unsuccessful. In other words, it is an expected result that as the rate of postponement of academic tasks increases, academic achievement naturally decreases. It was observed that there was a high, negative and significant relationship between academic achievement and self-handicapping levels of university students. When the studies examining the relationship between academic achievement and self-handicapping are investigated, it is noticed that the results are similar to this study (Gündoğdu, 2013; Hirabayashi, 2005; Kalyon, Dadandı & Yazıcı, 2016; Karner, 2014). When students face a situation that they think they cannot overcome, they experience the fear of not being successful and protect themselves by blaming this failure on external factors. This strategy, which is used to protect themselves, disrupts the responsibilities they have to fulfill in school and thus causes them to be unsuccessful. In short, the increase in self-handicapping behaviors negatively affects students' school success. It was observed that there was a high, positive and significant relationship between university students' exam anxiety and academic procrastination behaviors. This result indicates that there is a relationship between exam anxiety and academic procrastination and that an increase in one variable will lead to an increase in the other variable. Aydoğan (2008) stated in his study that the level of anxiety increased with the increase in the level of delaying academic tasks. Kağan (2010) reached parallel results with the results of this study in his study on the use of Rational Emotive Behavioral Therapy to overcome academic procrastination. When it is considered that academic procrastination leads to not being well prepared for the courses and exams, it can be said that taking the exam unprepared increases the anxiety experienced during the exam. It was observed that there was a high, positive and significant relationship between university students' test anxiety and self-handicapping levels. When the literature is examined, it is seen that there

are studies similar to this result (Sahranç, 2011; Yıldırım, 2015). Students take dozens of exams throughout their lives and try to achieve the goals they want. However, an individual who takes an exam that he/she thinks he/she will not be successful may be more anxious than other students during the exam. As this level of anxiety and the possibility of failure increase, the student hinders himself/herself, shows those obstacles to his/her friends and blames the failure on those obstacles. In addition, students who have made a habit of putting obstacles in front of themselves may worry more because they think that they will not be successful in the exam because they cannot adequately prepare for the exam. There is a positive, high and significant relationship between academic procrastination behaviors and self-handicapping levels of university students. Individuals who do not fulfill their academic tasks on time may prevent themselves because they think that they will not be able to complete their tasks and be successful, and in order not to attribute this failure to themselves. When we look at the other dimension, it can be said that as the frequency of individuals who put obstacles in front of themselves increases, the probability of completing their tasks on time will decrease. Therefore, it can be said that these two variables decrease and increase depending on each other. When the literature is examined, it is noteworthy that there is a positive relationship between delaying academic tasks and self-handicapping in the studies of Gündoğdu (2013), Söyleyen (2018) and Yıldırım (2015).

It was seen that test anxiety, academic procrastination levels and self-handicapping tendencies of university students explained 61% of their academic achievement. It was also concluded that academic procrastination and self-handicapping negatively and significantly affected academic achievement, while test anxiety did not significantly affect academic achievement. In addition, academic procrastination was found to be more effective on academic achievement. According to these results, it can be said that there are two variables that prevent students from being academically successful, and the most effective of these is the delay of the tasks that need to be fulfilled on time, that is, procrastination behavior. When the study conducted by Ekinci (2011) on this subject is examined, it is seen that there are similar results to this study. Ekinci (2011) concluded that academic procrastination can explain 6% of academic achievement. Özer (2005) also stated that delaying academic tasks negatively affected achievement.

Based on the results of the research, the following suggestions are presented.

- ✓ It has been observed that there is a negative relationship between academic achievement and test anxiety. Therefore, as the exam anxiety experienced by the individual increases, there is a decrease in academic achievement. Therefore, a number of methods such as breathing exercises, muscle relaxation exercises, bibliotherapy, systematic desensitization can be applied by the guidance and psychological counseling units of universities in order to cope with exam anxiety to students who experience intense exam anxiety and as a result, their academic achievement decreases. Individuals who constantly delay their responsibilities can be helped in time management, preparing a study program and timetable. Individual or group counseling activities can be conducted to help students who have chronic self-inhibition to overcome this problem.
- ✓ If anxiety, procrastination or self-inhibition problems affect the quality of life and psychological well-being of the individual, psychological counseling sessions can be conducted with these individuals by the guidance and psychological counseling units of universities.
- ✓ It is stated that male students exhibit more procrastination behavior and this is due to the upbringing style. If parents want to reduce their children's procrastination behavior, they should be able to impose the same responsibilities on their sons as they do on their daughters, and they should indicate that both of them have duties and that they should fulfill them on time. In addition, men are said to use behavioral self-handicapping more

depending on the culture they live in. In order to reduce males' behavioral self-handicapping tendencies, it is suggested that parents should set rules that apply to both genders and follow these rules.

- ✓ Students who are new to university may fail academically in their first year because they do not know the course system, exam system and faculty members well enough. In order to overcome this problem, orientation activities can be conducted by academics for all new students.

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The Effect of Self-Efficacy Intervention Programs in Children: A Protocol for a Systematic Review *

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Abstract: Self-efficacy, defined as an individual's belief in their ability to succeed in certain situations, is a critical aspect of child development that significantly impacts various areas of life, including academic performance, social interactions, and emotional well-being. The importance of self-efficacy in children is highlighted by its role in promoting the resilience and motivation necessary to overcome childhood and later challenges. Recent research on self-efficacy intervention programs for children has highlighted various strategies and their effectiveness in increasing self-efficacy in different contexts. Self-efficacy in children appears to be a vital component that affects children's academic achievement, social interactions, and emotional resilience. Understanding and improving the factors that affect children's self-efficacy will increase the number of healthier and more successful individuals in society for parents, educators, and policy makers. In this context, interventions, educational tactics, and programs designed to increase self-efficacy levels in children and adolescents will be systematically reviewed. This study aims to clarify whether the current state of the research is suitable for a systematic review. A comprehensive search was conducted using the terms 'self-efficacy, children' and 'intervention' in databases such as EBSCOhost, Web of Science, PubMed, Scopus and DergiPark applying inclusion and exclusion criteria. The initial search yielded 122.829 studies spanning from 2015 to 2025. The planned review aims to provide a new perspective for educators and practitioners by providing a comprehensive analysis of interventions in different areas for the development of self-efficacy. Considering the significant amount of studies in this area, researchers need to conduct an extensive literature review. A thorough review of existing literature can provide resources for new research and can also inspire the design of new interventions and prevention measures in this area.
Keywords*:* Self-efficacy, Children, İntervention, Treatment.

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Introduction

Self-efficacy refers to individuals' belief in their ability to successfully perform the behaviors necessary to achieve specific goals. Bandura's Social Learning Theory (Bandura, 1977) outlines how self-efficacy is shaped through cognitive, behavioral, and environmental factors, offering a comprehensive framework for understanding the development of self-efficacy. It is believed that self-efficacy is the most powerful predictor of human behavior. Bandura defined self-efficacy as "belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). In this regard, self-efficacy is a belief about one's ability and, therefore, may not necessarily align with actual competence in a given domain (Artino, 2012).

Bandura (1977) identified two key components of self-efficacy: outcome expectations and efficacy expectations. Outcome expectations are based on individuals' expectations about the consequences of their actions. This type of competence reflects an individual's ability to control environmental factors to achieve a desired outcome (Bandura, 1998). Efficacy expectations, on the other hand, relate to the consistency between an individual's effort and their belief in their own competence. Throughout life, individuals evaluate the effectiveness of their actions and compare them to those of others. A person may develop a positive sense of self-efficacy even if they are not actually skilled in a given area, simply because they believe they possess the ability. Conversely, a person may exhibit a low sense of self-efficacy and behave ineffectively even when they have the necessary skills (Bandura, 1977).

According to Bandura (1977), self-efficacy influences a person's choice of activities, effort, and persistence. Individuals with low self-efficacy may avoid tasks, while those with high self-efficacy are more likely to engage in them. The tendency of individuals with high self-efficacy to exert more effort and persist longer is particularly important, as most personal achievements require persistent effort. In this sense, low self-efficacy can become a self-limiting process. Therefore, individuals need a strong sense of self-efficacy to overcome life's inevitable challenges and succeed (Bandura, 1997).

According to Social Cognitive Theory (Bandura, 1997), children develop and modify their sense of self-efficacy through interpreting information from four main sources: past experiences (mastery experiences), feedback and evaluative information from others (social persuasion), observing models in reference groups (vicarious experiences), and physiological and emotional states experienced during or while thinking about a performance. Bandura (1986) argued that having self-efficacy beliefs slightly above actual abilities may be beneficial, as it can increase effort and persistence during difficult times.

Research has shown that self-efficacy predicts academic success and influences various aspects of children's lives, including physical activity, dietary habits, and social interactions (Bozgün & Pekdoğan, 2018; T et al., 2018; Curelaru et al., 2020). The development of self-efficacy in children is significantly influenced by both parental factors and educational environments, highlighting the importance of supportive contexts that strengthen children's belief in their abilities (Nursanti et al., 2023; Kim et al., 2017; Lu et al., 2015). Fostering self-efficacy in children not only promotes self-confidence and self-awareness of abilities but also enhances metacognitive awareness, a positive attitude toward learning, and coping skills (Cera et al., 2013). Furthermore, the effects of self-efficacy extend beyond immediate behavioral outcomes, being associated with long-term psychological well-being and resilience in children. High self-efficacy is linked to lower levels of anxiety and higher levels of life satisfaction, indicating that children who believe in their abilities are better equipped to handle challenges and stressors (Moksnes et al., 2018; Shi, 2023). Therefore, understanding the factors that

contribute to the development of self-efficacy in children is essential for educators, parents, and policymakers aiming to create environments that support healthy psychological and physical development.

Intervention programs designed for children aim to support their cognitive, emotional, and social skills by considering developmental stages. These programs not only promote healthy development but also play a protective role against risk factors. Especially for school-aged children, intervention programs are crucial across a broad spectrum, from academic achievement to social adaptation (Durlak et al., 2011).

In recent years, various intervention programs have been implemented to enhance children's self-efficacy. These programs vary in form, including individual psychoeducational activities, group-based applications, and school-based social-emotional learning (SEL) programs. However, the literature on these programs is scattered and methodologically heterogeneous. There are significant differences across studies in terms of duration, content, techniques used, and assessment tools. This variability makes it difficult for practitioners to determine which types of interventions are most effective (Usher & Pajares, 2008; Klassen, 2004).

At this point, systematic reviews serve as a method to comprehensively, objectively, and transparently evaluate scientific evidence within a field. Systematic reviews synthesize findings from individual studies, reveal general trends, identify research gaps, and help develop evidence-based recommendations for practice (Moher et al., 2009). Therefore, a systematic review focusing on interventions aimed at enhancing self-efficacy in children is expected to make a significant contribution to the literature.

Developing a protocol before conducting a systematic review ensures the scientific validity and methodological consistency of the study. Such a protocol increases transparency, promotes reproducibility, and prevents biased interpretations during the research process (Shamseer et al., 2015). Moreover, protocols enhance reporting integrity by defining potential deviations in advance and increase trust within the scientific community (Moher et al., 2009). In this context, it is considered necessary to develop a clearly defined and pre-established protocol for this study, which aims to systematically examine intervention programs designed to improve self-efficacy in children aged 6 to 12 years.

Method

This study aims to systematically examine intervention programs designed to positively influence the self-efficacy levels of children and adolescents. Accordingly, a systematic review methodology was employed in this research. A systematic review is defined as “the impartial and systematic identification of studies in a particular field based on predefined criteria, the evaluation of the validity of the obtained findings, and the comprehensive synthesis and presentation of results to answer a specific research question” (Çınar, 2021, p.1).

The conduct and reporting of this planned systematic review will follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). PRISMA is a standardized and transparent approach that facilitates the rigorous execution of systematic reviews and meta-analyses, thereby enhancing the reliability and usability of their findings (Page et al., 2021).

Inclusion and Exclusion Criteria

The **inclusion criteria** for the review will consist of the following:

1. Interventions specifically designed to influence self-efficacy levels,
2. A sample comprising children or adolescents,
3. Studies conducted within the last 10 years,
4. Peer-reviewed research articles published in academic journals to ensure the quality and reliability of sources.

The **exclusion criteria** will include:

1. Literature types such as reviews, case studies, and descriptive studies that do not provide sufficient empirical evidence required for this analysis.

Search Strategy

To identify studies that examine variables affecting students' self-efficacy levels, searches were conducted using the PubMed, Web of Science (WoS), EBSCOhost, Scopus, and DergiPark databases. The scope of the review was limited to studies published between 2015 and 2025. The search strategy included the following terms: *("self-efficacy" OR "self efficacy") AND (adolescents OR "children" OR "youth" OR "students") AND ("education" OR "intervention" OR "treatment" OR "program")*. In addition, the search was expanded in databases that may include Turkish literature, such as DergiPark and ERIC, by incorporating the Turkish equivalents of these terms.

Study Records

Data Management

To manage the data extraction process, the Rayyan – Intelligent Systematic Review software, developed by Ouzzani et al. (2016), will be utilized to evaluate eligible articles. Rayyan is an AI-assisted web application specifically designed for conducting systematic reviews. It allows researchers to include or exclude articles, import search results, and remove duplicates efficiently, thereby facilitating the review process.

Selection Process

The researcher will independently screen the titles and abstracts of studies obtained through the search process, eliminating duplicate records. Following this initial screening, the full texts of the shortlisted studies will be thoroughly reviewed to determine their eligibility based on the predefined inclusion and exclusion criteria.

To ensure full transparency of the systematic process, the study selection methodology will be illustrated using a PRISMA flow diagram, as recommended by the PRISMA-P guidelines. This flowchart will detail the entire pathway—from the initial identification of records to the final inclusion of studies—providing a clear overview of the selection process (see Figure 1).

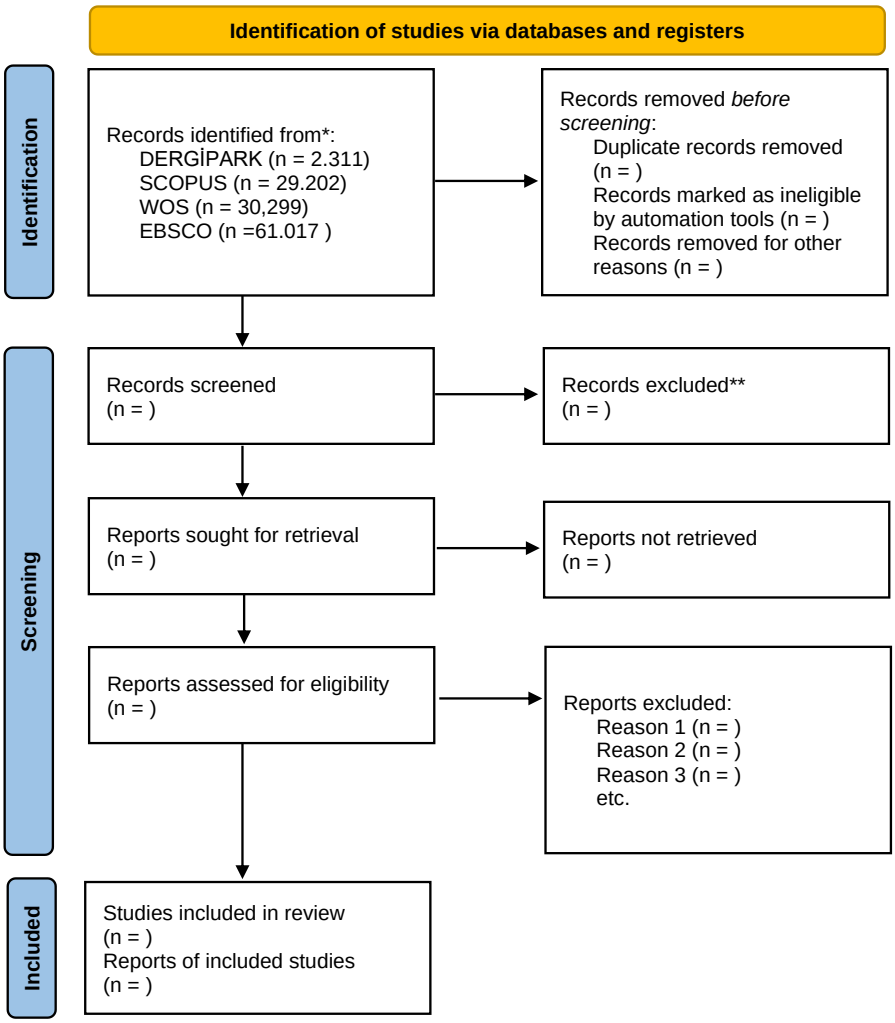

Figure 1. The selection process

Discussion

Self-efficacy, defined as an individual's belief in their ability to succeed in specific situations, is a critical component of child development that significantly affects various aspects of life, including academic performance, social interactions, and emotional well-being. The importance of self-efficacy in children is underscored by its role in fostering the resilience and motivation needed to overcome challenges during childhood and beyond. Recent research on self-efficacy intervention programs for children has highlighted diverse strategies and their effectiveness in enhancing self-efficacy across different contexts.

Studies have shown that children with higher self-efficacy are more likely to engage in self-regulated learning, persist in the face of difficulties, and demonstrate better problem-solving skills. This core belief in their capabilities not only improves their academic outcomes but also contributes positively to their mental health and social competence (Bozgün & Pekdoğan, 2018; Shin, 2021). Beyond academic and behavioral outcomes, self-efficacy plays a crucial role in emotional regulation and coping strategies. Research indicates that children who believe in their abilities are better equipped to handle stress and adversity, which is particularly

significant in contexts of trauma or adverse life conditions (Diehl & Prout, 2002; Han & Park, 2020). For instance, self-efficacy can mediate the effects of traumatic experiences by helping children develop healthier coping mechanisms and reduce the likelihood of developing anxiety or depression (Diehl & Prout, 2002). Thus, promoting self-efficacy in children not only benefits immediate performance but also serves as a protective factor for long-term psychological well-being.

Intervention programs aimed at increasing self-efficacy can enhance children's belief in their abilities, thereby improving both academic achievement and social relationships. These programs may also reduce the negative impact of social challenges on academic success by increasing motivation, strengthening resilience to peer bullying, and improving emotional adjustment (Raskauskas et al., 2015). One key area of focus in self-efficacy-based interventions is health behavior education, which has been shown to significantly improve children's self-efficacy. For example, a study on the Healthy Friends program demonstrated that targeted interventions in healthy eating and physical activity effectively closed the intention-behavior gap, thereby increasing children's self-efficacy regarding physical activity (Isa et al., 2018). Similarly, interventions targeting children with chronic illnesses such as asthma reported increases in self-efficacy following educational programs that helped them manage their health more effectively (Kocaaslan & Kostak, 2019). These findings emphasize the value of structured educational interventions in promoting self-efficacy in health-related behaviors.

Moreover, creative interventions, such as dance therapy, have also been explored. A study in China examining the impact of a Latino dance intervention on left-behind children found significant improvements in both academic motivation and self-efficacy (Zhou et al., 2023). This suggests that engaging children in enjoyable and culturally relevant activities can enhance their self-efficacy in ways that transfer to other areas of life, including academic domains. These findings align with broader evidence that self-efficacy-focused interventions can enhance children's life satisfaction and overall well-being (Long, 2023).

Additionally, self-efficacy is intricately connected to the support children receive from parents and educators. Studies have shown that parental self-efficacy—parents' belief in their ability to influence their children's development—plays a significant role in shaping children's own self-efficacy beliefs (Kong & Yasmin, 2022; Strauß et al., 2001). For instance, parents with high self-efficacy are more likely to engage in positive parenting practices that encourage children's autonomy and learning, thereby fostering a stronger sense of competence in their children (T et al., 2018). This reciprocal relationship underscores the importance of creating supportive environments that nurture both parental and child self-efficacy, which in turn can lead to improved health behaviors and academic achievement (Diehl & Prout, 2002).

Despite the common perception that research on self-efficacy interventions for children is limited, there has been a growing number of studies in recent years, with many published in international databases (Usher & Pajares, 2008; Klassen, 2004). However, the dispersal of these studies across disciplines and the restricted use of keywords may hinder access to this knowledge and reduce visibility in the literature (Bergman et al., 2018; Shogren et al., 2020). Furthermore, the tendency of many systematic reviews to focus only on local-language databases may exclude studies published in English, creating a misleading impression of the available body of evidence (Cunningham & Card, 2014).

In conclusion, self-efficacy in children is a vital factor influencing their academic success, social functioning, and emotional resilience. For parents, educators, and policymakers, recognizing the role of self-efficacy in creating nurturing environments for children's development can significantly contribute to supporting individual growth and long-term well-being.

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