

Turkish Online Journal of Educational Technology

Volume 24, Issue 2

April 2025

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THE TURKISH ONLINE JOURNAL OF EDUCATIONAL TECHNOLOGY

April 2025
Volume 24 – Issue 2

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Editor-in-Chief

ISSN: 2146 - 7242

Indexed by
Education Research Index
ERIC
EBSCOhost – Current Abstracts
EBSCOhost – Education Research Index
EBSCOhost – TOC Premier
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Index Copernicus Journal Master List

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Published in TURKEY

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Message from the Editor-in-Chief

Dear Colleagues,

It is with great pleasure that we present the April 2025 issue of *The Turkish Online Journal of Educational Technology (TOJET)*. This issue brings together a rich selection of research studies that reflect the evolving dynamics of educational technologies and media across different disciplines and cultural contexts.

As digital transformation continues to reshape education globally, the articles featured in this issue emphasize the interdisciplinary nature of technology integration. Topics span from e-learning environments and mobile technology use in education to curriculum development strategies and the social impacts of digital media.

This issue includes a diverse range of studies from researchers around the world. For instance, we examine the effects of social media marketing on consumer education in the real estate sector, explore students' perceptions of e-learning in higher education, and analyze the educational implications of smartphone usage across various student demographics. We also highlight systematic reviews and meta-analytical approaches to program development and curriculum design—showing a growing trend toward evidence-based educational planning. Several contributions in this issue also address broader themes such as digital citizenship, communication strategies for visibility in global media, and the intersection of language technologies with international social media platforms. These studies reflect both the challenges and opportunities educators and institutions face in adapting to a rapidly changing educational landscape.

We extend our sincere gratitude to all the authors, reviewers, and editorial team members who contributed to this issue. Your commitment to scholarly excellence and educational innovation continues to strengthen TOJET's position as a leading international journal in the field.

We hope that the insights shared in this volume will inspire further research and practical applications that support transformative learning experiences and inclusive educational policies worldwide.

TOJET, in collaboration with international universities, will host the IETC 2025 Conference (www.ietc.net) in Rabat, Morocco between July 10-11, 2025

Call for Papers:

TOJET welcomes academic studies in the field of educational technology. Submitted articles may address topics such as the use of technology in classrooms, the impact of technology on learning, and the perspectives of students, teachers, administrators, and the community on educational technology. Such studies will enhance the quality of theoretical and practical approaches in educational technology.

Article Submission Criteria:

- Submitted articles must be original, unpublished, and not under consideration by another publication.
- Articles may cover a wide range of topics, including assessment, attitudes and beliefs, curriculum design, equity, applied research, learning theories, sociocultural issues, and educational practices for special populations.

Warm regards,

Prof. Dr. Aytekin İŞMAN
Editor-in-Chief

The Turkish Online Journal of Educational Technology (TOJET)
April 2025

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Evaluating the Effectiveness of the Program Developed to Increase the Awareness of Municipality Employees on Corporate Social Responsibility¹

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Abstract

The primary goal of education is to ensure the retention and effective utilization of knowledge and skills. In recent years, program development efforts have been implemented not only in formal education institutions but also in social organizations and non-formal education settings. Educational programs primarily focus on making sense of knowledge, emphasizing how to learn rather than what should be taught. In this context, the implementation of training programs in the field of corporate social responsibility and the evaluation of their effectiveness are considered essential. The concept of social responsibility has long been developed within the private sector and has been framed within the corporate obligations of businesses towards society. However, increasing social responsibility initiatives within public service units is crucial, particularly in terms of providing benefits to disadvantaged groups. Accordingly, it is necessary to enhance the awareness levels of municipal employees to help them better distinguish between social responsibility and social services. Within the scope of this study, the corporate social responsibility perceptions of employees in a selected municipality were identified, and the effectiveness of a training program designed to enhance their awareness was evaluated. The research findings indicate that the implemented training program contributes to increasing corporate social awareness.

Keywords: Program development, corporate social responsibility, educational program.

INTRODUCTION

Program Development

An educational program is "the entirety of instructional curricula encompassing teaching-learning processes, as well as activities and programs beyond the instructional curriculum" (Küçükahmet, 2009). Curriculum development, in its broadest definition, refers to the process of designing, implementing, evaluating, and subsequently redesigning and organizing educational programs based on the findings obtained from the evaluation (Odabaşı, 2014). In its simplest form, curriculum development is the process of planning, implementing, and evaluating the curriculum, ultimately resulting in the formulation of a curriculum plan (Lunenberg, 2011). According to Bobbitt, curriculum development consists of a series of deliberately guided educational experiences utilized by schools to facilitate the completion and perfection of individuals (Cincioğlu, 2014). According to Demirel (2015), curriculum development can be defined as "the comprehensive set of dynamic relationships among the objectives, content, teaching-learning process, and assessment components of an educational program." According to Tuncel (2014), curriculum development is a process based on scientific research and benefits from multiple disciplines. Throughout the curriculum development process, questions related to various disciplines such as history, philosophy, psychology, sociology, and economics are explored. Although there is no universally agreed-upon definition of the educational content referred to as curriculum in schools, Marsh (2009) has summarized the key aspects encompassed by different definitions as follows:

- ✓ The curriculum consists of subjects that include the required knowledge
- ✓ Curricula encompass useful subjects
- ✓ The curriculum includes all the learning experiences that a school is required to provide
- ✓ It comprises learning experiences through which individuals can acquire general skills and knowledge in different ways

Within the scope of curriculum development definitions, the concept is acknowledged to consist of four fundamental components: objectives, content, the teaching-learning process, and assessment and evaluation. The objectives component includes the desired behaviors that learners are expected to acquire. The content component refers to the body of topics that align with the predetermined objectives of the curriculum. The teaching-learning process outlines the selection of learning-teaching models, strategies, methods, and techniques necessary to

¹ This study is derived from the doctoral dissertation titled The Effectiveness of the Developed Program Aimed at Enhancing Municipal Employees Corporate Social Responsibility Awareness prepared by the author at Near East University, Institute of Educational Sciences.

achieve the specified objectives. The assessment and evaluation component emphasizes the systematic testing of objectives and behaviors, determining the extent to which the desired behaviors have been acquired, and ensuring the quality control of the implemented education (Demirel, 2015). In curriculum development, the primary emphasis is placed on school-related subjects and knowledge, the principles guiding how knowledge is addressed in the classroom, the acquisition of the minimum required knowledge, skills, and values by students, and the identification of information deemed important by curriculum designers for both students and society (Preez & Simmonds, 2014).

As in course documentation, the written and published curriculum is considered the official curriculum. The goal of educational development is to ensure that the official curriculum is delivered as the functional curriculum and that there is no discrepancy between curriculum development and its implementation (Slattery, 2013). The most distinctive characteristic of today's knowledge society is its rapid pace of change and development. As a result, advancements in science and technology significantly influence social, economic, and cultural life, leading to the continuous evolution of professions and their definitions. Additionally, the required workforce profile for these emerging professions is constantly being redefined (Hursen, 2016). Therefore, it is of great importance that education and curriculum programs are developed in alignment with these changes.

Curriculum development is the continuous improvement of an implemented program based on research findings (Küçükahmet, 2009). In light of this information, the primary goal of curriculum development is to provide structured learning experiences for all students. The curriculum is recognized as the crucial link between teaching and learning, as well as between teachers and students. The more comprehensive the curriculum and its planning process, the more effectively it can achieve its educational objectives (Aliyeva, 2016).

Curriculum development is a broad and complex process. Within this process, the curriculum can be defined in two ways. First, it is regarded as a sequence of experiences aimed at developing skills in individuals. From another perspective, it is a series of educational experiences utilized by schools to facilitate and enhance this developmental process (Soto, 2015). Furthermore, curriculum development is not a short-term task but rather a process that requires the collaboration of multiple experts and participants. Additionally, ongoing advancements necessitate the continuous renewal and adaptation of curriculum development (Carl, 2009).

Curriculum Design

Curriculum design is the process of identifying the components that constitute a program (Alcı, 2014). Program design, similar to the concept of industrial design, aims to structure instruction within a meaningful framework (Demirel, 2015). Curriculum design seeks to establish the fundamental structure of a program (Alcı, 2014). According to Print (1993), curriculum encompasses planned learning experiences, the presentation of the educational program, the representation of a document, and the outcomes obtained from the implementation of this document. Since quality and excellence in education are crucial for all aspects of society, there has been a focus on ensuring that programs fulfill their missions through program evaluation and assessment strategies (Abate et al., 2003). Program evaluation refers to the collection of information that enables judgments about the value and effectiveness of a specific program. Through this process, decisions can be made regarding the program's future, including whether it should be continued, modified, or completely discontinued (Hussain et al., 2011). Calley (2011) outlines the components of curriculum development as follows: developing the program rationale, conducting a comprehensive review of research in curriculum design, designing clinical programs, establishing an organizational structure, identifying relevant community resources, determining potential funding sources, developing proposals and an initial budget, conducting program evaluation, enhancing professional advocacy, defining data reporting methods, and creating plans for exploration.

Every curriculum design is also concerned with specific social benefits and values. During the curriculum development process, practitioners must be aware of which curriculum will provide greater social benefits and the underlying values of the curriculum. This awareness ensures that the curriculum aligns with the intended objectives (Thomas & Lien, 2005).

Corporate Social Responsibility and the Scope

At the present stage, businesses can no longer be defined solely as profit-driven entities. As organizations that are part of society and interact with it, they must consider their stakeholders in decision-making processes, giving rise to the concept of social responsibility. In general, corporate social responsibility (CSR) encompasses products, processes, and services beyond economic considerations (Hohnen & Potts, 2007). Social responsibility, which involves engaging in a social contract and consensus, represents the sum of mutual understandings and expectations that arise from relationships between two or more individuals or institutions. Organizations must take into account certain restrictions and limitations imposed by the society in which they operate. At its core, CSR

emphasizes prioritizing societal benefit, ensuring that business activities are conducted within this framework (Akım, 2010). According to Crowther and Aras (2011), corporate social responsibility (CSR) concerns the nature of relationships between global corporations, national governments, and individual citizens, as well as how these relationships should ideally function. More specifically, CSR can be defined as the interactions between a company and its stakeholders. Social responsibility, which refers to an organization's ethical and responsible behavior towards its internal and external environment, involves making and implementing decisions in alignment with these principles. CSR is generally shaped around sustainability and sustainable development, encompassing the economic, legal, ethical, and discretionary expectations of the society in which a business operates. Beyond merely complying with legal regulations, CSR also involves adhering to unwritten ethical norms and engaging in voluntary social initiatives and campaigns, emphasizing the broader responsibilities of businesses toward society (Gümüş & Öksüz, 2009). Çelik (2007) defines the concept as "a company's engagement in economic activities by utilizing its scarce resources in the most efficient way to produce in accordance with the needs and desires of society, without causing harm to employees, shareholders, consumers, or individuals within the community."

There is no universally accepted definition of the concept of corporate social responsibility (CSR), which has emerged as a result of the social responsibility approach. The primary reason for this is its relativity and the varying connotations it evokes for different individuals (Bayraktaroğlu, İlter, & Tanyeri, 2009). From a broad perspective, corporate social responsibility can be defined as "a concept that extends beyond the legal obligations of businesses and is voluntarily undertaken, encompassing social, economic, ecological, and ethical dimensions. It aims to ensure a certain level of satisfaction for all internal and external stakeholders with whom the business interacts while also maintaining business profitability. Moreover, CSR involves planning and implementing activities that will enable the business to sustain its future alongside its environment" (Ceritoğlu, 2011). Kotler and Lee (2006) define the concept as voluntary commitments aimed at enhancing societal well-being through the contribution of corporate resources and practices.

Corporate Social Responsibility (CSR) is generally regarded as the social responsibilities that institutions hold toward society. However, while some interpret these responsibilities as limited to activities such as building schools, painting healthcare centers, or providing scholarships to students in need, others extend the definition to include the use of raw materials that do not pose a threat to public health, the production of goods, services, or businesses that contribute to environmental well-being, and responsible production processes (Boran, 2011). Although CSR is defined in various ways, it fundamentally refers to the alignment of business activities with widely accepted social and ecological standards and the fulfillment of legal obligations. Additionally, it encompasses voluntary investments in initiatives that provide public benefit, thereby expanding the scope of social responsibility. One perspective on CSR defines the concept as the efforts of organizations to address issues arising from their own operations (Boran, 2011). Social responsibility refers to the obligation of decision-makers within businesses to undertake actions that not only protect and promote their own interests and those of their companies but also safeguard and enhance societal well-being. Consequently, social responsibility imposes constraints on businesses throughout the entire process from production to consumption, compelling them to adopt policies, methods, and actions that account for these limitations. Companies that embrace social responsibility do not solely focus on satisfying business owners but also strive to enhance the welfare of employees, customers, partners, investors, and communities. Therefore, social responsibility requires businesses to engage not only in economic activities but also in socially responsible initiatives (Pelit, Keleş, & Çakır, 2009).

Related Researches

In Turkey, curriculum development has generally been approached as a process focused on formal education. There is a notable scarcity of curriculum development studies specifically addressing in-service training programs for employees in both the public and private sectors.

Regarding curriculum development, Arsal (1998) states that research findings indicate that past curricula have not been developed based on a thorough analysis of actual needs using needs assessment techniques for society, individuals, and subject areas. Instead, these programs have been designed primarily based on expert opinions rather than systematic needs assessment research. Aykaç (1993), in his thesis titled *Determining the In-Service Training Needs of Keçiören Municipality Law Enforcement Personnel*, conducted a study closely related to our research. In addition, Turan (2002) conducted a curriculum development study aimed at women enrolled as trainees in a Public Education Center, serving as another example of social responsibility. One of the few studies in this field was conducted by Kaya, Çepni, and Küçük (2004), who developed a program to address the in-service training needs of physics teachers regarding laboratory use. Within this framework, a total of 60 hours of training was provided to enhance teachers' knowledge and experience in the laboratory. Observations at the end of the program indicated that participants' knowledge and experience had significantly improved. Similarly, Güler and Çavuş (2016) examined teachers' opinions on an in-service training program designed to enhance their knowledge

levels. The study found that participants' views on the program differed significantly based on gender, while no significant differences were observed in their success levels concerning demographic characteristics. Kontaş (2009) developed a program to address the curriculum development needs of BİLSEM (Science and Arts Center) teachers and evaluated its effectiveness. In this study, teachers' knowledge of curriculum development was assessed before implementing a two-week training program. Following the program's implementation, the curriculum was evaluated. Based on the results of pre- and post-tests, a significant difference in favor of the post-test scores was found, indicating the effectiveness of the program.

Goals

Within the scope of this study, the aim is to develop a program to enhance the social responsibility awareness of employees in public institutions, using a municipality as a case study. The program will be implemented, and its outcomes will be evaluated. To achieve these general objectives, the following sub-objectives have been determined:

1. Can municipal employees' awareness of social responsibility be enhanced through training?
2. Can municipal employees' perspectives on social responsibility be changed?
3. What are municipal employees' views on their training needs regarding social responsibility?
4. How should a training program on social responsibility be designed for municipal employees?
5. What is the success level of municipal employees who have completed the social responsibility training program?

STRATEGIES AND METHOD

Research Model

Both qualitative and quantitative analyses were utilized in the study. The qualitative analyses were conducted using the interview method, one of the qualitative research methods. Qualitative research was chosen due to its advantages, such as reflecting the reality of specific cases, facilitating the development of theories based on its findings, and enabling a better understanding of various factors in the environment. The quantitative analyses in the study were carried out using the survey model. The survey model is an approach that aims to describe a past or present situation as it exists. The event, individual or object that is the subject of the research is analyzed within its own conditions.

Sample

Since the study is limited to Yalova, the research population consists of all employees working at Yalova Municipality. The sample of the study comprises 46 employees from Yalova Municipality.

Data Collection Tools

1) Gain test

Within the scope of the study, an Achievement Test was designed to measure participants' level of knowledge regarding social responsibility. For this purpose, various academic studies in the field of social responsibility were examined in terms of their problem statements, and participants' knowledge levels regarding the questions addressed in these studies were assessed. The test was administered twice, once at the beginning and once at the end of the study. After the first test, correct answers were not provided to the participants, and the same test was re-administered at the end of the training.

2) Social responsibility awareness scale

A literature review was conducted on municipalities' understanding of social responsibility, and a question pool consisting of 25 statements was initially created on the subject. Expert opinions were obtained for the created pool, and 10 statements that were deemed to contain semantic shifts, be prone to misinterpretation, or be ineffective in measuring the intended concept were removed based on expert evaluations. Additionally, following a reliability test, 6 more statements were excluded, as it was observed that their removal would increase the reliability value. With these adjustments, the final version of the scale was determined. The reliability value is an indicator of the degree to which repeated measurements yield the same result. Therefore, survey questions are subjected to reliability analysis. In reliability analysis, Cronbach's Alpha coefficient is used. This coefficient ranges between 0 and 1, and as it approaches 1, the reliability of the survey increases. If the coefficient is above 0.70, the survey is considered to be reliable (Cihangiroğlu et al., 2011). The Cronbach's Alpha coefficient for all sub-dimensions of the Corporate Social Responsibility Survey in Municipalities is above 0.9. Therefore, the survey results are highly reliable.

Table 1: Reliability Values

	Cronbach's Alpha	N
Health Care Studies	,916	9
Transportation Studies	,957	9
Studies for the Elderly	,932	9
Children Studies	,936	9
Environmental Studies	,904	9
Welfare Studies	,933	9
Studies on Natural Disaster Regions	,942	9
Studies on Public Education	,940	9
Studies on Special Occasions	,955	9
Studies on people with disabilities	,917	9

3) Personal information form

A personal information form was created to collect participants' personal data, including gender, age, marital status, educational background, work experience, duration of employment at the municipality, and income level.

4) Education program development

Particularly, the training program to be developed on corporate social responsibility aims to comprehensively cover the essence of the subject. Efforts have been made to develop solutions for practical challenges that employees interested in social responsibility may encounter. Previously developed training programs in this field have been examined, with a specific focus on the curricula of certification programs, which have been instrumental in shaping the training program. Additionally, to ensure the validity and reliability of the designed training program, expert opinions were sought. Based on these evaluations, the training content was deemed appropriate for enhancing corporate social responsibility awareness.

Data Analysis

The data collected for the research were analyzed using the SPSS 22.0 software package and were first subjected to reliability analysis. Subsequently, in accordance with the research objectives, frequency analyses were conducted, along with t-tests for two-group variables and ANOVA analyses for variables with more than two groups.

FINDINGS AND DISCUSSIONS

General Opinions on Social Responsibility

When examining participants' opinions on the municipality's activities, it is observed that they generally hold positive views regarding all areas of work. The most favorable opinions are related to corporate social responsibility initiatives for individuals with disabilities and activities conducted on special occasions. Therefore, it can be concluded that participants are highly satisfied with social responsibility efforts targeting individuals with disabilities and special occasion initiatives. Although views on natural disaster-related initiatives are also positive, this area appears to have the lowest level of satisfaction compared to other social responsibility efforts.

Table 2: General Opinions on Corporate Social Responsibility

	N	Average	Standard Deviation
Health Care Studies	46	3.8792	,71581
Transportation Studies	46	3,8357	,88819
Studies for the Elderly	46	4,1280	,72803
Children Studies	46	4,0435	,72065
Environmental Studies	46	4,3092	,59716
Welfare Studies	46	4,3043	,62567
Studies on Natural Disaster Regions	46	3,7971	,94202
Studies on Public Education	46	4,1884	,80358
Studies on Special Occasions	46	4,3841	,71730
Studies on People with disabilities	46	4,3937	,59199

Opinions of Municipal Employees Regarding Their Training Needs

According to the majority of municipal employees participating in the study, corporate social responsibility (CSR) refers to voluntary initiatives that are not legally mandated. When thinking about corporate social responsibility, what comes to mind is the efforts undertaken by institutions for the benefit of society without any obligation. In most cases, activities carried out within the scope of CSR are not directly part of the municipality's core responsibilities but are instead voluntary initiatives aimed at benefiting society. Another definition describes CSR as "societal communication efforts." Municipalities engage in CSR activities to maintain their connection with society and to demonstrate that they exist for the benefit of the public, thereby conducting societal communication initiatives. According to another significant definition, CSR represents solutions to social problems. Participants believe that municipalities should provide solutions to various societal issues, even if they are not legally required to do so. By doing so, they contribute to the development of a more peaceful and prosperous society.

Table 3: Descriptions of Corporate Social Responsibility

	n	%
² Corporate social responsibility studies are efforts for social communications.	15	32,6
Corporate social responsibility studies are voluntary and have no obligations.	17	37,0
Corporate social responsibility studies are solution proposals to social problems.	14	30,4
TOTAL	46	100,0

According to the participants, corporate social responsibility (CSR) activities are not profit-oriented initiatives. Instead, they serve as means of social communication and solutions to societal problems. Therefore, they should not be profit-driven. If profit becomes the primary goal, the initiative ceases to be a social responsibility effort and transforms into a commercial activity. Participants also believe that corporate social responsibility requires sustainability. When proposing solutions to social issues through CSR, a long-term perspective should be adopted rather than a short-term one. Therefore, projects developed within this scope must be sustainable. Additionally, according to the participants, mass circumcision or wedding ceremonies should not be considered corporate social responsibility activities. Such events are not issues that concern society as a whole, and therefore, they should not be evaluated within the scope of social responsibility.

Table 4: Non-Corporate Social Responsibility Activities

	n	%
These activities are not conducted for profit	24	52,2
They cannot be considered as unsustainable activities.	11	23,9
Activities such as collective circumcision feasts or weddings are not seen as non-corporate social responsibility activities.	11	23,9
TOTAL	46	100,0

According to the participants, corporate social responsibility (CSR) cannot be likened to any specific entity. However, some participants described CSR as resembling an umbrella, as it brings together and unites all beneficiary groups by ensuring the participation of all actors in social life. Others compared CSR to an ant, as its function increases as social responsibility activities are carried out and expand.

Table 5: What is Corporate Social Responsibility like?

	n	%
It is a unique entity.	22	47,8
It is like an umbrella keeping benefit groups together.	5	10,9
Like ants, the performance of corporate social responsibility activities increase as their numbers grow.	4	8,7
I have no idea.	15	32,6
TOTAL	46	100,0

²²²²² This study is derived from the doctoral dissertation titled AN APPLICATION PROGRAM DEVELOPMENT IMPROVING THE CORPORATE SOCIAL RESPONSIBILITY AWARENESS OF MUNICIPAL EMPLOYEES

According to the municipal employees who participated in the study, municipalities should primarily engage in social responsibility activities related to children, followed by initiatives concerning individuals with disabilities and transportation. Participants believe that "children are the future of society." Therefore, social responsibility activities aimed at children will lay the foundation for a peaceful society in the future. Additionally, individuals with disabilities represent a disadvantaged group that often faces difficulties in integrating into social life. For this reason, social responsibility initiatives should be organized to support their inclusion in society and enhance their participation in community life.

Table 6. In What Areas Should the Municipality Organize Corporate Social Responsibility Studies?

	n	%
Health	4	8.7
Transportation	6	13.0
Elderly	4	8.7
Children	10	21.7
Environment	5	10.9
Welfare	3	6.5
Natural disaster	3	6.5
Public Education	2	4.3
Special Occasions	2	4.3
People with Disabilities	7	15.2
TOTAL	46	100.0

According to the participants, in the corporate social responsibility (CSR) initiatives undertaken by the municipality, people from different segments of society should work together to contribute to social cohesion. Additionally, these individuals should participate on a voluntary basis and should not engage in these activities for financial gain, as doing so would contradict the essence of corporate social responsibility. However, the participants emphasized that high-level professionals, such as psychologists, psychiatrists, and sociologists, should be involved in these initiatives to ensure that societal problems are addressed with expert intervention.

Table 7. Who should take part in the Corporate Social Responsibility Studies of the municipalities?

	n	%
Volunteers should be involved	10	21.7
Academic staff should be involved	14	30.4
People from different sections of society must work together	22	47.8
TOTAL	46	100

The majority of municipal employees believe that municipalities should take on corporate social responsibility (CSR) duties. However, a minority of employees consider the implementation of CSR activities by municipalities unnecessary.

Table 8. Should Municipalities Undertake Corporate Social Responsibility Duties?

	N	%
Yes, they should	39	84.8
No, they should not	7	15.2
TOTAL	46	100.0

The majority of participants find municipalities' social responsibility efforts sufficient. However, among those who believe that municipalities should undertake corporate social responsibility (CSR) duties, a minority group considers these efforts insufficient. Additionally, some employees believe that municipal CSR initiatives should be evaluated not by municipal employees but by the public.

Table 9. Are the Municipalities' Corporate Social Responsibility Studies Adequate?

	n	%
The public should evaluate rather than municipal employees.	11	23.9
I think that our social responsibility studies are adequate.	19	41.3
I think that our social responsibility activities are inadequate.	9	19.6
There is no need for municipalities to assume social responsibility.	7	15.2
TOTAL	46	100.0

According to the municipal employees who participated in the study, the most important duty of municipal administrators in corporate social responsibility (CSR) initiatives is to maintain close communication with the public rather than being disconnected from them. Additionally, municipal administrators should provide training on corporate social responsibility to all municipal employees, from the lowest-level staff to the highest-ranking officials.

Table 10. Duties of Municipal Managers on Corporate Social Responsibility

	N	%
Be in touch with the public	20	43.5
Do his job well	9	19.6
Provide training in the field of social responsibility from the bottom to the top.	17	37
TOTAL	46	100.0

The majority of municipal employees believe that they need training on corporate social responsibility (CSR).

Table 11. Do You Need Training?

	N	%
Yes	29	63.0
No	17	37
TOTAL	46	100.0

The trainings that the participants want to receive on corporate social responsibility are generally shaped in two different types. While one group of municipal employees favored distance education, another group argued that practical training should be given by dividing into small groups. In addition, they stated that the production of projects for social actors such as children, the elderly and the disabled should be encouraged in these practices.

Training Program Prepared for Social Responsibility Needs of Municipal Employees

The Municipal Employees' Social Responsibility Awareness Enhancement Program, developed for this study, was designed over approximately one month through a review of previous studies, observations, and other research methods, ensuring its originality. In this section, information will be provided regarding the name of the activity, its objectives, duration, target audience, measurement, and evaluation methods. Each participant who successfully completes this program is expected to acquire the following skills:

- ✓ Knowledge of the basic concepts about social responsibility,
- ✓ Knowledge of the historical development of social responsibility,
- ✓ Knowledge of approaches regarding social responsibility,
- ✓ Knowledge of social responsibility activities in the field of transportation,
- ✓ Knowledge of social responsibility activities for the elderly,
- ✓ Knowledge of social responsibility activities for children,
- ✓ Knowledge of social responsibility activities for the environment,
- ✓ Knowledge of social responsibility activities on welfare,
- ✓ Knowledge of social responsibility activities regarding natural disasters,
- ✓ Knowledge of social responsibility activities regarding public education,
- ✓ Knowledge of social responsibility activities in the field of health care,
- ✓ Knowledge of social responsibility activities for special occasions,
- ✓ Knowledge of social responsibility activities for people with disabilities,

The duration of the activity consists of a total of 32 hours, with two sessions per day. The target group of the activity includes Yalova Municipality employees who participated in our previous survey. In addition:

- ✓ This activity has been organized to increase the social responsibility awareness of municipal personnel.
- ✓ An expert in social responsibility, who has experience in providing in-service training on this subject, has been assigned as the trainer.
- ✓ The classroom environment has been arranged to facilitate effective communication among participants.
- ✓ The training was conducted in an environment equipped with internet-connected computers and a projector, and the training content was supported with appropriate materials.
- ✓ The training took place in a conference-style seating arrangement.
- ✓ The necessary lighting and sound system were adjusted according to the number of participants.
- ✓ The number of participants was limited to a maximum of 40 per training session.
- ✓ At the end of the activity, a 25-question post-test was administered to assess the learning outcomes achieved through the training.

Table 12. Activity Content

<i>Topics</i>	<i>Time (hours)</i>
Social responsibility concept and scope	9
Social responsibility in municipal works	13
Sample case demonstration and observation tour	4
Project work, brainstorming	4
Assessment and Evaluation (Quiz)	2
Total	32

In light of the findings identified through the survey study, it has been determined that public employees working in the municipality need training and that they themselves have expressed a demand for such training. Based on this, the need to develop a training model has emerged. Within this scope, the aim is to develop a training program based on the following stages. As part of the training program, the first step is to establish the working group. Therefore, efforts have been made to create three fundamental units:

- ✓ Program Decision and Coordination Group
- ✓ Program Working Group
- ✓ Program Advisory Group

The curriculum development work plan has been established through the coordination of the three units mentioned above. Based on the survey findings, a training program was designed in response to the majority of municipal employees requesting corporate social responsibility (CSR) training. Accordingly, the implementation of the training program for participants was structured as follows:

Table 13. Training Program

Duration of training	32 hours/2 sessions
The number of target group of the training	46
Type of training	Practical Training

Participants' opinions on corporate social responsibility (CSR) were evaluated under the subcategories of health, transportation, elderly care, children, environment, social aid, natural disasters, public education, special occasions, and disability services. According to the findings, participants expressed positive views on municipal social responsibility efforts across all subcategories. Participants generally found municipal services in all these areas to be sufficient. However, CSR efforts related to natural disasters were rated the least positively, while initiatives for individuals with disabilities received the most favorable evaluations. Therefore, when determining training needs, priority has been given to corporate social responsibility training topics related to natural disasters and children.

In light of the data obtained from the findings, the primary objective of the study is to positively influence municipal employees' perception of corporate social responsibility (CSR). The initial survey results are also positive, indicating that participants approach the municipality's CSR initiatives favorably.

The training preferences of participants regarding corporate social responsibility (CSR) were generally divided into two types. While some municipal employees favored practical training, others suggested that a week-long training program should be conducted, where participants are divided into groups to receive small-scale practical training. Additionally, they emphasized that these sessions should encourage the development of projects related to social actors such as children, the elderly, and individuals with disabilities.

How is the Success Status of the Municipal Employees passing the prepared Social Responsibility Training Program?

Before the training, a multiple-choice questionnaire was distributed to participants to assess their knowledge level in the field of social responsibility. At the end of the initial assessment, the correct answers were not provided to the participants. After the training was completed, they were asked to retake the same test, and the accuracy of their responses before and after the training was analyzed to determine whether there was an increase in their correct answer rate. Accordingly, the distribution of participants' responses before and after the training is presented in Table 14.

Table 14. Pre and Post Training Status (%)

	PRE TRAINING		POST TRAINING	
	CORRECT	FALSE	CORRECT	FALSE
Q1	65	35	80	20
Q2	54	46	75	25
Q3	61	39	79	21
Q4	52	48	75	25
Q5	70	30	85	15
Q6	66	34	75	25
Q7	64	36	80	20
Q8	46	54	80	20
Q9	44	56	85	15
Q10	44	56	90	10
Q11	40	60	80	20
Q12	52	48	85	15
Q13	70	30	90	10
Q14	66	34	85	15
Q15	65	35	85	15
Q16	54	46	80	20
Q17	61	39	80	20
Q18	46	54	88	12
Q19	44	56	86	14
Q20	44	56	85	15
Q21	40	60	75	25
Q22	52	48	90	10
Q23	40	60	90	10
Q24	55	45	88	12
Q25	55	45	88	12

The first question asked participants to identify which option represents a social responsibility project in the field of health. Before the training, 65% of participants answered this question correctly, while this rate increased to 80% after the training. This indicates that participants learned what constitutes a social responsibility project in the health sector.

The second question aimed to determine which option does not represent a primary objective of health-related social responsibility activities. Before the training, 54% of participants answered correctly, whereas this rate increased to 75% after the training. This suggests that participants gained a better understanding of the primary objectives of social responsibility projects in the health field.

The third question focused on identifying the most important topic for social responsibility projects aimed at new mothers. Before the training, 61% of participants responded correctly, while this rate rose to 79% after the training. Therefore, it can be concluded that participants learned the key topic for social responsibility projects targeting new mothers.

The fourth question asked participants to identify which option represents a social responsibility project in the field of transportation. Before the training, 52% of participants answered correctly, while this rate increased to 75% after the training. This indicates that participants learned what constitutes a social responsibility project in the transportation sector.

The fifth question aimed to determine which option does not represent a primary objective of transportation-related social responsibility activities. Before the training, 70% of participants answered correctly, whereas this rate increased to 85% after the training. This suggests that participants gained a better understanding of the primary objectives of social responsibility projects in the transportation field.

The sixth question focused on identifying which option does not represent a primary objective of social responsibility activities for the elderly. Before the training, 66% of participants responded correctly, while this rate rose to 75% after the training. Therefore, it can be concluded that participants learned the key objectives of social responsibility projects targeting the elderly.

The seventh question asked participants to identify which option represents a project that can be evaluated within the problem analysis framework for elderly-focused initiatives. Before the training, 64% of participants answered correctly, while this rate increased to 80% after the training. This indicates that participants learned how to conduct problem analysis in social responsibility projects for the elderly.

The eighth question aimed to determine which option represents a social responsibility project for children. Before the training, 46% of participants answered correctly, whereas this rate increased to 80% after the training. This suggests that participants gained a better understanding of what constitutes a social responsibility project for children.

The ninth question focused on identifying the most important reason why children are chosen as the target group in social responsibility activities. Before the training, 44% of participants responded correctly, while this rate rose to 80% after the training. Therefore, it can be concluded that participants learned why children are prioritized in social responsibility initiatives.

The tenth question asked which option represents an environmentally responsible behavior. Before the training, 44% of participants answered correctly, while this rate increased to 90% after the training. This indicates that participants learned environmentally responsible behaviors.

The eleventh question aimed to determine which option represents a measure to prevent the unconscious use of resources. Before the training, 40% of participants answered correctly, while this rate increased to 80% after the training. This indicates that participants learned measures to prevent resource waste after the training.

The twelfth question focused on identifying which option represents a behavior related to social aid and solidarity. Before the training, 52% of participants responded correctly, while this rate rose to 85% after the training. Therefore, it can be concluded that participants learned behaviors associated with social aid and solidarity.

The thirteenth question asked which option represents a social responsibility project related to natural disasters. Before the training, 70% of participants answered correctly, while this rate increased to 90% after the training. This indicates that participants gained knowledge about social responsibility projects related to natural disasters.

The fourteenth question aimed to determine which option represents the responsibilities of municipalities in the field of public education. Before the training, 66% of participants answered correctly, while this rate increased to 85% after the training. This indicates that participants learned about the responsibilities of municipalities in public education.

The fifteenth question focused on identifying which social responsibility activities municipalities undertake to address overconsumption, waste, and societal values. Before the training, 65% of participants answered correctly, while this rate increased to 85% after the training. This suggests that participants gained a better understanding of municipalities' responsibilities regarding waste prevention and societal values.

The sixteenth question asked which social responsibility activity municipalities engage in to protect natural resources, prevent environmental pollution, and promote environmental development. Before the training, 54% of participants answered correctly, while this rate increased to 80% after the training. This indicates that participants learned about the role of municipalities in protecting natural resources, preventing pollution, and fostering environmental sustainability.

The seventeenth question aimed to determine which social responsibility area refers to municipalities allocating part of their resources to educational, artistic, and social projects. Before the training, 61% of participants answered correctly, while this rate increased to 80% after the training. This indicates that participants learned which social responsibility projects require municipalities to allocate a portion of their resources.

The eighteenth question focused on measuring corporate social responsibility (CSR) strategies. Before the training, 46% of participants answered correctly, while this rate increased to 80% after the training. This suggests that participants gained a better understanding of CSR strategies.

The nineteenth question was related to the responsibilities of municipalities in addressing environmental pollution. Before the training, 44% of participants answered correctly, while this rate increased to 85% after the training. This indicates that participants learned about municipalities' responsibilities regarding environmental protection. The twentieth question focused on the key principles of social responsibility campaigns. Before the training, 44% of participants answered correctly, while this rate increased to 85% after the training. This indicates that participants learned the key principles of social responsibility campaigns.

The twenty-first question was related to economic development. Before the training, 40% of participants answered correctly, while this rate increased to 75% after the training. This suggests that participants enhanced their knowledge of economic development.

The twenty-second question focused on activities carried out within the scope of social responsibility. Before the training, 52% of participants responded correctly, while this rate rose to 90% after the training. Therefore, it can be concluded that participants gained a better understanding of what social responsibility activities entail.

The twenty-third question addressed social responsibility initiatives in the field of education. Before the training, 40% of participants answered correctly, while this rate increased to 90% after the training. This indicates that participants learned about social responsibility activities in education.

The twenty-fourth question asked which option represents social responsibility projects that can be carried out in collaboration with non-governmental organizations (NGOs). Before the training, 55% of participants answered correctly, while this rate increased to 88% after the training. This suggests that participants learned about the types of social responsibility projects that can be implemented in partnership with NGOs.

Finally, the twenty-fifth question focused on the rules of social responsibility. Before the training, 55% of participants answered correctly, while this rate increased to 88% after the training. This indicates that participants gained knowledge about the principles and guidelines of social responsibility.

When we make a general assessment, it is observed that participants gained a better understanding of the concept of social responsibility following the implementation of the awareness-raising program. Their success rate significantly increased based on the answers they provided to the designated questions.

CONCLUSION

Curriculum development is a frequently discussed topic in Turkey, particularly in the context of formal education. Research in this field has primarily focused on this area. However, studies aimed at enhancing education and awareness remain limited. Considering this need, the training program developed within this study, similar to previous research, has yielded results that enhance participants' knowledge levels regarding both their work and various other topics. Within the scope of this study, participants' awareness of corporate social responsibility was measured both before and after the training, and findings were found to be consistent with previous research. Accordingly, similar to the findings of Aykaç's (1993) study conducted at Keçiören Municipality, in-service training has led to an increase in participants' knowledge accumulation. This finding is consistent with the studies conducted by Kaya, Çepni, and Küçük (2004) and Turan (2002). Similarly, in Kondaş's study, the results of the achievement test administered before and after the program indicated a significant difference in favor of the post-test scores, demonstrating that the pre-service teachers' knowledge improved after the training. However, in contrast, Güler and Çavuş (2016) found that, following the training program designed to enhance teachers'

knowledge levels, participants' perceptions of the in-service training program differed significantly based on gender. However, no significant difference was observed in their success levels based on demographic characteristics.

Corporate social responsibility (CSR) in the public sector encompasses a set of practices that not only aim to identify and address citizens' issues but also provide various benefits, including enhancing political participation. Therefore, improving the awareness levels of municipal employees, who are the primary group in direct contact with the public, is of great importance in municipal services. Within the scope of this study, the primary objective was to determine the sample group's awareness level regarding the core values of social responsibility. Accordingly, the research was conducted with a sample of 46 municipal employees, the majority of whom were women, aged between 25 and 29, married, held a bachelor's degree, had 5 to 10 years of work experience, had been employed at the municipality for up to 5 years, and had a monthly income ranging between 3,001 TL and 4,000 TL. As a result of the reliability analysis, the findings were determined to be highly reliable.

Participants were asked to express their opinions on corporate social responsibility (CSR) under the subcategories of health, transportation, elderly care, children, environment, social aid, natural disasters, public education, special occasions, and disability services. According to the findings, participants' views on municipal social responsibility efforts across all subcategories were positive. They generally found municipal services in these areas to be sufficient. However, CSR efforts related to natural disasters were rated the least positively, while initiatives for individuals with disabilities received the most favorable evaluations. Additionally, participants' perspectives on social responsibility did not vary based on their demographic characteristics.

Participants defined corporate social responsibility (CSR) as "voluntary initiatives that are not legally mandated but serve as a means of social communication and offer solutions to societal problems." According to the participants, profit-driven activities and events such as mass circumcision or group weddings should not be considered social responsibility initiatives. Additionally, the majority of participants stated that social responsibility cannot be likened to any specific entity.

Participants stated that municipalities should primarily focus on social responsibility activities aimed at children. According to them, initiatives targeting children are investments in the future, contributing to the formation of a harmonious and peaceful society. Additionally, municipal employees believe that municipalities should take on responsibilities in corporate social responsibility (CSR) initiatives and, in doing so, bring together individuals from different segments of society. While some municipal employees found the existing social responsibility efforts sufficient, others argued that such evaluations should be made by the public rather than municipal employees. A very small minority expressed the opinion that municipalities do not need to undertake social responsibility initiatives.

Participants expressed two main preferences regarding the type of training they wished to receive on corporate social responsibility (CSR). While some municipal employees were open to online (remote) training, others emphasized the need for a one-week training program, where participants would be divided into groups and engage in small-scale practical training sessions. They also suggested that these practical sessions should encourage the development of projects related to social actors such as children, the elderly, and individuals with disabilities.

A 32-hour training program was developed and implemented to enhance municipal employees' awareness of social responsibility. Following the program, an additional assessment test was conducted to evaluate the effectiveness of the training by measuring participants' knowledge levels. In light of these findings, it was determined that even a 32-hour social responsibility training program significantly improved municipal employees' awareness of social responsibility. Therefore, addressing the training needs identified through survey findings has provided valuable insights for further studies in this area. Additionally, it was concluded that enhancing municipal employees' awareness will contribute to the more effective and sustainable implementation of social responsibility initiatives within municipal services.

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Fleeing TikTok to Rednote: Leveraging Generative Technologies to Support Cross-Language Communication for TikTok Refugees on Chinese Social Networking Platforms

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ABSTRACT

As the U.S. government enforces a ban on TikTok, many users are seeking alternative platforms, creating unprecedented opportunities for Chinese social media applications, particularly platforms like Xiaohongshu (RedNote). These platforms have seen a significant increase in downloads in the U.S. market, showcasing the global potential of Chinese social platforms. However, alongside this opportunity comes the challenge of effectively navigating multilingual and multicultural environments. Optimizing language services to accommodate and fulfill the needs of global users has thus become a critical factor in the successful expansion of Chinese social platforms into international markets. The optimization of language services involves not only basic translation issues but also the use of technology to enable seamless communication across languages, cultures, and countries. Modern technologies, such as natural language processing (NLP), machine learning, speech recognition, and generative artificial intelligence (GenAI), provide powerful support. These technologies can not only improve the accuracy and fluency of translations but also enable personalized and intelligent language services across platform interfaces, operational guidance, content creation, content recommendation, and content moderation, addressing the needs of users from different cultural and linguistic backgrounds. This paper will explore, from a technical implementation perspective, how advanced technologies can optimize language services and enhance the global competitiveness of Chinese social platforms. Key aspects include the application of real-time translation systems, speech-to-text and text-to-speech technologies, intelligent content recommendation algorithms, and multilingual content moderation tools. The effective integration of these technologies will not only improve user experience but also help platforms establish robust cross-national communication capabilities in diverse cultural and linguistic environments, strengthening their international development potential.

Keywords: TikTok Refugees; generative artificial intelligence; Social Networking Platforms; language services

1. INTRODUCTION

The U.S. government's ban on TikTok has compelled a significant number of loyal users to seek alternative platforms (Baptista et al., 2025; Cheung et al., 2025). Many of these users have migrated to Chinese social media platforms, notably Rednote and Douyin, which have witnessed a substantial increase in download volumes within the U.S. market (Lyons, 2025). Of particular note is Rednote, which rapidly ascended to the top of the U.S. Apple App Store's free app download chart as of January 13, 2025, maintaining a prominent position in the subsequent days (Rosenblatt, 2025; Trangle, 2025). This shift underscores the growing appeal and competitive strength of Chinese social media platforms in the U.S. market. Moreover, a considerable number of users have humorously

labeled themselves "TikTok refugees" (Ewe, 2025; Langchen, 2025), widely utilizing the #TikTokRefugee hashtag on social platforms, thereby further propelling the spread of this phenomenon across global social media networks. This trend has sparked widespread attention within the international community, signaling a significant transformation in the global social platform ecosystem and user behavioral patterns.

As an increasing number of international users flock to Chinese social platforms, the importance of language services has become increasingly prominent, particularly in the context of platform globalization (Ekuerhare & Udoka, 2024; Shi et al., 2022; Yao et al., 2016). These platforms are confronted with users from diverse cultural backgrounds and varying language requirements, making language services a critical issue in addressing the challenges of global expansion (Alguliyev & Mahmudov, 2018). Overcoming language barriers, cultural preferences, and the diversity of user needs has thus emerged as a key factor in whether Chinese social platforms can successfully attract and retain overseas users. For example, in response to this challenge, Xiaohongshu has swiftly posted recruitment advertisements for language service-related positions (Wakasugi, 2025), signaling the indispensable role of language services in the platform's globalization strategy. This initiative not only highlights the platform's recognition of the pivotal role language services play in enhancing user experience and attracting international users but also underscores the strategic importance of language services in the internationalization process. Whether through content translation, language support for real-time social interactions, or the localization of interfaces and content, language services play a key role in improving user experience, enhancing cultural adaptability, and strengthening competitiveness in the global market. Therefore, achieving precision and efficiency in language services is a core issue for Chinese social platforms as they expand into global markets.

In today's globalized digital landscape, the delivery of high-quality language services in a timely manner has emerged as a pivotal factor in the international expansion of Chinese social media platforms. This research seeks to address this critical need by investigating how cutting-edge technologies—including natural language processing, machine learning, speech recognition, and generative artificial intelligence—can be leveraged to develop robust language service strategies. The study will analyze the linguistic and cultural challenges these platforms encounter as they expand globally, with the ultimate goal of enhancing their international competitiveness. Specifically, the research will focus on the role of technology in facilitating seamless cross-linguistic and cross-cultural interactions. It will explore how platforms can optimize various aspects of their operations, such as interface design, user navigation, content generation, distribution, and moderation, to effectively engage and retain a diverse global audience. Additionally, the study will propose innovative, technology-driven solutions to refine language services, thereby improving user experience and strengthening cross-cultural communication capabilities. These advancements are expected to support Chinese social platforms in achieving greater market penetration and success in their global expansion efforts.

2. SUGGESTIONS

The analysis in this section will examine how Chinese social platforms can address the challenges in the globalization process through the optimization of language services. Specifically, platforms need to adopt effective strategies in areas such as interface selection, operational guidance, content creation, content recommendation, and content moderation to ensure they can meet the needs of users from different linguistic and cultural backgrounds.

2.1 INTERFACE SELECTION

Platforms should offer users the option to automatically detect their language preferences based on geographic location, IP address, or account settings, and subsequently select the appropriate interface language (Gäde & Petras,

2014; Reinecke, 2012). This functionality not only alleviates the need for manual language selection but also ensures that users can swiftly access their preferred language environment, which is particularly critical for users in multilingual regions. For example, when a user is located in the UK, the platform will automatically switch to an English interface, while in China, it will transition to a Chinese interface. By integrating such automatic recognition features, platforms can provide personalized services that enhance user experience and overall satisfaction (Liu & Heimgärtner, 2022; Reinecke, 2012).

In addition, platforms should provide a manual language selection feature, allowing users to choose their interface language according to personal preferences (Gäde & Petras, 2014; Montagud et al., 2017). This feature ensures that users have greater control beyond the automatic selection, which is particularly important for multinational corporations or users within multilingual communities. Through flexible language options, users can select from a variety of languages, including Chinese, English, Japanese, Spanish, and others, thereby accommodating the needs of diverse linguistic groups (Alon & Krtalić, 2024).

For platforms with a diverse user base, it is essential to further enhance language adaptation features. For example, offering real-time language switching options or automatically adjusting the interface based on the user's frequently used language settings can optimize operational processes and improve user experience (Alahari et al., 2024). Additionally, to benefit a wider range of users, platforms could incorporate language learning modes to assist users in gradually improving their language skills while using the platform, especially in contexts where cross-cultural communication is frequent (Xia et al., 2024).

2.2 OPERATIONAL GUIDANCE

To help new users quickly adapt to the platform, it is essential to provide operational guidance in multiple languages. The onboarding process should cover basic platform functionalities through various forms of tutorials, including text, images, and videos (Chi et al., 2012; Rosser & Wiggins, 2018). For instance, the platform could offer multilingual onboarding videos in languages such as English, French, and Spanish to ensure that users from diverse linguistic backgrounds can easily get started.

Additionally, the platform should automatically display the corresponding language version of the operational guide based on the user's language settings, preventing confusion due to language barriers. The guidance content should be concise and clear, highlighting key platform features and common operational steps to help new users quickly master essential skills and enhance their initial experience. Interactive help features can be incorporated, allowing users to ask questions at different stages of operation and receive immediate responses, thereby ensuring a smooth registration, setup, and basic usage process (Koehn, 2009).

2.3 CONTENT CREATION

The author randomly selected 100 English comments and their corresponding Chinese translations, inviting three translation instructors to evaluate the accuracy of RedNote's automatic translation. The results showed a relatively high average accuracy rate of 99%. The only errors were related to the translation of one culturally loaded term (brick by brick). However, its automatic translation feature is currently limited to English-to-Chinese translation and does not yet support translation between other language pairs (e.g., English to Chinese or Chinese to French). Therefore, the platform should provide translation or speech conversion services across multiple languages for various content types, including text, images, and videos (Castilho et al., 2017). These features not only improve content creation efficiency but also enhance communication and interaction among global users. Firstly, the

platform should offer real-time translation services that enable the automatic conversion of user-generated text into different language versions. Whether it is a brief social media post, a blog article, or professional literature, the platform can automatically detect the source language and provide accurate translations. Users can select from various language versions, ensuring that their content reaches a multilingual audience, particularly in international and multicultural settings. This functionality helps users overcome language barriers and expand their reach to a broader audience (Gough et al., 2023).

In addition, the platform should support multilingual conversion during video recording, utilizing advanced technologies such as speech recognition (Gaikwad et al., 2010), speech synthesis (Dutoit, 1997), and lip-syncing (Ali et al., 2018; Park et al., 2022) to provide accurate language conversion (Kumar et al., 2023; Nanditha et al., 2023). These technologies enable content creators to overcome language barriers and enhance the global dissemination of their content.

Additionally, the platform should provide features such as real-time generation of translated subtitles (Yan, 2022) to ensure the smooth presentation of video content across different language users. Especially in a cross-cultural context, technology can optimize the localization of videos to better align with the expressions of various languages and cultures, enhancing the user's viewing experience. The platform should offer more flexible and effective tools through multimodal transformation to support content sharing and interaction among global users, promoting the spread of content across different linguistic environments.

Finally, for the text in images, the platform should provide OCR (Optical Character Recognition) technology to automatically extract and translate the text content in the image (Hemalakshmi et al., 2017; Sarika et al., 2021). This is particularly important for displaying images with text, such as advertisements, posters, infographics, etc. OCR technology can instantly recognize the text in images and translate it into the target language, making the content of the image understandable to users of different languages. This technology will provide users with a more convenient content creation experience, reducing the complexity of manual translation.

2.4 CONTENT MODERATION

With the globalization of platforms, especially the influx of international social media users like those from TikTok onto domestic Chinese platforms, the diversity of content and frequency of interaction have increased dramatically, presenting unprecedented challenges for these platforms. This influx of users has not only facilitated broader cultural exchange and language collisions but also heightened the complexity of content management. In order to maintain the healthy development of the platform and ensure compliance with local laws, regulations, and ethical standards, effective content moderation mechanisms must be implemented to prevent the spread of misinformation, hate speech, discriminatory content, and inappropriate behavior (Ulrich & Petermann, 2017; Wilson & Land, 2020).

Specifically, as users from different cultural and linguistic backgrounds continue to increase, content moderation on platforms must not only quickly identify and address inappropriate content but also consider cultural sensitivity, ensuring that content can be appropriately interpreted and disseminated within various linguistic and cultural contexts (Chan et al., 2023). For example, misinformation may spark widespread attention globally, hate speech and discriminatory content can trigger severe social conflicts, while biases and stereotypes may exacerbate social injustice and inequality. In this context, platforms must rely on efficient and accurate content moderation mechanisms to protect user safety, promote cross-cultural understanding, and ensure the platform's long-term development and compliance.

Platforms can achieve efficient and accurate content moderation by combining the synergy of artificial intelligence (AI) and human review (Barnes, 2022). AI technology can play a crucial role in content moderation (Mantri, 2021; Sun & Ni, 2022; Udupa et al., 2021), especially when dealing with large volumes of data. Through natural language processing (NLP) and machine learning models, AI can efficiently and automatically detect and flag potential violations such as misinformation, hate speech, discriminatory content, biases, and stereotypes (Nakov et al., 2021). For example, AI can analyze text content and identify offensive language, use sentiment analysis to determine the emotional tone of content, and even monitor the cross-linguistic spread of malicious information (Shah et al., 2022; Skumanich & Kim, 2024). Additionally, AI can analyze images and videos to detect inappropriate content (El Bakri et al., 2024; Zhuang et al., 2020). The application of AI technology can help platforms review large amounts of content in real time, quickly identify issues, and reduce the workload of human moderators.

However, AI-based moderation is not flawless, especially when handling complex contexts and cultural differences, which may lead to misjudgments (Llansó, 2020). Therefore, human review remains an indispensable complement (Lai et al., 2022). Human moderators can conduct in-depth analyses of AI-flagged content based on cultural background and context, ensuring the accuracy and fairness of the moderation (Wang, 2025). The collaboration between AI and human moderators can enhance both the efficiency and precision of content review, ensuring that platform content aligns with the ethical norms and legal requirements of global users (Lykouris & Weng, 2024).

2.5 CONTENT RECOMMENDATION

For tagged content, the platform needs to leverage natural language processing (NLP) technology to automatically recognize and understand the semantics of the tags, ensuring that the core meaning of the tags can be accurately conveyed across languages and cultures (Germann et al., 2018; Maynard et al., 2017; Savchenko & Tynchenko, 2024). Through semantic analysis, the platform can assess the applicability of tags in different linguistic environments and establish a multilingual tag mapping system. The platform should also dynamically adjust the mapping of tags based on global and regional trending topics to ensure that tags are consistently understood and recommended across different cultural contexts.

For content without tags, the platform should use automatic summarization technology to extract key information, followed by cross-linguistic translation and cultural adaptation (Goriparthi, 2021; Ogden et al., 1999; Zhang et al., 2016). During the translation process, it is essential to focus not only on the literal meaning but also to make appropriate adjustments based on the target cultural context to ensure that the recommended content aligns with the user's cultural habits and values. Additionally, the platform should personalize content recommendations based on the user's historical behavior and preferences, making the content more relevant to the user's cultural perspective and needs (Lee et al., 2017; Tongx & Danting, 2024).

The platform must address the sensitivities inherent in diverse cultural and religious contexts, particularly with respect to religion, beliefs, and taboos, ensuring that the content disseminated does not provoke controversy or misunderstandings (Rehm et al., 2007). To this end, the platform should implement cultural adaptation algorithms capable of identifying and mitigating content that touches on sensitive topics. Moreover, it is essential to adjust both the form and tone of the content in accordance with cultural distinctions, ensuring that the disseminated material not only aligns with the cultural norms of the target audience but also respects their religious beliefs and social customs (Rehm et al., 2007).

3. THEORETICAL UNDERPINNS

The Technology Acceptance Model (TAM) (Davis, 1989) provides a useful framework for explaining why foreign users flocked to RedNote after the ban on TikTok and why potential technological enhancements could further strengthen user adoption. According to TAM, two key factors influence technology adoption: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness refers to the extent to which users believe that using a particular technology will enhance their performance or meet their needs, while Perceived Ease of Use refers to how effortless and intuitive users perceive the technology to be. When TikTok was banned, users sought alternative platforms that could fulfill similar social and entertainment needs, positioning RedNote as a natural substitute. Its user-friendly interface, algorithm-driven content recommendations, and strong community engagement closely resemble TikTok's content ecosystem, reinforcing users' perception of its usefulness and ease of use.

The potential integration of advanced technological features could further enhance RedNote's perceived usefulness and ease of use. If real-time translation systems were introduced, they would enable users to overcome language barriers, facilitating communication and content consumption across different cultures. Speech-to-text and text-to-speech technologies could enhance accessibility and content creation, making it easier for users to engage with the platform's content. Intelligent content recommendation algorithms would personalize the user experience by analyzing user behavior and preferences, ensuring that users are shown content aligned with their interests, thereby increasing engagement and satisfaction. Additionally, multilingual content moderation tools could help maintain a safe and respectful online environment, fostering trust and comfort among international users. These technological enhancements would improve both the perceived usefulness and ease of use, making RedNote more appealing and encouraging sustained user engagement.

The introduction of AI-driven content moderation and machine translation also raises some ethical concerns. Firstly, privacy issues are a significant ethical challenge in content moderation. AI content moderation systems automatically analyze user-generated text, images, audio, and video to identify potential violations or sensitive information. This means platforms need to collect and process large amounts of user data, including personal chat records, search history, and location information, which could lead to data misuse and privacy breaches. Therefore, platforms need to define the scope of data usage, strengthen user consent mechanisms, and ensure the protection of user privacy. Secondly, the issue of bias in machine translation also causes controversy in cross-cultural communication. AI translation systems are often trained on large-scale language data, which may carry cultural, political, and gender biases. For example, AI may automatically reinforce gender stereotypes when translating job-related terms. Therefore, platforms need to optimize training data to reduce biases and improve the fairness and accuracy of translations.

5. CONCLUSION

The "TikTok refugee wave" has ushered in a surge of international users, presenting Chinese social media platforms with unprecedented growth opportunities. However, this influx also demands a significant enhancement of their global and multilingual service capabilities. Refining language services is crucial, as it not only breaks down linguistic and cultural barriers but also elevates the overall user experience, providing robust support for the platforms' international expansion. To effectively attract and retain users from diverse cultural backgrounds, Chinese social platforms must adopt strategies such as multilingual interfaces, real-time translation, cultural localization, and intelligent content moderation. These measures are essential for strengthening their competitiveness in the global market.

As globalization continues to advance, language services will become an integral component of the internationalization strategy for Chinese social media platforms. By leveraging advanced technologies—such as natural language processing, machine learning, speech recognition, and generative artificial intelligence—platforms can optimize language services to facilitate seamless interaction and cross-cultural communication among global users. These technological solutions enable platforms to efficiently address the challenges posed by linguistic and cultural diversity, positioning them to thrive in the fiercely competitive global landscape. Ultimately, this approach will drive broader market reach and sustained user growth, ensuring long-term success in the international arena.

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History, Identity, and Education: The Impact of the Discourses of TRNC Presidents on Education Policies

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ABSTRACT

This study examines the impact of the discourses of the Presidents of the Turkish Republic of Northern Cyprus (TRNC) on education policies. Education in the TRNC has been a crucial component of identity construction throughout its historical process, and the discourses of political leaders have played a significant role in shaping education policies. In this context, the study analyzes how the discourses of TRNC Presidents regarding education policies are reflected in the education system through discourse analysis. The primary objective of the study is to reveal the impact of presidential discourses on education policies in the TRNC. Initially, the study discusses the political history of the TRNC and the process of identity construction, followed by an examination of the role of education in this process. The statements of the Presidents at different periods, their attitudes toward education policies, and their influence on educational practices are evaluated using the discourse analysis method. The study finds that each President has developed distinct discourses on education policies based on the political and social conditions of their respective periods. While some Presidents emphasized the role of education as a tool for strengthening Turkish Cypriot identity, others adopted a more pragmatic approach, favoring education models aligned with international standards. These differences in discourse have played a decisive role in shaping education policies. The findings of the study indicate that education in the TRNC is not merely an academic process but also an integral part of identity construction. It has been determined that presidential discourses directly influence education policies, manifesting in various aspects, from curriculum changes to teacher policies. Furthermore, the study concludes that the political conjuncture and Cyprus negotiation processes also play a significant role in shaping education policies. Ultimately, the study demonstrates that the discourses of the Presidents have a substantial impact on education policies in the TRNC. This research provides a crucial framework for understanding how education policies in the TRNC have been shaped within historical and political contexts. It is also suggested that discourse analyses of this nature can contribute significantly to guiding future education policies.

Keywords: Turkish Republic of Northern Cyprus (TRNC), President, Education, Media, Discourse Analysis.

INTRODUCTION

The education policies in the Turkish Republic of Northern Cyprus (TRNC) have undergone various transformations throughout history, shaped significantly by the discourses of the country's political leaders. The statements made by TRNC Presidents regarding education policies play a crucial role in shaping social identity and directing the education system. Education is not merely a means of transmitting academic knowledge; it also serves as a tool for strengthening social belonging and preserving the Turkish Cypriot identity. This study examines how the discourses of TRNC Presidents have influenced education policies and compares the policies and statements of different Presidents regarding education.

The education policies of the TRNC have been shaped in accordance with the historical and political developments on the island. Following the 1974 Cyprus Peace Operation, the education system in Northern Cyprus was restructured within the framework of close relations with Turkey. After the declaration of the TRNC in 1983, the Presidents actively played a role in determining the fundamental directions of education policies. From the early years, the Turkish model was adopted in education policies, with a strong emphasis on national identity construction.

The education policies of the Turkish Cypriot community have undergone different phases throughout history. In the 1960s, while living under the Republic of Cyprus, the Turkish Cypriot community faced significant restrictions in education and struggled to establish its own education system. After 1974, education was perceived as a key instrument in the institutionalization process of the TRNC. Particularly, collaborations with Turkey in the field of education led to significant reforms from primary to higher education in the TRNC.

Salih Sarpten, in his book *The Historical Development, Council Decisions, and Education Policies of the Turkish Cypriot Education System*, emphasizes the multifaceted nature of this process by stating that “the roots of the Turkish Cypriot education system reflect not only political developments but also social dynamics.” Furthermore, according to Sarpten, “the decisions of the education council serve as indicators of fundamental changes within the education system,” highlighting the pivotal role of these decisions in shaping reforms.

Examining the development of the Turkish Cypriot education system from the Ottoman Empire to the present day necessitates an analysis of the social, cultural, and political factors that have influenced its structure:

- Ottoman Period (1571–1878): Education in Cyprus during the Ottoman rule was based on a religious framework introduced by the Ottoman administration. During this period, the educational needs of the Turkish population were mainly met by religious schools. However, literacy rates were low, and education remained largely confined to religious subjects.
- British Colonial Period (1878–1960): With the beginning of British administration, the education system underwent significant transformations. Although the British attempted to modernize local education, there were major disparities between Turkish and Greek communities in terms of education. The education system was shaped primarily along ethnic lines, with both communities encouraged to establish their own schools.
- Independence Period and the 1960 Constitution: With the establishment of the Republic of Cyprus in 1960, structural changes in education accelerated. Issues such as educational equality, multilingual education, and cultural discrimination became prominent. However, political tensions and ethnic conflicts within the Republic of Cyprus left deep marks on the education system.
- Post-1974 Turkish Cypriot Education System: Following the 1974 Cyprus Peace Operation, Turkish Cypriots began to establish an independent education system in Northern Cyprus. The restructuring of institutional frameworks in education became a crucial focus during this period (Sarpten, 2020).

Education policies play a critical role in constructing the historical and cultural identity of a nation. Particularly, history education is considered a key tool in shaping national identity (Smith, 1991). In countries like the TRNC, where international recognition is limited, education policies influence not only academic success but also the formation of collective identity (Karadağ & Kılıç, 2019).

In this context, the discourses of TRNC Presidents are significant in shaping the direction of the education system. Leaders’ statements on history, identity, and education have far-reaching impacts, from curriculum design to educational reforms. This study aims to examine how the historical and national identity discourses of TRNC Presidents have been reflected in education policies.

CYPRUS COUNCIL DECISIONS AND EDUCATION POLICIES

A detailed examination of the Council decisions, which hold a significant place in the Turkish Cypriot education system, is essential. The Turkish Cypriot Education Council has functioned as a fundamental body in determining education-related policies. The decisions made by the Council have had a substantial impact on the development of education.

Structural Reforms in Education: The Council decisions have played a crucial role in implementing structural changes and reforms in education. For the first time, comprehensive education policies were formulated, addressing key issues such as teacher training, curriculum regulations, and school infrastructure.

Intellectual and Societal Reflections in Education: One of the primary objectives of the Council decisions has been to examine how the identity, culture, and societal structure of the Turkish Cypriot community are shaped through education policies. Special emphasis has been placed on language, history, and cultural courses to strengthen the Turkish Cypriot identity (Sarpten, 2020). A thorough analysis of how Turkish Cypriot education policy has evolved and developed over time is essential.

Priority Areas in Turkish Cypriot Education: Some priority areas in education policies have been determined based on the needs of society and the structural challenges of the education system. These areas include teacher training, the revision of textbooks, strengthening school infrastructure, and initiatives aimed at higher education development.

Efforts to Improve Education Quality: One of the major issues in the Turkish Cypriot education system is the lack of quality. Reforms aimed at enhancing the quality of education have been introduced, including curriculum modifications and innovations in teaching methodologies.

The Turkish Cypriot Education System and Policy Makers: The individuals and institutions that shape the policies of the education system also play a significant role in the literature. The Ministry of Education, teachers’ unions,

and other public institutions related to education have been critical in shaping the Turkish Cypriot education system.

This section provides a comprehensive overview of how Council decisions have influenced the formulation and evolution of education policies in Northern Cyprus, emphasizing the role of reforms, societal reflections, and the contributions of policymakers.

TURKISH CYPRIOT SOCIETY AND EDUCATION

A comprehensive examination of the impact of the education system on society is necessary. The relationship between the Turkish Cypriot community and education is one of the most significant factors shaping the social structure of the society.

Education and the Modernization of Society: Education has been a crucial instrument for the modernization and development of the Turkish Cypriot community. Through education, efforts have been made to achieve social development, democratization, and economic growth.

Education and Identity Issues: The education system has significant effects on ethnic identity, culture, and the preservation of national values. In this context, the Turkish Cypriots have sought to strengthen their historical and cultural identity through education.

This section highlights the integral role of education in shaping the social and cultural fabric of the Turkish Cypriot community, emphasizing its influence on modernization and identity formation.

THE TURKISH CYPRIOT EDUCATION SYSTEM AND HISTORY TEXTBOOKS

The education system in Cyprus has been shaped by nationalist discourses in terms of historical narratives for many years. The history textbooks used in the Turkish Republic of Northern Cyprus (TRNC) predominantly present a Turkish identity-centered narrative, framing the Cyprus issue primarily within the context of Turkish-Greek conflict. In this regard, the education system has played a polarizing role, focusing on strengthening Turkish Cypriot identity and presenting historical events from a particular perspective.

Particularly following the 1974 Cyprus Peace Operation, the historical narrative emphasized the victimization of Turkish Cypriots and portrayed the Greek Cypriot side as the aggressor. Rather than fostering a shared historical narrative with Greek Cypriots, history textbooks have been structured around a discourse that reinforces division. This process has also been shaped within the framework of TRNC's relations with Turkey, with history education serving the purpose of integrating with Turkish national identity (Önen, Dağseven, Karahasan, & Latif, 2010).

This section examines how history education in the TRNC has been influenced by nationalist discourses, emphasizing its role in shaping collective identity and political narratives.

EDUCATION REFORMS AND RECONCILIATORY TRENDS

Since the early 2000s, particularly under the influence of the European Union harmonization process and bicomunal projects, history education reforms have become a significant topic in Cyprus. During this period, efforts were made to adopt a more reconciliatory and multi-perspective approach in history textbooks.

Following the 2004 Annan Plan, certain education reforms laid the groundwork for history textbooks to develop a more objective and peaceful discourse. The newly designed curricula in the TRNC during this period contributed to incorporating a more pluralistic and reconciliatory narrative into history education. However, due to political shifts and societal sensitivities, these reform initiatives have experienced setbacks at times (Önen, Dağseven, Karahasan, & Latif, 2010).

This section examines the transition towards a more inclusive and balanced historical narrative, highlighting the challenges and limitations of education reform efforts in the TRNC.

THE POLARIZING OR RECONCILIATORY IMPACT OF HISTORY EDUCATION

When evaluating the Turkish Cypriot education system, the function of history education can be examined under two main categories:

Polarizing Impact: When history textbooks are written to reinforce a particular national identity, they may emphasize certain aspects of the past while ignoring others. The history textbooks used in the TRNC for many years have primarily focused on conflicts with Greek Cypriots, aiming to strengthen Turkish identity. These

narratives, by presenting historical events from a one-sided perspective, have made it difficult for students to be open to alternative viewpoints.

Reconciliatory Impact: As alternative historical narratives develop and bicommunal educational programs receive support, history education has the potential to contribute to the peace process in Cyprus. However, such initiatives have frequently been disrupted by political and societal factors.

For instance, while some teachers and academics argue that history textbooks should adopt a more reconciliatory perspective, certain political groups and segments of society have opposed these changes, viewing them as a form of “identity erosion”. This resistance has been one of the primary obstacles to the implementation of education reforms.

What Should Be Done?

The Turkish Cypriot education system has experienced both polarizing and reconciliatory trends in terms of the content of history textbooks. History education, particularly in Cyprus, is directly linked to negotiations and political processes. Although efforts are being made today to develop a more pluralistic and neutral history education, this process remains dependent on political will and societal dynamics.

To promote social reconciliation, the Turkish Cypriot education system should move toward more balanced and inclusive historical narratives. However, for this to be achieved, history education must go beyond being a mere tool for identity construction and take on a role that supports a culture of peace. Education policies should address past events from multiple perspectives objectively, thereby fostering an environment of dialogue and cooperation between the two communities.

In this context, the Turkish Cypriot education system stands at a critical crossroads: Will it continue to foster division, or will it embrace reconciliation? Transforming education into a peaceful and pluralistic framework requires more than just revising history textbooks—it also necessitates teacher training policies, curriculum reforms, and public awareness initiatives. Only through such measures can history education shift from exacerbating past wounds to becoming a tool for building a shared future (Önen, Dağseven, Karahasan, & Latif, 2010).

IDENTITY CONSTRUCTION AND EDUCATION

Education systems serve as a crucial tool in the construction of national identity. In the Turkish Republic of Northern Cyprus (TRNC), education goes beyond the mere transmission of academic knowledge; it carries the mission of strengthening social belonging and preserving Turkish Cypriot identity. The discourses of TRNC Presidents have played a decisive role in this identity-building process. In particular, the emphasis on national history, cultural heritage, and relations with the motherland (Turkey) has been a prominent aspect of education policies. The history and social studies curricula have been designed to highlight the political status of the TRNC and its ties with Turkey.

The construction of Turkish Cypriot identity has been shaped particularly through history courses and curriculum content. The Ottoman period, British colonial rule, the 1960 Republic of Cyprus, and post-1974 developments have been regarded as major milestones in education. The history and social studies courses have been structured to reinforce the idea that the TRNC is an independent state. However, the emphasis on identity has varied across different Presidential terms (Irkad, 1997).

The discourses of TRNC Presidents have directly influenced the content and direction of the education system. The key elements that have shaped education policies in the TRNC include:

Strengthening National Identity and Historical Awareness: National identity and historical consciousness hold a significant place in the education curriculum. TRNC Presidents have consistently emphasized the importance of transmitting knowledge of Turkish Cypriot history to future generations. History courses have covered the Ottoman period, British colonial rule, and the post-1974 period in detail. Salih Sarpten underscores this point by stating, *"The discourses of Presidents play a determining role in shaping education policies."*

Continuity of Turkish as the Medium of Instruction: The official language of education in the TRNC is Turkish, and all Presidents have shared a common stance on maintaining this policy. However, at different times, there have been calls for greater emphasis on English education, particularly in higher education. The increasing number of international students has sparked debates on expanding English-medium instruction, especially at universities.

Enhancing Educational Cooperation with Turkey: Educational collaboration between Turkey and the TRNC has significantly influenced curriculum development, teacher training policies, and student exchange programs. TRNC Presidents have actively encouraged academic support from Turkey and have promoted policies aimed at increasing scholarship opportunities for students.

Internationalization of Higher Education and Foreign Student Policies: In recent years, universities in the TRNC have become increasingly attractive to international students. TRNC Presidents have expressed their aspirations to position the TRNC as an "education island", advocating for policies to attract more foreign students. However, they have also stressed the need to maintain quality standards and develop regulatory mechanisms in higher education (Feridun, 2011).

Balancing Secularism and Religious Education: While secularism has traditionally been a fundamental principle of education in the TRNC, there have been periods where religious education has gained prominence. The establishment of Imam Hatip schools and the introduction of Qur'an courses have been among the controversial topics in the education policies of different Presidential administrations.

Salih Sarpten highlights that education reforms in the TRNC have been shaped not only by Presidential discourses but also by Council decisions. He states, *"Education system reforms have progressed in parallel with both leadership discourses and Council decisions,"* summarizing the dynamic interaction between political leadership and policy-making bodies in shaping the education system.

DISCOURSE ANALYSIS: PRESIDENTIAL STATEMENTS ON EDUCATION

An analysis of the statements made by TRNC Presidents regarding education reveals that different periods have been marked by distinct emphases. For example:

- During Rauf Denktaş's tenure, there was a strong emphasis on national identity, history education, and integration with Turkey. These discourses positioned the education system as a key instrument for reinforcing national consciousness.
- Under Mehmet Ali Talat's administration, the focus shifted towards harmonization with Europe, educational reforms, and EU-funded projects, emphasizing modernization and the adoption of international standards.
- During Derviş Eroğlu's presidency, the primary themes included educational cooperation with Turkey and increased investments in technical education.
- Mustafa Akıncı's tenure highlighted multiculturalism in education, the peace process, and the promotion of intercommunal dialogue.
- Under Ersin Tatar's administration, national identity and educational integration with Turkey were prominent themes (Olgun, 2020).

Salih Sarpten succinctly describes these discourses as "expressions that ensure the continuity of collective memory and cultural heritage." He further details how each leader's stance on education has led to variations in policy content and implementation, shedding light on the evolution of the TRNC education system.

A comparative analysis of different Presidents' educational discourses reveals that each period has had its own distinct priorities and emphases. While Denktaş's era prioritized national identity and independence, Talat's term focused on educational integration with Europe. Both Eroğlu and Tatar's administrations highlighted close cooperation with Turkey, whereas Akıncı's tenure emphasized peace-oriented narratives and multiculturalism in education.

These differences illustrate how education policies have been shaped by political dynamics over time and how the evolving political landscape of the TRNC has influenced its education system. Presidential discourses have been a key determinant of the direction of education policies, consistently reinforcing the role of education in identity construction.

CONCLUSION AND RECOMMENDATIONS

This study has examined how the discourses of TRNC Presidents on history, identity, and education have influenced education policies. The findings indicate that political leaders' approaches can directly shape the education system and that education plays a central role in the construction of national identity. While this study highlights the impact of political discourse on education policies in the TRNC, it also encourages discussions on how this process can be anchored in a more scientific and impartial framework in the future.

This research has comprehensively analyzed the influence of TRNC Presidents' statements on education policies. The discourses surrounding identity, history, and education play a significant role in determining the fundamental direction of TRNC education policies. Based on Salih Sarpten's work, it is evident that Presidential discourses and Council decisions together have laid the groundwork for major educational reforms. The future trajectory of education policies will continue to evolve based on internal and external dynamics affecting the TRNC.

The TRNC education system should be shaped within the principles of political independence and scientific neutrality. When developing history curricula, a multi-perspective and scientifically grounded approach should be adopted. It is recommended that TRNC education policies be formulated within a long-term strategic framework, independent of the ideological views of political leaders. While fostering educational cooperation with Turkey, local needs and the educational autonomy of the TRNC should also be taken into consideration.

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The Historical Development and Current State of Turkish-Language Print Media in North Macedonia

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ABSTRACT

This research explores Turkish printed media's history, historical development, and current state in North Macedonia. In this context, the evolution of Turkish printed media in North Macedonia from the past to the present is examined, and a detailed analysis of the current situation is presented. The study aims to investigate the history, general condition, and impact of newspapers and magazines published in Turkish in Macedonia. Given the limited research conducted on Turkish media in North Macedonia in general, this study is carried out by taking into account the significance and urgency of the topic. Furthermore, the research aims to reveal the social, political, literary, and international dimensions of Turkish-language printed media, to understand the transformations in this field, and to provide a comprehensive evaluation. This study will also contribute to future research on Turkish media in Macedonia, serve as a guide, and raise awareness about the importance of Turkish media. The study is structured into two main periods: before and after the independence of North Macedonia. This division is significant because prior to independence- during the Yugoslav era- Turkish media supported the preservation of ethnic identities and cultures and provided detailed information about the challenges faced by the Turkish community. The number of Turkish newspapers and magazines in Macedonia has varied across different periods. The significant decline in Turkish language publications before and after the Yugoslav era occurred under the direct influence of political and social changes in the region. In recent years, with the spread of digital media, it has been concluded that Turkish-language publications have begun to increase in digital platforms.

Keywords: North Macedonia, Turkish, Media, Turkish Printed Media.

INTRODUCTION

The geographical location of North Macedonia has been known as a region inhabited by Turks before, during, and after the Ottoman period. Following the Ottoman Empire's settlement in this region, it became historically notable as a center that produced significant authors who left a profound impact on Turkish literature. With the withdrawal of the Ottoman Empire from the region, many Turks returned to Anatolia, and subsequent waves of migration led to a steady decline in the Turkish population in the area. It is a historical fact that major developments following the retreat of the Ottoman Empire negatively affected the Turkish population; however, these circumstances did not lead to the complete disappearance of the Turkish presence, nor did they eradicate the influence of the Turkish language in the region.

The period of silence that began in 1912 began to ease somewhat after the establishment of the Socialist Federal Republic of Yugoslavia following the end of World War II. Nevertheless, negative developments during the early years of the Yugoslav federation prompted another wave of migration, with many Turks once again relocating to the Republic of Turkey. Despite a significant demographic loss during this period, the presence of the Turkish community persisted, and the influence of the Turkish language expanded. Turkish-language education was introduced, Turkish theater was established, and Turkish-language media continued to operate within the state structure.

The publication of the newspaper *Birlik* by the Yücel Organization marked a significant milestone. Later, the newspaper was incorporated into the state system and continued publication under the *Nova Makedonija* printing house. In its early years, the newspaper was considered a publication for Muslims, but it later became the official organ of the Macedonian People's Front. In fact, this was recognized as a right granted to the Turks of Yugoslavia, allowing Turkish-language media to exist within state-supported platforms such as newspapers, television, and radio.

From the end of World War II until the independence of North Macedonia, Turkish-language newspapers and magazines were published periodically—weekly, three times a week, monthly, or quarterly. During various periods,

different civil society organizations also published their own media outlets. The most significant problem in Turkish-language print media has been the lack of continuity. Among these publications, *Birlik* stands out as the longest-running newspaper compared to others.

The Contribution and Influence of Turkish-Language Print Media on Balkan Turkish Literature

Print media in Macedonia and the broader Balkan region has made a significant contribution to the development of Balkan Turkish literature. This process began with the publication of the *Birlik* newspaper, established in Macedonia in 1944, and continued with the dissemination of Turkish-language radio programs, newspapers, magazines, and book publications. A new literary circle was formed in the region, laying the foundation for the emergence of Balkan Turkish literature, which left a lasting impact throughout the Yugoslav territory. However, Turks living in the autonomous region of Kosovo were only able to access such opportunities starting in 1969, with the publication of newspapers and magazines in the region (İsen, 2009).

The establishment of Turkish-language schools in both urban and rural areas of Macedonia, the publication of Turkish-language textbooks, and the opening of Turkish-language departments in faculties and higher education institutions created a fertile ground for the growth and development of Turkish cultural life within the borders of Macedonia. In this context, Balkan Turkish literature began and flourished under the umbrella of the *Birlik* newspaper. With its publication, poems, tales, and short stories began to appear in the press, contributing to the literary development of poets and writers.

In Macedonia and other parts of the Balkans, the works of poets and writers were published in newspapers and magazines. The children's magazines *Sevinç* and *Tomurcuk*, published under the *Nova Makedonija* publishing house, made substantial contributions to children's literature. The same publisher also released the *Sesler* magazine, which provided broader coverage of literary works. These magazines, particularly *Sevinç*, *Tomurcuk*, and *Sesler*, played a crucial role in nurturing a new generation of poets and writers.

In subsequent years, magazines such as *Üçüncü* and *Köprü* further enriched Macedonian and Balkan Turkish literature by introducing new literary voices. Overall, these developments significantly increased contributions to Turkish literature as a whole.

The Relationship Between Turkish-Language Print Media and Politics

Turkish-language print media in North Macedonia has undergone significant changes and transformations throughout history. From the Ottoman era through the influence of Yugoslavia and into the post-independence period, media institutions and publications have experienced various developmental phases. During this process, the political affiliations of the media, its role in social transformation, technological evolution, its relationship with minority communities, the European Union integration process, and international relations have all been key areas of focus.

The functioning and freedoms of print media in North Macedonia are governed by legal regulations. Fundamental principles such as press freedom and freedom of expression are constitutionally protected and supported by other legal frameworks. However, in certain instances, political pressures and legal restrictions have also been observed. The relationship between print media and politics in North Macedonia has frequently been a subject of public debate. The affiliations between media organizations and political groups, editorial manipulation of news content, and censorship are prominent issues in the media landscape. To ensure the independence of print media institutions from political influences, a legal framework has been established.

Political orientations within Macedonian print media institutions are clearly reflected in the editorial preferences, news selection, and visual presentation of newspapers and magazines. Print media outlets with differing political perspectives often express their affiliations through their relationships with political parties and through the manner in which they represent the political figures they support within their news coverage.

The Publications of Civil Society Organizations Operating in Macedonia

With Macedonia's declaration of independence in 1991, the Turkish community in the country initiated a process of organizational development. The Turkish Democratic Union, established in 1990, entered a phase of political structuring and officially became a political party in 1992. Meanwhile, in the aftermath of World War II, during the late 1940s and 1950s, several cultural and fine arts associations were founded with the aim of preserving and promoting Turkish culture and arts. Organizations such as *Yeni Yol* in Skopje and the *Kardaşlık* Cultural and Fine Arts Associations in Ohrid and Resen began organizing various activities to preserve Turkish traditions and customs. These associations operated in diverse areas such as drama and literature.

Following Macedonia's independence, the organizational revival of the Turkish community accelerated towards the late 1990s and early 2000s, with the establishment of new civil society organizations. Many of these newly formed associations began publishing their own periodicals. The early 2000s marked the emergence of the fourth generation of Macedonian Turkish poets and literary figures. In 2002, a group of students from the Department of Turkish Language and Literature at Ss. Cyril and Methodius University in Skopje founded the literary, cultural, and artistic magazine *Köprü*, providing young writers and poets with a platform to publish their works.

Köprü magazine was first published in January 2002 in Skopje through the efforts of faculty member Hayati Yavuzer and students of the Department of Turkish Language and Literature at the Faculty of Philology. In March 2003, it became an officially registered association under the name Köprü Association for Culture, Art, and Education. Initially published quarterly, it later adopted a monthly publication schedule (Demir & Kayadibi, 2012). In recent years, *Köprü* has continued to publish at irregular intervals.

Founded in August 2002 in Upper Banitsa, the Namık Efendi Association was established to support development in the fields of aid, education, culture, art, and sports. The association published a magazine titled *Dere* for a certain period (Çayırılı, 2015). The Niyazi Bey Cultural and Arts Association, established by Turkish youth in Resen, published a short-lived magazine called *Kızıl Elma*.

Since 1997, the Abdülhakim Hikmet Doğan Center for Culture and Arts in Gostivar has been publishing *Hikmet*, an international peer-reviewed academic journal. The journal features high-quality academic articles, reviews, critiques, and book introductions in fields such as Classical Turkish Literature, Modern Turkish Literature, Folk Literature, Turkish Language, Turkish-Islamic Literature, Contemporary Turkic Dialects, Linguistics, and Comparative Literature.

Üçüncüler, a magazine published by Macedonian Turkish youth beginning in 1994, continued its publication until 1999. As Ertuğrul Karakuş (2014) notes in his book *Üçüncüler in Macedonian Turkish Literature*, the authors of *Üçüncüler* generally adopted an independent stance and advocated for freedom and non-interference in their literary production.

The Ufuk Association, whose founding efforts began in November 2008 and which held its Founding General Assembly on December 17, 2008, launched *Ufuk* magazine in March 2009. The first four issues focused on literature and culture, while subsequent issues addressed social developments in Macedonia and included content related to the Turkish world. Initially published quarterly, the magazine was later published monthly at various intervals. The final issue of *Ufuk* (No. 37) was released in December 2021.

The Millennium Association was established in 1993 in Vrapčište by a group of idealistic youth and was officially recognized as a civil society organization in January 2000 under the civil society law enacted in 1998. The association aimed to promote peace, democracy, and interethnic dialogue through collaboration with youth via various projects and activities. For a period, it published a newspaper titled *Haberci*.

Turkish-Language Newspapers Published in Macedonia

Newspapers published in the Turkish language in Macedonia hold significant importance for the social, cultural, and political life of Turks living in Macedonia and the broader Balkan region. Following the withdrawal of the Ottoman Empire from the region, Turks, now a minority in the country, have relied heavily on Turkish-language media to preserve their identity. From the time of the Ottoman withdrawal until the end of World War II, Turkish communities received education in Serbian rather than their mother tongue. During this period, Turkish was only spoken at home and in public spaces. Prior to 1941, newspapers published in Turkish using the Arabic script included *Hak*, *Hak Yolu*, *Işık*, *Sada-yi Millet*, *Mücadele*, *Yeni Vakit*, and *Doğru Yol* (Kaya, 1999).

The end of World War II, particularly December 1944, marked a turning point for Turkish communities in Macedonia. On December 23, 1944, the newspaper *Birlik* began publication, and on December 26, the Turkish-language *Tefeyyüz* primary school opened. The 1950s represented a period of renewed efforts and developments regarding Turkish-language initiatives. The publication of *Birlik* paved the way for other Turkish-language media and laid the foundation for the expansion of Turkish-language education throughout the country. Despite various challenges, Turkish-language press and media institutions developed under these conditions and continue to exist today. Since 1944, all newspapers and magazines published in Macedonia have used Standard Turkish (Turkey Turkish). These publications have fulfilled literary and cultural needs, preserved the Turkish language, and played a key role in safeguarding the community's linguistic identity.

Birlik Newspaper

The first issue of *Birlik* was published on December 23, 1944, with the slogan “Death to Fascism – Freedom to the People!” It was initially launched as the weekly newspaper of the National Liberation Front of the Muslims of Macedonia. Although it was intended to be published weekly, publication intervals varied—sometimes biweekly or monthly.

With the launch of *Birlik*, the first stirrings of Turkish literature in North Macedonia began. The newspaper made a significant contribution to the development of Balkan Turkish literature. It featured dedicated pages for children and students, as well as a *Children’s Garden* supplement. *Birlik* played a pioneering role in the publication of children’s magazines such as *Sevinç* and *Tomurcuk*, and with the later publication of *Sesler*, collections of folk literature began to appear regularly.

Birlik holds a special place in the collective memory and cultural heritage of Turks in Macedonia. It is one of the longest-running Turkish-language newspapers in the history of the Turkish press. After the bankruptcy of the *Nova Makedonija* public company, *Birlik* entered a privatization process that ultimately failed. The newspaper published its final issue—number 6,072—on March 18, 2004.

Throughout its 60-year publication history, *Birlik* not only significantly contributed to Balkan Turkish literature and children’s literature, but also documented the sociopolitical developments of the Turkish community in Macedonia. Despite occasional political propaganda, the newspaper consistently focused on educational and cultural activities relevant to the Turkish minority and witnessed the community’s organizational progress. It also spearheaded the publication of *Sesler* magazine, which ran from 1965 to 2001 with a total of 331 issues. *Sesler* is the longest-running magazine in the Balkans and continued publication—albeit irregularly—until April 2001.

Vardar Newspaper

Under the leadership of Kosovan-born Turkish journalist Burhan Sait, the *Vardar* magazine was first published in 1994 in Skopje, followed by the *Vardar* newspaper in 1999. As editor-in-chief and proprietor, Burhan Sait was critical of emigration from Yugoslavia to Turkey, arguing that it would further marginalize the Turkish minority. After the closure of *Vardar*, he became a citizen of Turkey and moved to Istanbul with his family in 2003 (Gezgin, 2023).

Although its publication lifespan was short, *Vardar* closely monitored the sociopolitical developments of Turks in Macedonia. Unfortunately, Burhan Sait died in a traffic accident in Turkey in 2004.

Yeni Balkan Newspaper

Following the closure of *Birlik*, which had played a critical role in documenting the history and development of the Turkish community in Macedonia, the *Yeni Balkan* newspaper was launched to fill the resulting gap in Turkish-language print media.

First published in 2004, *Yeni Balkan* initially appeared as a supplement to the *Yeni Dönem* newspaper in Kosovo. It later became an independent publication in Macedonia. The founder and editor-in-chief is Mürteza Sulooça, a former mufti of Resen. *Yeni Balkan* is published weekly and has contributed—albeit to a limited extent—to preserving Macedonian Turkish culture and sustaining Turkish literature. However, the newspaper has also occasionally featured political propaganda and applied editorial censorship toward certain political figures, ultimately leading to its discontinuation.

Turkish-Language Children's Magazines in Macedonia

Turkish literature, and specifically Turkish children's literature in Macedonia, began to develop in the aftermath of World War II. In this new post-war era, the right to mother-tongue education was granted, and Turkish-language schools were established. With the launch of the *Birlik* newspaper, a new period began, paving the way for the publication of children's magazines such as *Sevinç* and *Tomurcuk*, which specifically targeted young readers. The first periodical publication in Macedonian Turkish children's literature, *Pioneer*, began in 1950, using the Latin alphabet.

Within the framework of the renewed Turkish-language press and publishing activities beginning in 1944, *Pioneer* represents the starting point of children’s publishing in Macedonia. As the official publication of the Pioneers’ Union, the magazine aimed to spark children's interest in reading, writing, and literature. However, only ten issues were published. The lead article of the first issue was written by Mahmut Demir (Gürel, 2025).

Tomurcuk magazine began publication in 1957 and was founded by Necati Zekeriya. The main aim of the magazine was to help children in primary education better utilize the Turkish language. Published by Birlik Publishing in Skopje in 1957, the magazine sought to contribute to the education of Turkish children in the region. It was published ten times per year, excluding July and August. Some issues were combined editions (Okumuş, 2012).

Together with *Sevinç*, *Tomurcuk* played a vital role in the establishment of Turkish children's literature in North Macedonia. These magazines were instrumental in fostering the development of children's literature and nurturing new literary talents. However, following the privatization of the state-owned publishing company *Nova Makedonija*, the publication of *Tomurcuk* came to an end.

The children's magazine *Bahçe*, published by the *Yeni Balkan* Publishing House, released its first issue in 2004. The magazine's publisher is Mürteza Sulooça, who is also the proprietor of *Yeni Balkan* newspaper. To date, *Bahçe* has published 37 issues.

Kardelen magazine was launched in November 2009 by the *Köprü* Association. The magazine is edited by Yeliz Daut Kurtiş. Since its inception in 2009, *Kardelen* has published 113 issues to date.

CONCLUSION

Turkish-language print media in North Macedonia has undergone a rich historical development from the era of the Ottoman Empire to the present day and continues to maintain its presence. During the Ottoman period, the Turkish presence in the Balkans held significant importance, as Turks from Anatolia were resettled in the region through the Empire's settlement policies, allowing Turkish culture to take root. The foundations of Turkish-language press in the region were laid during the Ottoman era, with the establishment of printing houses and the publication of official newspapers in cities such as Bitola (Manastır) and Skopje (Üsküp), contributing to the emergence of a strong Turkish press tradition.

In particular, the newspaper *Birlik*, first published in 1944, holds a prominent place in the history of Turkish-language media in Macedonia. Today, despite various challenges, Turkish-language press in North Macedonia continues to exist. Thanks to the efforts of contemporary media institutions, the Turkish language and culture continue to be preserved and promoted in the region. However, current economic and social challenges pose significant threats to the sustainability and future of Turkish-language media.

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Investigation of Smartphone Addiction of Middle School and High School Students¹

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ABSTRACT

Addiction is the state of being addicted to any activity, substance, object or behavior in a way that excludes other activities of one's life or causes physical, mental or social harm to oneself and others. In addition to many and various types of addiction, it seems that an important type of addiction is technology addiction. Today, the dizzying development of technological developments and their inclusion in every aspect of our lives has made it necessary for us to rethink the concepts of far and near. With the rapid development in mobile phone technology, the standard mobile phones used in the past to call someone or send a message to someone have been replaced by state-of-the-art smartphones that make our daily lives much easier. However, on the other hand, it is seen that addiction to smartphones, which have become an integral part of life, is on the rise, and this goes back to pre-school periods. In this context, the aim of the research was determined to examine whether the smartphone usage level of students studying in secondary and high schools affiliated to the National Education Directorate of Tunceli province Hozat district in the 2022-2023 academic year varies significantly according to some demographic characteristics of the students. Within the scope of quantitative research, the data of the research designed in the general survey model were collected by applying the "Smartphone Addiction Scale Short Form (ATBÖ-SF)", developed by Kwon et al. and adapted to Turkish by Noyan et al., face to face between May and June 2023. The scale, for which validity and reliability studies were conducted, was found to be suitable for the use of parametric tests, and in addition to test analyzes such as frequency, percentage, arithmetic mean, T Test and One-Way Variance Analysis were used to determine the significance of the difference using statistical data analysis techniques. As a result of the analysis, the average smartphone addiction level being below 3 was interpreted as the students not having smartphone addiction, but the measurements being just below the average indicating a risk factor, while the difference between the dependent and independent variables was not significant ($p < .005$). According to the research findings, the smartphone addiction level of students at the lower limit of addiction carries a risk factor, in this respect the findings are warning, and it is recommended that parents, society, and especially schools and relevant institutions and organizations take precautions against the apparent danger.

Keywords: Smartphone, student, education, addiction, technology

INTRODUCTION

In today's world, where progress in science and technology has reached incredible dimensions, social life is also seen to be keeping pace with this rapid change and transformation, much like the interconnected pieces of a puzzle. The dizzying pace of technological developments, and their inclusion in every aspect of our lives, has prompted a reevaluation of the concepts of distance and proximity (Gürkan et al., 2022). With the rapid advancements in mobile phone technology, the standard mobile phones, which were once used solely for calling or texting, have been replaced by state-of-the-art smartphones that greatly simplify daily life. Nowadays, tasks and processes that could only be performed with computers in the past can be easily carried out with smartphones (Çakır & Oğuz, 2017).

¹ This article is derived from the master's thesis titled "Investigation of Smartphone Addiction Among Students: A District School Case Study," conducted in the Department of Political Science and Public Administration at Munzur University Institute of Graduate Education.

Smartphones offer numerous activities that simplify human life and have positive effects, such as easy access to desired data, data sharing, enhanced communication opportunities, listening to music, taking photos, using social media, making friends, playing online and offline games, accelerating banking transactions, and online shopping from websites (Şimşek & Zabun, 2019). However, alongside the expected conveniences that smartphones bring, especially as they are used for an increasing variety of purposes, a significant impact of their use manifests in the form of addiction. Research findings show that smartphones, which have found widespread use not only among different age groups but also among middle and high school students, have addictive effects. This has drawn attention to individuals at this educational level. In this context, the main theme of this study is to examine the level of smartphone addiction among students in the pre-university education stage.

PROBLEM STATEMENT

Communication is the state in which living beings, especially humans, interact with each other by using visual and auditory symbols to convey their emotions, knowledge, and ideas. In other words, communication is the transmission of information, ideas, attitudes, or feelings from one person or group to another (or others) via symbols, as described by Bülbul (as cited in Çakır & Topçu, 2005, p.2). It is the process of assigning meaning to the message through the exchange of information between a source and a receiver via a channel. Communication, which was quite limited in ancient times, has reached a mass scale and an incredible speed due to advancements in science, technology, and technical tools. For example, communication, which in prehistoric times was carried out using a single method like smoke signals, reached its second method, cuneiform writing, around 3100–2500 BCE. Subsequently, in the 1st and 2nd centuries, it evolved to the use of courier letters, and by 2900–3500 BCE, pigeons were used for postal services. In the 17th century, communication witnessed tremendous development. Newspapers, which delivered daily information to the masses, came into play, significantly increasing both the scope and speed of communication, as well as the number of individuals engaged in the process.

Initially, books were a communication tool limited to a very small, elite group compared to newspapers. By 1784, postal carriages began to be included as carriers of information, news, etc. The invention and use of the telegraph between 1791-95 weakened the influence of postal carriages in the communication world while leading to another development. In the 1830s-40s, postage stamps were introduced into postal services. The laying of transcontinental cables became possible in the 1850s-60s, bringing communication to a transcontinental level (Barbier, 2001; Güneş, 2013:290). The telephone, invented in the 1870s, drastically shortened the time between the invention of the second, third, and fourth communication tools, serving as a harbinger of further developments. This new development became even more effective with the inclusion of radio in the process in the early 1900s, removing all barriers to the advancement of communication and communication tools.

By the 1920s, airmail was introduced, and in the 1960s, communication satellites were launched, allowing live broadcasts to be delivered to people through television. The early 20th century saw the introduction of the internet (with email enabling instant communication), and by the beginning of the 21st century, mobile communication and mobile phones (or smartphones) became part of mass use (Güneş, 2013:294). This led to an unprecedented speed and continuity in communication, bringing people from all over the world closer together and perfectly completing a crucial leg of globalization. In other words, while globalization was completed on the economic level, it was also achieved in terms of communication. However, the problem here is that the accessibility of communication tools, which was once insufficient for people, has now increased to the point where it has reached the level of addiction through mobile phones (Aydoğan, 2013; Baldini, 2000; Barbier, 2001; Toplu, 2008; Aymaz, 2018; Uslu, 2021).

Over the past fifteen years, the use of mobile devices during childhood has significantly increased in many countries (Rideout, Saphir, Pai, & Rudd, 2013). A recent study in the UK found that children now spend more time online than watching TV, with tablets and smartphones being the devices most frequently used by children to access the internet (Ofcom, 2016). Similar studies conducted in other countries suggest that more Asian children and adolescents are developing smartphone addiction (Çelik, 2020; Çelik & Ulusoy, 2019; Ektiricioglu et al., 2020; TÜİK, 2022), with a growing trend towards younger ages and an increasing rate of smartphone addiction among individuals in pre-university education. Given this situation, it becomes crucial to examine the causes and consequences of smartphone addiction across all educational levels nationwide, as well as to analyze it based on some demographic characteristics of students. This would help gather reliable data, which could assist decision-makers in taking timely and meaningful actions to mitigate potential negative impacts on children and adolescents.

Research Purpose

The aim of this study is to examine the smartphone addiction levels of middle and high school students based on certain demographic characteristics and to develop recommendations in light of the findings. To achieve this, the following research questions were addressed:

1. What is the level of smartphone addiction among students?
2. Do students' smartphone addiction scale scores show a significant difference based on gender?
3. Do students' smartphone addiction scale scores show a significant difference based on school level?
4. Do students' smartphone addiction scale scores show a significant difference based on their parents' income levels?
5. Do students' smartphone addiction scale scores show a significant difference based on their parents' educational levels?
6. Do students' smartphone addiction scale scores show a significant difference based on their parents' occupations?

METHOD

This section provides information on the research model, the population and sample, data collection methods, data collection tools, and data analysis.

Research Model

This research was designed using the general survey model within the scope of quantitative research. The most fundamental principle of quantitative research is to express the findings in numerical terms, making them measurable, and to base the research on hypotheses, testing these hypotheses (Ekiz, 2003, p.93). Survey studies, which are widely used in social sciences and allow for large-scale analysis, typically describe the existing performance, views, thoughts, and attitudes of the target group, such as gender, age, and socioeconomic status, either individually or in relation to some factors (Büyüköztürk, 2014, p.2; Gurbetoğlu, 2018). According to Christensen and colleagues (2015, p.368), survey research aims to reveal changes over time or uncover the underlying aspects of a particular situation.

Population and Sample

The population of the study consists of a total of 232 students enrolled in middle and high schools affiliated with the Hozat District Directorate of National Education in Tunceli during the 2022-2023 academic year. Among these students, 118 are in middle school and 114 are in high school (Table 1). Since it was possible to reach the entire population, no sampling method was used.

Table 1. Data of Middle and High Schools from the Hozat District Directorate of National Education for the 2023-2024 Academic Year

School Type	Number of Students	Number of teachers	Number of students
Ercan Doğan Middle School	118	19	118
Zübeyde Hanım High School	114	11	114
Total	232	30	232

Despite the response rate of the administered scale being 82%, the number of scales that could be subjected to statistical analysis remained at 144. This represents 62% of the total participants. Accordingly, the personal characteristics of the 144 participants are presented in Tables 3.2, 3.3, 3.4, and 3.5.

Table 2. Percentage and Frequency Distribution of the Personal Characteristics of Participants (N=144)

Variables	Characteristics	Frequency (f)	Percentage (%)
Gender	Female	73	50.7%
	Male	71	49.3%
School Type	Middle School	62	43.1%
	High School	82	56.9%
Father's Occupation	Not Working	33	22.9%
	Worker	77	53.5%
	Civil Servant	25	17.4%
	Retired	9	6.3%
Mother's Occupation	Not Working	109	75.7%
	Worker	20	13.9%
	Civil Servant	15	10.4%
	Other	23	16.0%
Family Income Level	Medium	101	70.1%
	High	16	11.1%
	Very High	4	2.8%

Table 2 presents the percentage and frequency distribution of certain personal characteristics of the participants. As shown in the table, 50.7% of the participants are female, while 49.3% are male. Among them, 43.1% are middle school students, and 56.9% are high school students. When examining the occupations of their fathers, it can be noted that 22.9% of the fathers are not working, 53.5% are workers, 17.4% are civil servants, and 6.3% are retired. In terms of mothers' occupations, 75.7% of the mothers of the participating students are not working and are homemakers. Meanwhile, 13.9% are workers, and 10.4% are civil servants. According to the perceptions of income levels in Turkey, 16.0% of the participants perceive their families as having low income, 70.1% as having medium income, 11.1% as having high income, and 2.8% as having very high income.

The information regarding the responses to other questions included in the personal information form of the participants is provided below.

This includes the daily smartphone usage duration of the participants, the smartphone brands they use, and the level of impact smartphone usage has on their lives.

The percentage and frequency distribution regarding the daily smartphone usage duration, the smartphone brands used, and the level of impact on their lives is presented in Table 3.

Table 3. Percentage and Frequency Distribution of Participants' Daily Smartphone Usage Duration, Smartphone Brand, and Impact Level on Their Lives

Variables	Characteristics	N	%
Daily Usage Duration	0-2 Hours	60	41.7
	2-4 Hours	52	36.1
	4-6 Hours	22	15.3
	6-8 Hours	8	5.6
	8 Hours and Above	2	1.4
Smartphone Brand	Apple	34	23.6
	Samsung	58	40.3
	Huawei	14	9.7
	Other	38	26.4
Impact of Smartphone on Life	Not at all	23	16.0
	Very little	39	27.1
	Partially	53	36.8
	It affects	23	16.0
	It affects a lot	6	4.2
Do You Think You Are Addicted?	Yes	16	11.1
	No	78	54.2
	Partially	44	30.6
	No opinion	6	4.2

Table 3 shows the distribution of participants' daily smartphone usage time, the brands of smartphones they use, the extent to which smartphone usage affects their lives, and their opinions on whether they consider themselves smartphone addicts. According to Table 3, it can be seen that the participants use their smartphones for the most part between 0-2 hours a day, which accounts for 41% of the group. The second most common usage time is between 2-4 hours, with 36.1%. In third place, 15.3% use their smartphones for 4-6 hours a day, while 5.6% use them for 6-8 hours, and only 1.4% use them for 8 hours or more a day.

When asked about the brand of smartphone they use, the participants indicated that the highest percentage, 40.3%, use Samsung smartphones. Additionally, 26.4% reported using smartphones other than Apple, Samsung, and Huawei, while 23.6% use Apple and 9.7% use Huawei smartphones.

In response to the question of how much smartphones affect their lives, 36.8% of participants stated that smartphones affect them to some extent, 27.1% indicated that they affect them very little, 16.0% said they do not affect them at all, and 4.2% claimed that smartphones affect them very much.

Regarding whether the participants consider themselves smartphone addicts, 54.2% stated that they are not addicted, 30.6% said they are somewhat addicted, 11.1% said yes, they are addicted, and 4.2% did not express any opinion.

Participants' Purpose of Smartphone Usage

The percentage and frequency distribution of the participants' purpose of smartphone usage is presented in Table 4.

Table 4. Percentage and frequency distribution of smartphone usage purposes

Variables		N	%
Purpose of Smartphone Usage	Social Networks	83	57.6
	Talking	50	34.7
	Browsing the Internet	48	33.3
	SMS	105	72.9
	Educational Applications	51	35.4
	Checking Social Networks	54	37.5
	Playing Games	61	42.4
	Listening to Music	38	26.4
	Making Calls	51	35.4
	Checking Emails, Correspondence	123	85.4
	Text Messaging	109	75.7
	Watching TV/Movies	57	39.6
	Reading Books	108	75.0
	Taking Photos	55	38.2
	Checking News	93	64.6
	Others (if any)	130	90.3

Table 4 shows the percentage and frequency distribution of the purposes of smartphone usage. According to the examination of Table 4, it can be observed that students indicated they use smartphones primarily for listening to music, at a rate of **73.6%**. Additionally, **66.7%** reported using them for browsing the internet and **65.3%** for communication. The lowest usage purposes were found to be checking emails at **14.6%** and text messaging at **24.3%**. Information about the sample group is provided in the tables below.

The Most Used Type of Social Media Among Smartphone Users

The percentage and frequency distribution of the most used types of social media on smartphones is shown in Table 5.

Table 5. Percentage and frequency distribution of the most used social media on smartphones.

Variable	Feature	N	%
The Most Used Social Media on Smartphones	Instagram	74	51.4
	WhatsApp	79	54.9
	Twitter	19	13.2
	Facebook	13	9.0
	YouTube	83	57.6
	Other (if any)	16	11.1

Table 5 shows the percentage and frequency distribution of the social media tools most used by students on their smartphones. According to the table, YouTube ranks first with 57.6%, followed by WhatsApp in second place with 54.9%, and Instagram in third place with 51.4%. Twitter comes in fourth with 13.2%, while other social media networks rank fifth with 11.1%. Finally, Facebook is the least used, with 9.0%.

Data Collection

The data for this research was collected using the Short Form of the Smartphone Addiction Scale (ATBÖ-KF) in addition to a personal information form. The necessary permissions for the application of the scale were obtained based on the researcher's application dated 02/03/2023 with reference number 7377, according to the decision numbered 2023/06-06 of the Munzur University Non-Invasive Research Ethics Committee.

Information about the Short Form of the Smartphone Addiction Scale (ATBÖ-KF)

The long form of the smartphone addiction scale developed by Kwon et al. (2013) consists of 33 questions, while the short form designed for adolescents (the transition period from childhood to adulthood) contains 10 questions. The short form was adapted into Turkish by Noyan et al. (2015) and its validity and reliability were tested among university students. It was shown to have a single-factor structure, and its sub-scales have not been defined. The calculated Cronbach alpha value is reported to be 0.867, indicating that it is valid and reliable for assessing

smartphone addiction in young adults. The scale, consisting of 10 questions, is rated on a scale from 1 to 6. The ratings are as follows: 1 – Strongly disagree, 2 – Disagree, 3 – Slightly disagree, 4 – Slightly agree, 5 – Agree, 6 – Strongly agree. The scale demonstrates a one-factor structure, and scores range from 10 to 60. As the score obtained from the scale increases, the risk of smartphone addiction also increases. According to a standardization study, if a student's total score from the scale is below 29.50, they are not considered a smartphone addict, while a score above 29.50 indicates smartphone addiction.

Validity and Reliability Analyses of the Short Form of the Smartphone Addiction Scale (ATBÖ-KF) Used in the Research

Reliability Analysis of the Short Form of the Smartphone Addiction Scale (ATBÖ-KF)

The reliability of the scales used in the research indicates how accurately the scales measure the behaviors we aim to assess in the participants (Kurtuluş, 2006:374). In measuring the reliability of the questions in the questionnaire evaluated in this study, the Alpha Value (Cronbach Alpha) and item-total correlation values were used. According to some researchers (Büyüköztürk, 2004, 165), an alpha coefficient greater than 0.70 indicates a high reliability scale, while others (Kalaycı et al., 2006, 403) suggest that a value of 0.60 and above in social sciences also indicates a scale of high reliability.

Table 6. Alpha coefficient values of the Short Form of the Smartphone Addiction Scale (ATBÖ-KF)

	Scale Mean (when the item is removed)	Scale Mean (when the item is removed)	Scale Mean (when the item is removed)	Scale Mean (when the item is removed)
S 1	23,02	101,265	,639	,891
S 2	23,25	100,399	,655	,890
S 3	22,92	99,679	,646	,891
S 4	22,63	95,143	,701	,887
S 5	23,06	96,458	,731	,885
S 6	23,17	101,263	,607	,893
S 7	23,11	99,680	,670	,889
S 8	23,42	103,085	,547	,897
S 9	22,72	96,079	,710	,886
S 10	22,63	98,290	,607	,894
N= 144 (α) = 0.900 Number of Variable = 10				

Internal Consistency and Reliability of the “Smartphone Addiction Scale-Short Form” (SAS-SF)

The internal consistency and reliability of the 10-item "Smartphone Addiction Scale-Short Form" (SAS-SF) were first assessed by looking at the alpha coefficient values. Previous research has reported the Cronbach's alpha coefficient for the SAS-SF as 0.90. For this study, the α value of the scale was calculated to be 0.900. According to the obtained alpha (α - Cronbach's Alpha) coefficient, the scale has a very high reliability (Table 6).

To test the reliability of the scale, in addition to the alpha value, the total score correlation values of the scale were also examined (Şencan, 2005, 257-62; Büyüköztürk, 2004, 165). This value should be greater than 0.30. As seen in Table 6, no value below 0.54 is observed. Therefore, according to the item-total score correlation values, the questionnaire is reliable.

Validity Analysis of the Smartphone Addiction Scale-Short Form (SAS-SF)

The long form of the smartphone addiction scale developed by Kwon et al. (2013) consists of 33 questions, while the short form developed for adolescents (the transitional period from childhood to adulthood) consists of 10 questions. The short form has been adapted into Turkish by Noyan et al. (2015) in Turkey, and its validity and reliability have been studied among university students. It has been shown to have a single-factor structure, and no subscale has been defined. The calculated Cronbach alpha value is reported as 0.867, indicating that it is valid and reliable for assessing smartphone addiction in young adults. The scale, consisting of 10 questions, is scored on a scale from 1 to 6. The scoring is as follows: 1 - Strongly Disagree, 2 - Disagree, 3 - Somewhat Disagree, 4 - Somewhat Agree, 5 - Agree, 6 - Strongly Agree. In the interpretation of the findings, as the score obtained from the scale increases, the risk of smartphone addiction also increases; according to the standard-setting study conducted, if a student's total score from the scale is below 29.50, they are not considered a smartphone addict, while a score above 29.50 indicates smartphone addiction. In other words, the cutoff score of the scale has been obtained as 29.50, regardless of gender. Participants scoring below this value are not assessed as smartphone addicts, while those with higher scores are considered to be smartphone addicts.

Factor Analysis for the Scale's Validity

Factor analysis was conducted to assess the validity of the scale. To determine whether the data collected from respondents are suitable for factor analysis, KMO (Kaiser-Meyer-Olkin) and Bartlett tests were applied. The KMO value should be above 0.5, and the Bartlett test should yield significant results (Kalaycı et al., 2006:321-322). Additionally, it is preferred that the factor loadings for the items found through factor analysis be 0.40 or higher (Büyüköztürk, 2004).

As a result of the factor analysis, the Kaiser-Meyer-Olkin (KMO) value for the Smartphone Addiction Scale-Short Form (SAS-SF) was found to be 0.910. A KMO value above 0.50 indicates that the scale is suitable for factor analysis (Büyüköztürk, 2004).

Secondly, the Bartlett test values were examined regarding the factor analysis. The significance value of the "Smartphone Addiction Scale" question list was found to be significant ($p = 0.000 < 0.01$; $\chi^2 = 658.252$). Furthermore, the 10 statements included in the smartphone addiction scale explain 52.950% of the total variance, indicating that it is unifactorial.

Analysis of the Data

For the analysis of the data, statistical test techniques were applied, and the normal distribution was checked using Skewness and Kurtosis values, both of which were found to be between -1.00 and +1.00. Considering that the Skewness (.683) and Kurtosis (-.109) values are referenced for normal distribution of scale scores in social sciences, it can be concluded that the scale scores of the "Smartphone Addiction Scale-Short Form" demonstrate normal distribution.

FINDINGS

In this section of the study, the findings related to the research problem and sub-problems are presented. What is the level of smartphone addiction among students?

The first sub-problem of the research is stated as "What is the level of smartphone addiction among students?" The total scores, mean, and standard deviation values obtained from the scale are presented in Table 7.

Table 7. Students' Participation Levels in the Smartphone Addiction Scale

Measure	Min.	Max.	Mean Participation Level ($\bar{x}$)	Standard Deviation
Smartphone Addiction	10	55	25.54	1.1

Participants' Responses to the Smartphone Addiction Scale

Participants demonstrated a mean participation level of $\bar{X} = 25.54$ in the "Smartphone Addiction" scale, indicating a near-moderate level of engagement. In other words, since the students' smartphone addiction levels remained below $\bar{X} = 29.50$, it can be interpreted that they are not considered smartphone addicts.

The levels of agreement regarding the statements included in the scale are presented in Table 8.

Table 8. The levels of agreement regarding the statements included in the scale

Scale	Statements	Average Participation Level ($\bar{x}$)	Standard Deviation
Smartphone Addiction	1. I cannot keep up with the tasks I planned because of smartphone use.	25.3	1.38
	2. I have difficulty concentrating while doing assignments or listening to lessons in class due to smartphone use.	23.0	1.42
	3. I feel pain in my wrists or neck when using my smartphone.	26.3	1.48
	4. I cannot live without my smartphone.	29.2	1.68
	5. I feel impatient and irritable when I do not have my smartphone in my hand.	24.9	1.54
	6. Even if I don't use it, my smartphone is always on my mind.	23.8	1.44
	7. Even if my daily life is greatly affected, I will never stop using my smartphone.	24.4	1.44
	8. I constantly check my smartphone to avoid missing conversations among other people on Twitter or Facebook.	21.2	1.43
	9. I use my smartphone for longer than I think.	28.3	1.60

10. People around me say that I use my smartphone too much.	29.2	1.66
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Table 8: When examining the levels of participation in the smartphone addiction scale, the highest participation was observed for the statements "People around me say that I use my smartphone too much" (M: 29.2) and "I can't live without my smartphone" (M: 29.2). Additionally, high levels of participation were noted in the statements "I use my smartphone longer than I think" (M: 28.3), "I feel pain in my wrists or neck when using my smartphone" (M: 26.3), and "I can't complete my planned tasks because of smartphone use" (M: 25.3). According to the calculations made for all statements, the addiction score is below $M = 29.50$; therefore, they appear to have a lower level of addiction. However, it should be noted that the level of smartphone addiction is close to the midpoint, suggesting that there may be a risk of addiction.

Do the smartphone addiction scale scores of students show a significant difference based on gender? Findings related to the sub-problem statement:

The second sub-problem statement of the study is expressed as "Do the smartphone addiction scale scores of students show a significant difference based on gender?" The total scores, means, and standard deviation values obtained from the scale are presented in Table 9.

Table 9: Smartphone addiction scores of students based on gender - Test results

Table 3: Smartphone addiction scores of students based on gender							Test Results	
Scale	n	$\bar{x}$	ss	Levene Test		sd	t Test	
				F	p		t	p
Smartphone addiction								
Famale	73	25,12	10,73	,986	,322	142	-,469	,640
Male	71	25,98	11,32					

*Independent Samples t-Test, * $<0,05$, ** $<0,01$*

To determine whether there is a significant difference in the perceptions of "Smartphone Addiction" based on the gender of the participants, the results of an independent samples t-test indicated that no statistically significant difference was found in students' perceptions of smartphone addiction according to their gender ($t: -0.469$; $p: 0.640 > 0.05$). This finding can be interpreted as indicating that there is no significant relationship between smartphone addiction and gender.

Do students' smartphone addiction scale scores show a significant difference according to school levels? Findings related to the sub-objective sentence

The third sub-objective problem statement of the research is expressed as "Do students' smartphone addiction scale scores show a significant difference according to school levels?" The total score, mean, and standard deviation values obtained from the scale are presented in Table 10.

Table 10. Differences in students' smartphone addiction based on school types

				Levene Test		t Test		
Scale	n	$\bar{x}$	ss	F	p	sd	t	p
Smartphone addiction								
Secondary School	62	22,67	10,00	4,410	,038	142	-2,787	,006**
High School	82	27,71	11,28					

*IndependentSamples t-Test, * $<0,05$, ** $<0,01$*

To determine whether there is a significant difference in the perceptions of "Smartphone Addiction" based on the type of school variable among the participants, the results of an independent samples t-test showed that a statistically significant difference was found in students' perceptions of smartphone addiction according to their school types ($t: -2.787$; $p: 0.006 < 0.01$). Accordingly, students studying at the high school level have higher levels of smartphone addiction (M: 27.71) compared to those studying at the middle school level (M: 22.67).

Findings Related to the Sub-objective Sentence on the Differences in Smartphone Addiction Based on Class Levels
The fourth sub-objective problem statement of the research is expressed as "Do students' smartphone addiction scale scores show a significant difference according to class levels?" The total score, mean, and standard deviation values obtained from the scale are presented in Table 11.

Table 11. One-way ANOVA results of students' smartphone addiction based on class levels

Dimensions	n	$\bar{x}$	Stand Dev	Variance.	Total Squares	sd	Mean Squares	F	p	LSD
Smartphone Addiction										
1. 1.st class	26	26,23	10,15	Between Groups	1107,494	3	369,165	3,190	,026*	2-1
2. 2nd. class	32	20,43	8,65							
3. 3rd.class	49	27,57	11,81							
4. 4th. class	37	26,81	11,30							
Total	144	25,54	11,00	Total	17309,660	143	115,730			2-4

*One Way ANOVA, * $<0,05$, ** $<0,01$*

To determine whether there is a significant difference in the perceptions of "Smartphone Addiction" based on the class level variable among the participants, the results of the one-way ANOVA analysis indicated that a statistically significant difference was found in students' perceptions of smartphone addiction according to their class levels (F: 3.190; p: 0.026 < 0.05). The difference found is significant in favor of 2nd-grade students. Accordingly, the smartphone addiction levels of 2nd-grade students were found to be lower than those of students in other grades. Findings Related to the Sub-objective Sentence on Differences in Smartphone Addiction Scale Scores According to Parents' Income Levels

The fifth sub-problem of the research is expressed as "Do students' smartphone addiction scale scores show a significant difference according to their parents' income levels?" The total score, mean, and standard deviation values obtained from the scale are presented in Table 12.

Table 12. One-way ANOVA results of students' smartphone addiction based on family income levels

Dimensions	n	$\bar{x}$	Stand Dev	Variance.	Total Squares	sd	Mean Squares	F	p	LSD
Smartphone Addiction										
1. None	23	29,21	11,02	Between Groups	675,901	3	225,300	1,896	,133	
2. Moderata	101	24,60	11,21							
3 Very much	16	27,93	9,08							
4. Quite a lot	4	18,75	6,80							
Total	144	25,54	11,00	Total	17309,660	143	118,813			

*One Way ANOVA, * $<0,05$, ** $<0,01$*

To determine whether there is a significant difference in the perceptions of "Smartphone Addiction" based on the family income levels of the participants, the results of the one-way ANOVA analysis indicated that no statistically significant difference was found in students' perceptions of smartphone addiction according to their family income levels (F: 1.896; p: 0.133 > 0.05).

Findings Related to the Sub-objective Sentence on the Significant Differences in Smartphone Addiction Scale Scores According to Parents' Occupations.

The sixth sub-problem of the research is expressed as "Do students' smartphone addiction scale scores show a significant difference according to their parents' occupations?" The total score, mean, and standard deviation values obtained from the scale for fathers' occupations are presented in Table 13.

Table 13. One-way ANOVA results of students' smartphone addiction based on fathers' occupations

Dimensions	n	$\bar{x}$	Stand Dev	Variance.	Total Squares	sd	Mean Squares	F	p	LSD
Smartphone Addiction										
Unemployed	33	28,48	10,57	Between Groups	432,533	3	144,178	1,196	,314	
Worker	77	24,89	11,21							
Civil Servant	25	23,44	10,88							
Retired	9	26,22	10,59							
Total	144	25,54	11,00	Total	17309,660	143	120,551			

*One Way ANOVA, * $<0,05$, ** $<0,01$*

To determine whether there is a significant difference in the perceptions of "Smartphone Addiction" based on the occupations of the fathers of the participants, the results of the one-way ANOVA analysis indicated that no statistically significant difference was found in students' perceptions of smartphone addiction according to their fathers' occupations ($F: 1.196; p: 0.314 > 0.05$).

Findings Related to the Sub-objective Sentence on the Differences in Students' Smartphone Addiction According to Their Mothers' Occupations

The seventh sub-problem of the research is expressed as "Do students' smartphone addiction scale scores show a significant difference according to their parents' education levels?" The total score, mean, and standard deviation values obtained from the scale for mothers' occupations are presented in Table 14.

Table 14. One-way ANOVA results of students' smartphone addiction based on mothers' occupations

Dimensions	n	$\bar{x}$	Stand Dev	Variance.	Total Squares	sd	Mean Squares	F	p	LSD
Smartphone Addiction										
1. Not working	109	25,85	10,85	Between Groups Within gr. Total	192,808	2	96,404	,794	,454	
2. Worker	20	22,80	9,49		17116,851	141	121,396			
3. Officer	15	27,00	13,85		17309,660	143				
Total	144	25,54	11,00							

*One Way ANOVA, * $<0,05$, ** $<0,01$*

According to the results, no statistically significant difference was found in the perception of smartphone addiction among students based on their mothers' occupations ($F: 0.794; p: 0.454 > 0.05$).

Conclusion

In the literature, addiction was previously understood as substance addiction, but recently, its scope has expanded, and research is now focusing on a new type of addiction (Yılmaz et al., 2020). This type of addiction, expressed as behavioral addictions unrelated to substances, involves "repetitive impulses to behave harmfully" (Marks, 1990), and despite the harm it causes to one's life, it is characterized by an uncontrollable desire to exhibit certain behaviors and engage in repeated pleasure-inducing behavioral patterns (Black, 2013; Mann et al., 2017). This addiction manifests itself not in dependence on a substance but in the addiction to a behavior or the feelings experienced when the behavior is performed (Alavi et al., 2011). On the other hand, behavioral addiction also involves excessive behavior accompanied by core addiction symptoms such as tolerance, withdrawal, loss of control, craving, cognitive salience, and mood regulation (Kwon et al., 2013).

This type of addiction is essentially digital addiction, encompassing smartphone addiction, internet addiction, screen addiction, social media addiction, digital game addiction, and an intense desire for various digital media tools (Dilci et al., 2019). People's addictions to technology are being investigated under the titles of internet addiction, technological addiction, computer addiction, virtual game addiction, Facebook addiction, digital game addiction, social media addiction, and importantly, smartphone addiction. In this context, the present research examined the relationship between smartphone addiction and certain demographic variables among adolescents in middle and high school. The World Health Organization (WHO) defines adolescence as the period between 10-19 years, youth as the period between 15-24 years, and those aged 10-24 as young people, while considering these age groups within adolescent health (WHO, 2020). Accordingly, individuals in middle and high school can be considered adolescents.

The data for this research, designed within the general survey model as part of a quantitative study, were collected through the Smartphone Addiction Short Form (SAS-SF). Since the scale scores were normally distributed, parametric test techniques were used to analyze the data. The findings revealed that the level of smartphone addiction among middle and high school students in the central district schools of Hozat was slightly below the level posing a risk ($\bar{X}=2.59$). One of the similar findings in the literature was made by Akyürek (2020) on high school students. According to this research, although the average score was slightly below the midpoint ($\bar{X}=2.44$), it was still considered significant enough to conclude that high school students were addicted to smartphones. It can be said that the findings of this research align with those of similar studies in the literature. For instance, Mazılı and Gültekin (2020) found that the majority of adolescents had a level of addiction slightly below the risk threshold. Similarly, Aljomaa, Qudah, Albursan, Bakhiet, and Abduljabbar (2016) reported similar findings in their study on high school students. A study by Çalışkan, Yalçın, Aydın, and Ayık (2017) also found that prospective teachers had a smartphone addiction level close to moderate. In Bağcı's (2018) research, it was found

that the students participating in the study had moderate levels of smartphone addiction. A study by Sırakaya (2018) found that associate degree students' smartphone use was at a moderate level. Durak and Seferoğlu (2018) aimed to examine the smartphone usage and addiction levels of 5th and 6th-grade middle school students based on certain demographic variables. According to the results, most students used smartphones mainly for gaming, and more than half of the students were classified as "addicted." Çakır and Oğuz's (2017) study involved 540 high school students. The results revealed that high school students had moderate levels of smartphone addiction and loneliness. Similarly, research by Chen, Liu, Ding, Ying, Wang, and Wen (2017) on smartphone addiction among medical students found that the smartphone addiction rate was 29.3% for women and 30.3% for men, with an overall rate of 29.3%. According to Kwon et al. (2013), students exhibited high levels of smartphone addiction. In a study by Haug, Castro, Kwon, Filler, Kowatsch, and Schaub (2015), 16.9% (256) of students were found to be smartphone addicts. The study by Kahyaoglu Süt, Kurt, Uzal, and Özdilek (2016) found that university students used their smartphones at high rates, while Mert and Özdemir's (2018) research found that the average smartphone usage rate among participants was above average ($\bar{X}=3.19$).

These findings indicate that secondary school students are at a borderline risk of smartphone addiction, and if preventive measures are not taken, it is inevitable that they will exceed the risk threshold and reach a level of behavioral addiction. This, in turn, is likely to lead to undesirable situations and events reflected in society due to the negative impact on the individual's life.

In conclusion, considering the fact that individuals and society cannot remove digital tools from their lives and instead must use them as a significant necessity, solutions must be developed. These solutions should be implemented at the international and national levels, involving all levels of society, including families, parents, schools, teachers, civil society organizations, and especially the media, which should be equipped with the necessary knowledge and resources on this matter.

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Program Development Studies for Undergraduate Courses in Turkey: A Systematic Review

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ABSTRACT

This study examines the process of program development for undergraduate-level courses in Turkey, focusing on the methodologies, models, and practices employed in curriculum design. The research adopts a systematic review approach to analyze 25 graduate theses published between 2010 and 2023, sourced from the Council of Higher Education (YÖK) Thesis Center. The findings reveal that the majority of studies (80%) were doctoral theses, reflecting the comprehensive and long-term nature of program development. Methodologically, qualitative (40%) and mixed methods (52%) were more prevalent than quantitative approaches (8%), highlighting the complexity of educational research. The most commonly used program design model was Demirel's Educational Program Development Model (DEPGEM), favored for its alignment with the Turkish education system. Studies were conducted across various disciplines, with education faculties (48%) being the most prominent, followed by health sciences (20%), fine arts (12%), and tourism (8%). Program evaluation was included in 48% of the studies, with pilot applications used in only 28%, indicating a need for more robust evaluation practices. Needs analysis was conducted in 76% of the studies, often involving multiple stakeholders such as experts, students, and industry representatives. Objectives were frequently based on Bloom's taxonomy (44%), though 56% of studies lacked clarity in defining objectives. The study concludes that program development in Turkey is increasingly adopting systematic and student-centered approaches, but greater methodological rigor and interdisciplinary collaboration are needed. Recommendations include the integration of technology, the use of mixed methods, and adoption of both local and international models to enhance the quality and effectiveness.

Keywords: Curriculum Desing, Curriculum Research, Systematic Review, Undergraduate Education.

INTRODUCTION

The term "curriculum" originates from the Latin word meaning "racecourse," metaphorically comparing the educational process to a race. Today, curriculum is fundamentally defined as a set of educational plans. However, this concept has been interpreted differently by various scholars. Schubert (1987) views curriculum as a product of society, emphasizing its primary purpose as transforming society. As a field of study, curriculum is grounded in philosophical, historical, psychological, and social foundations, serving as a tool to explore, develop, and interpret educational ideas. Simultaneously, it functions as a system for organizing educational processes and, as a subject area, refers to the content of a specific discipline (Ornstein & Hunkins, 2018). Curriculum is often utilized as a plan or written document that outlines desired objectives. In line with humanistic thought, Caswell and Campbell (1935) define curriculum as all the experiences students undergo under the guidance of teachers. This definition treats the student as a holistic being. The complex nature of curriculum has shifted the focus from what it is to what it does, what it should do, and how it should be developed.

In the curriculum development process, three fundamental approaches stand out: subject-centered, student-centered, and problem-centered. Each approach shapes curriculum design by emphasizing different elements. For instance, in student-centered approaches, the curriculum is structured around the needs of students (Ornstein & Hunkins, 2018). Curriculum development has been shaped by various models since the early 20th century, with Ralph W. Tyler's model recognized as one of the most influential works in this field. Curriculum models are generally classified as technical/scientific (positivist) and non-technical/post-positivist approaches. While technical approaches advocate for a systematic, step-by-step design of the curriculum, post-positivist approaches emphasize student-centeredness and process-oriented practices (Ornstein & Hunkins, 2018). Humanist theories, in particular, have gained prominence within post-positivist approaches.

In Turkey, curriculum development efforts have paralleled global trends but have faced interruptions due to the

country's political and social dynamics. In the early years of the Republic, curriculum development was carried out in the form of listing courses, while scientifically based curricula began to be developed after the 1950s. The 1968 curriculum is considered a significant turning point in this regard. However, since the 1980s, standardization in curriculum development processes has not been achieved, and different models have continued to be used (Demirel, 1992; Gözütok, 2003). The curriculum is one of the cornerstones of the education system, with a complex structure encompassing both theoretical and practical dimensions. Although curriculum development efforts in Turkey have encountered various challenges throughout history, more systematic and student-centered approaches are increasingly being adopted today. In this process, it is of great importance to consider local needs alongside global trends.

Program development is a comprehensive and dynamic process that forms the foundation of educational programs. This process begins with the determination of the program's objectives and includes the design and implementation of necessary content, teaching-learning strategies, and assessment methods to achieve these objectives. Program development represents a continuous cycle of improvement and refinement rather than a static structure (Demirel, 2005; Erden, 1998; Erişen, 1997; Lunenberg, 2011). Sağlam (2011) explains this process primarily through the stages of planning, implementing, and evaluating the program, while Yaşar (2014) addresses program development under two main headings: creating a new program and improving an existing one. In this context, the program development process encompasses both the design, implementation, and evaluation of new programs and the identification and improvement of shortcomings in existing programs.

In the program development process, the fundamental steps of planning, implementation, and evaluation stand out. However, Thijs and Akker (2009) explain this process through a cyclical model, emphasizing the stages of analysis, design, development, implementation, and evaluation. In this cyclical process, the current situation is first analyzed, and needs are identified. Subsequently, in the design phase, objectives and content are determined, while in the development phase, this design is transformed into a feasible product. The evaluation phase, central to the process, involves analyzing the outcomes of implementation and improving the program (Thijs & Akker, 2009). Program development plays a critical role in providing quality education that supports students' personal, academic, and professional growth. Ishemo et al. (2012) outline the primary objectives of program development as follows: (1) providing educators with a clear roadmap to ensure alignment between teaching and learning processes and objectives, (2) disseminating knowledge to society and cultivating informed individuals, (3) facilitating the transfer of knowledge and expertise across generations, (4) equipping individuals and communities with the knowledge and skills to adapt to changing conditions, and (5) enabling individuals to achieve their goals and contribute to society.

The planned and effective progression of the teaching-learning process is only possible with well-designed curricula. Therefore, the development of discipline-specific curricula is of great importance for educational institutions to achieve their goals (Yazıcı & Koca, 2014). Ertürk (1998) defines the program development process as a continuum consisting of planning, designing, piloting, evaluating, revising, and disseminating stages. At each stage, systematic steps are taken to enhance the program's effectiveness, and the program is continuously improved. This process highlights the dynamic and variable nature of educational programs (Ertürk, 1998). In conclusion, program development is one of the cornerstones of the education system, ensuring the creation of effective, sustainable, and student-centered educational programs. This process requires a comprehensive approach that encompasses both the design of new programs and the improvement of existing ones.

Among program development models, the Tyler Model, Taba Model, Taba-Tyler Model, Systems Approach Model, Eisner Program Development Model, Kerr Model, the Ministry of National Education (MEB) Program Development Model, and Demirel's Program Development Model have the following characteristics: The Tyler model is one of the most well-known approaches in curriculum development. According to Tyler (2014), four fundamental questions should be asked when developing a curriculum or instructional plan: (1) What educational objectives should the school achieve? (2) What educational experiences should be provided to achieve these objectives? (3) How can these educational experiences be organized most effectively? (4) How can it be determined whether the objectives have been achieved? These questions form the four main components of an educational program (Ornstein & Hunkins, 2009). In the Tyler model, general objectives are determined based on data derived from society, the individual, and the subject area. These objectives are filtered through educational philosophy and learning psychology to transform them into specific instructional goals, and the process is completed through the selection, organization, guidance, and evaluation of learning experiences. The Taba model, on the other hand, adopts an inductive approach and offers a seven-stage process aimed at fostering students' comprehension and critical thinking skills (Laanemets & Kalamees-Ruubel, 2013; Olivia, 1997). The process begins with identifying needs and includes stages such as formulating objectives, selecting and organizing content, determining learning experiences, evaluating learning outcomes, and checking the relationships among program

components. The Taba-Tyler model can be defined as a rational planning model that places the student at the center of the teaching-learning process. This hybrid model combines Taba's inductive approach with Tyler's views on program components, incorporating the common aspects of both approaches in program development processes (Erişen, 1997).

The systems approach model, developed by Wulf and Schave (1984), suggests that teachers can also develop curricula. The model consists of three main components: problem definition, identification and evaluation of needs and content, and evaluation. The evaluation process is present at every stage, but the model is noted to focus predominantly on the evaluation dimension (Demirel, 1992). The Eisner program development model emphasizes that five fundamental dimensions must be considered in the education system: objectives, structure, curriculum, pedagogy, and evaluation (Eisner, 1991). The objectives dimension involves determining the core values of education, while structure pertains to the organization of schools and time management. The curriculum aims to facilitate students' interaction with fundamental knowledge and skills, while pedagogy emphasizes the effectiveness of the teaching process. Finally, evaluation should not only involve grading students but also serve as a tool for school improvement.

The Kerr model addresses the program development process through four main components: objectives, knowledge, learning experiences, and evaluation (Kerr, 1968). In the model, the selection and organization of content based on objectives is a critical stage, and it emphasizes that knowledge construction requires consistency, repetition, and organization. Learning experiences encompass the interaction between students and environmental factors, and this process is influenced by the school's organizational structure and teacher-student relationships. Evaluation involves assessing the feasibility of objectives, the appropriateness of content and methods, and measuring student achievement (Ishemo et al., 2012).

The MEB Program Development Model, developed by the Turkish Ministry of National Education in 2004, is influenced by the Taba and Tyler models but stands as an original model (Uzunboylu & Hürsen, 2012). While adopting a student-centered approach, the model also incorporates a subject-centered perspective in determining objectives (Demirel, 2006). Progressing from general objectives to skills and outcomes, the model emphasizes interdisciplinary connections and material development. Demirel's Program Development Model provides a framework aimed at enhancing the quality of teacher training. Initially structured around three main stages, the model was expanded over time into a structure comprising five sections and fifteen steps. While it shares similarities with the Taba-Tyler and MEB program development models, it differs in terms of planning, pilot applications, and evaluation processes. The model, which has a cyclical structure, highlights the importance of establishing R&D units and ensuring continuity in the program development process.

Curriculum development efforts vary significantly across countries, often reflecting different educational philosophies, cultural values, and technological advances. For example, Finland's curriculum framework emphasizes student autonomy, interdisciplinary learning, and the integration of digital tools, contrasting with the more centralized and subject-focused approaches seen in countries such as South Korea (Sahlberg, 2015). Similarly, the United States has increasingly adopted competency-based curricula that focus on mastering skills rather than time spent in classrooms; this trend has influenced educational reforms in countries such as Australia and Canada (Patrick, Kennedy, & Powell, 2013). These global trends highlight the importance of aligning curriculum development with both local needs and international best practices. In the European context, the European Union's emphasis on lifelong learning and digital competence has led to the integration of technology-enhanced learning strategies into national curricula. For example, Estonia's 'Digital Turn' initiative has embedded coding and computational thinking into its curriculum from primary school, reflecting a broader trend to prepare students for a digital economy (European Commission, 2020). Similarly, Singapore's curriculum reforms have focused on developing 21st-century skills such as critical thinking, creativity, and collaboration, which are increasingly seen as essential in a globalized world (Tan, 2017). These examples highlight the transformative potential of aligning curriculum development with global education priorities. Moreover, the role of educational technology in curriculum development has been a focus of international discourse. In the United Kingdom, the integration of artificial intelligence and adaptive learning platforms into the curriculum has been shown to personalize learning experiences and improve student outcomes (Luckin et al., 2016). Meanwhile, in Japan, the government's 'GIGA School Program' aims to provide every student with a digital device and high-speed internet, reflecting a commitment to using technology for equal access to education (MEXT, 2021). These initiatives demonstrate how technology can act as a catalyst for curriculum innovation on a global scale.

In contrast, developing countries often face challenges in aligning their curricula with global trends due to resource constraints and infrastructure limitations. For example, lack of access to digital tools and internet connectivity in many African countries has hindered the adoption of technology-focused curricula (Unwin et al., 2020). However,

initiatives such as Kenya's Digital Literacy Program, which aims to integrate tablets into primary education, demonstrate the potential to overcome these barriers through targeted investments and partnerships (Kozma & Vota, 2014). These examples highlight the need for context-sensitive approaches to curriculum development that balance global trends with local realities. Studies also demonstrate the increasing importance of sustainability education in curricula worldwide. Countries such as Sweden and Germany have integrated environmental literacy and the sustainable development goals (SDGs) into their national curricula, reflecting a broader commitment to addressing global challenges (UNESCO, 2017). Similarly, New Zealand's curriculum provides a model for incorporating local values into global frameworks by emphasizing local knowledge and cultural sustainability (Ministry of Education, New Zealand, 2020). These examples demonstrate how curricula can serve as vehicles for promoting both global citizenship and local identity.

Educational technology is increasingly playing a significant role in curriculum development processes. The rapid advancement of technology has necessitated that educational systems adapt to these changes. Educational technology not only serves an instrumental function in curriculum design but also has a transformative impact on learning processes. Particularly in the digital age, the ways in which students access information and their learning styles have evolved, requiring curricula to be designed with technology integration in mind (Selwyn, 2016). Educational technology enriches both content delivery and learning experiences in the curriculum development process. For instance, online learning platforms, virtual reality applications, and artificial intelligence-supported learning systems provide learning environments tailored to students' individual needs (Bates, 2015). These technologies enhance student engagement while enabling teachers to monitor and assess student performance in real time. Additionally, educational technology allows curricula to become more flexible and dynamic, enabling them to adapt more quickly to rapidly changing knowledge and skill requirements (Kirkwood & Price, 2014). In Turkey, the integration of educational technology into curriculum development processes is also increasing. Initiatives such as the FATİH Project have encouraged the strengthening of technological infrastructure in schools and the use of digital content (MEB, 2012). However, in this process, technology should not be viewed merely as a tool but as a transformative element in learning processes. The effective use of educational technology can make curricula more inclusive, accessible, and student-centered (Altun & Ateş, 2018).

When the literature review focuses on program development studies for undergraduate-level courses, it becomes evident that there is no comprehensive compilation on this topic. To address this gap, a systematic review method has been adopted, aiming to provide a broad perspective on all studies conducted on program development at the undergraduate level. This approach seeks to contribute significantly to the body of knowledge in the field by offering a comprehensive overview of these studies.

METHODOLOGY

This study aims to comprehensively examine the process of research conducted in the field of program development for undergraduate-level courses, from its structuring to its conclusion. To achieve this goal, the systematic review method has been adopted. A systematic review is a methodological approach that involves identifying, selecting, critically analyzing, and systematically collecting and examining data from relevant studies to reassess a specific research question (Millar, 2004; Littell, Corcoran, & Pillai, 2008; Torgerson, 2003). Systematic reviews play a significant role in literature review processes due to their characteristics of objectivity, comprehensiveness, and replicability. Such studies, by clearly specifying the methods and study selection criteria, allow other researchers to easily replicate them and verify the results. For these reasons, systematic reviews are considered a critical tool for generating robust evidence (Hemingway & Brereton, 2009; Moula & Goodman, 2009). Millar (2004) emphasizes that systematic review studies should follow specific stages. These stages include clearly defining the research purpose, selecting studies based on predetermined criteria, outlining the key characteristics of the selected studies, and analyzing the findings from these studies to draw conclusions. In this study, the systematic review method has been chosen, aiming to conduct a detailed analysis of the examined research and to explore the data in a multidimensional and in-depth manner. The primary objective of this research is to identify and comprehensively evaluate studies conducted on program development for undergraduate-level courses in Turkey. Within this framework, the design of this research has been constructed by considering these principles.

Data Collection Process

The Council of Higher Education (YÖK) Thesis Center database was preferred to access the studies included in the review. The primary rationale for this choice is that program development processes, which are the focus of this review, are extensively addressed in graduate thesis research. Program development studies involve comprehensive and long-term sequential stages, such as needs analysis, program design, implementation, and evaluation. Therefore, the YÖK Thesis Center, which houses a large number of graduate theses, was deemed a suitable and reliable source for accessing such studies.

The data collection process was conducted between January 10, 2025, and January 15, 2025. No year restrictions were applied during the search, and the keyword "program development" was used to identify relevant studies. The initial search yielded 76 theses, which were then filtered under the "Education and Training" category, resulting in the identification of 57 theses deemed relevant. During the literature review process, the abstracts of the accessed studies were thoroughly examined by the researchers, and studies aligned with the objectives of the review were systematically recorded in a digital format using the "Year-Author(s)-Type" structure. The synthesis and categorization of the selected studies were carried out based on specific thematic criteria. Initially, a preliminary classification was made based on the educational level (undergraduate, graduate, etc.) and disciplinary focus (natural sciences, social sciences, engineering, etc.) of the studies. Subsequently, the stages of the program development process addressed by the studies (planning, design, implementation, evaluation) were analyzed, leading to a second round of categorization. Additionally, a detailed classification was performed by considering the methodologies used in the studies (quantitative, qualitative, mixed methods) and the program development models employed (Tyler, Taba, Taba-Tyler, etc.). Following the evaluations, it was determined that 22 theses did not focus on program development for an undergraduate-level course and were therefore excluded from the study. As a result, 25 theses were included in the review. The detailed flow chart of the search process is presented in Figure 1.

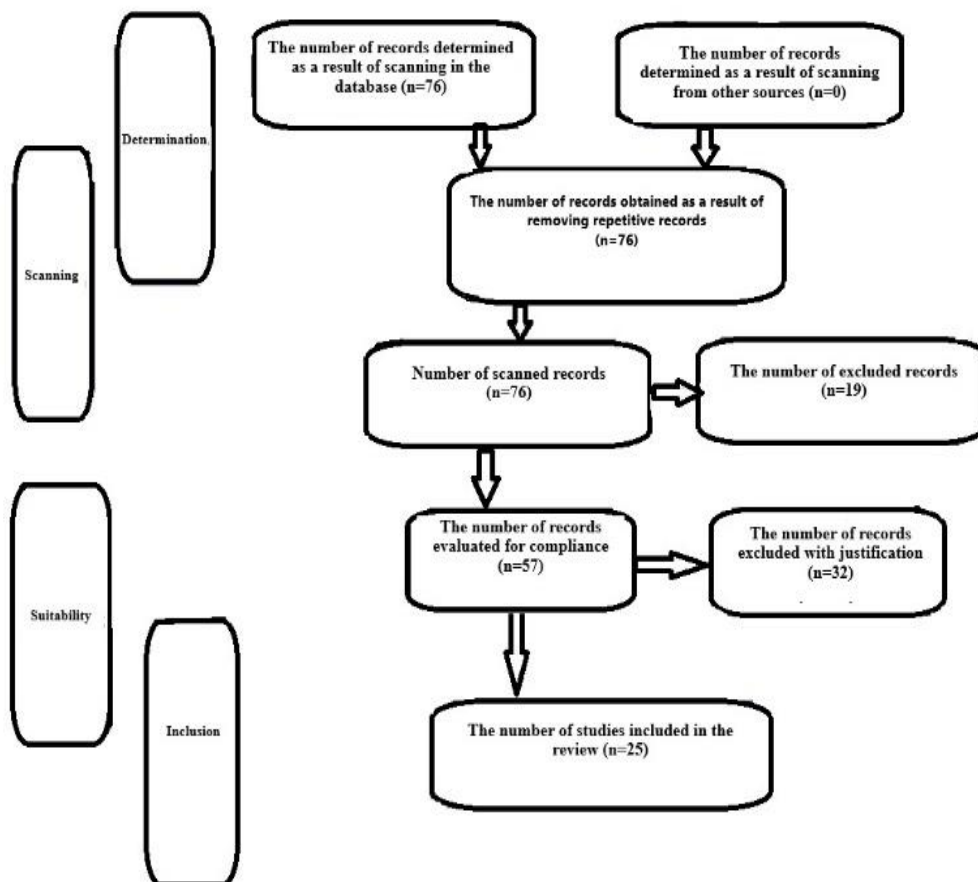


Figure 1: Search Process Diagram (Moher, D., Liberati, A., Tetzloff, I, Altman, D. G. and PRISMA Group, 2009, s. 1009).

FINDINGS

Research Types

Within the scope of the review, the focus was on graduate thesis studies conducted in the field of program development. According to the data presented in Figure 2, out of the 25 studies included in the review, 20 were doctoral theses (80%), and 5 were master's theses (20%). The fact that the majority of the research was published in the format of doctoral theses is considered a significant finding. This outcome can be interpreted as being related to the comprehensive and long-term nature of program development studies.

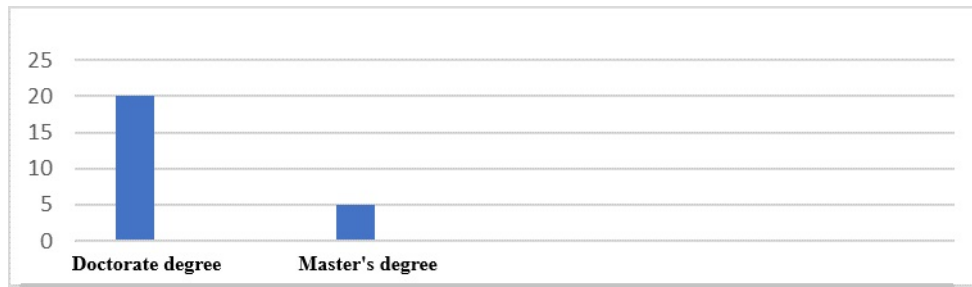


Figure 2. Resarch Types

Publication Years of the Studies

A comprehensive literature review was conducted on the YÖK Thesis Center database without any year restrictions. As a result of the examination, it was determined that the studies analyzed were published between 2010 and 2023. However, it was observed that studies were not published every year within this time frame. A column chart showing the distribution of studies by year is presented in Figure 3. Based on the graphical analysis, the earliest study on program development for an undergraduate-level course was found to have been published in 2010. Furthermore, when the publication density of the studies was examined, it was concluded that the highest number of studies, totaling 5, were conducted in 2019. These findings provide a significant perspective on the temporal distribution of studies in this field.

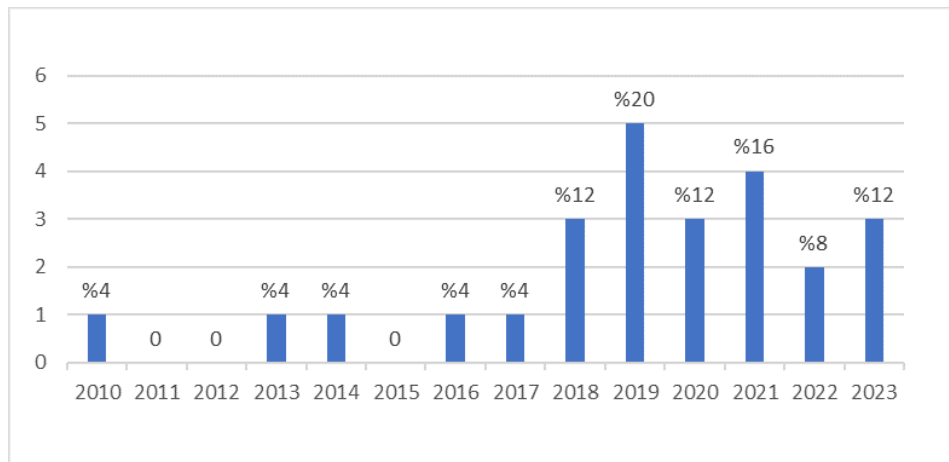


Figure 3. Publication Years of the Studies

Research Methods

When examining the methodological distribution of the 25 studies included in the review, it was found that 2 studies used quantitative methods (8%), 10 studies used qualitative methods (40%), and 13 studies employed mixed methods (52%). Among the studies using quantitative methods, one utilized the survey technique, while the other applied an experimental model. Of the studies conducted with qualitative methods, 3 were based on case study, 2 on survey models, and 2 on action research methods. The detailed distribution of the methods used in the studies is presented in Figure 4.

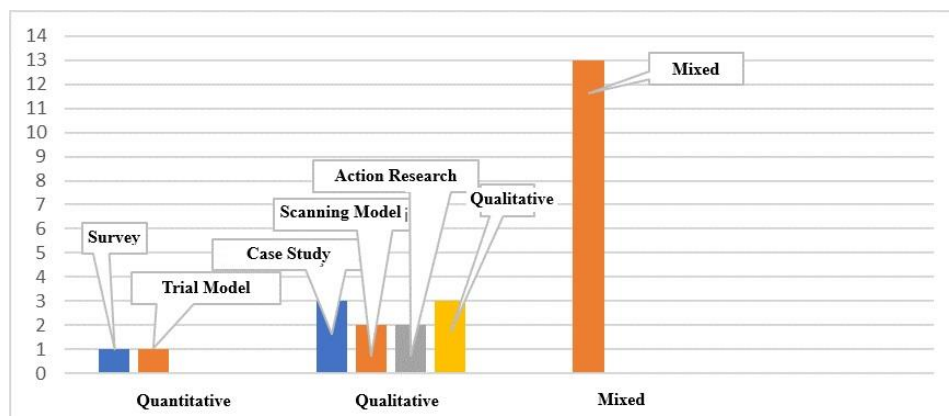


Figure 4. Research Methods

Program Design Models Used in the Studies

It was found that the program design models used in the studies were not explicitly stated in every study. However, among the studies that specified a design model, the most commonly used model was DEPGEM, which was employed in 8 studies. Other design models were used only once each, including the Taba Model, Multidimensional Contemporary Teaching Model, Oliva Program Development Model, Taba-Tyler and Systems Model, Outcome-Based Design Model, ADDIE Model, Learning Trajectories in Education Model, and Taba-Tyler along with Kern and Posner Models. The program design models are presented in Figure 5.

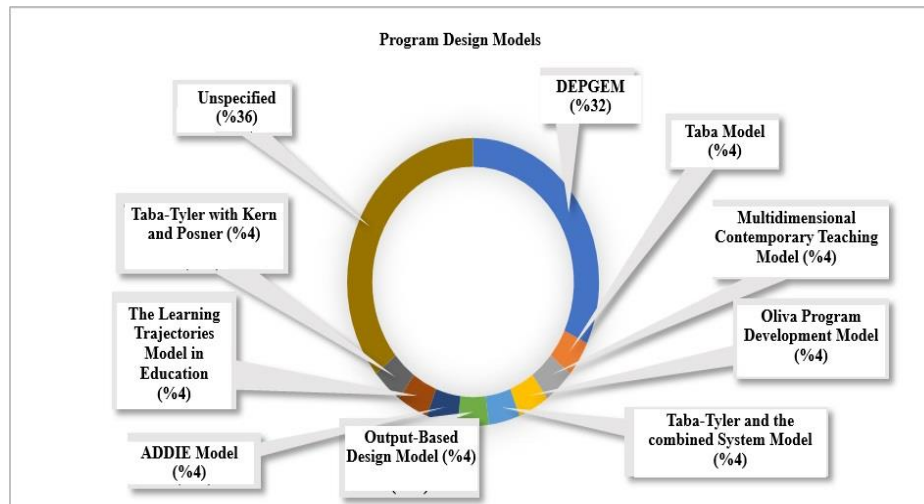


Figure 5. Program Design Models Used in the Studies

Faculties Where the Studies Were Conducted, Pilot Applications, and Program Evaluation Studies

When examining the faculties and departments where the studies were conducted, it was observed that the studies were distributed across various academic disciplines. According to the findings, 12 studies (48%) were carried out within education faculties, 5 studies (20%) in health sciences faculties, 3 studies (12%) in fine arts faculties, and 2 studies (8%) in tourism faculties. Additionally, other studies were conducted in institutions such as architecture faculties (4%), the International Baccalaureate Diploma Program (4%), and state conservatories (4%). When examining the disciplinary distribution of studies conducted within education faculties, it was found that 3 studies were in primary school teaching, 3 in Arabic language education, 2 in music education, 1 in social studies teaching, and 1 in preschool teaching, while 2 studies were designed to encompass all departments within the education faculty. The detailed distribution of the faculties and departments where the studies were conducted is presented in Figure 6. These findings reveal that the studies exhibit interdisciplinary diversity and that education faculties stand out as a prominent focus in this field.

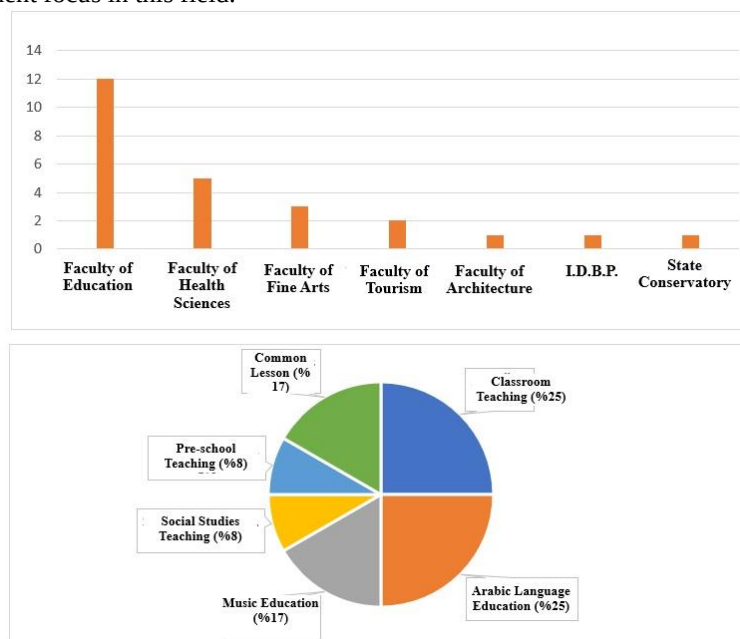


Figure 6. Faculties Where the Studies Were Conducted

In the studies conducted, it was found that a total of 12 studies (48%) included a program evaluation phase. Among these studies, 7 relied solely on the opinions of field experts, while 2 evaluated only student feedback. On the other hand, in 3 studies, data obtained from both experts and students were analyzed together. The details are presented in Figure 7. Additionally, it was concluded that only 7 of the studies examined (28%) conducted pilot applications to measure the effectiveness of the program. These findings reveal diversity in the involvement of different stakeholder groups in program evaluation processes and the use of pilot applications.

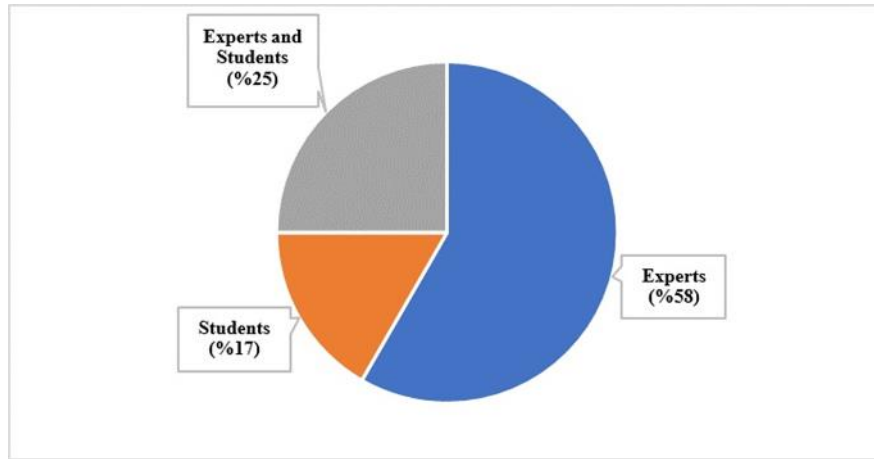


Figure 7. Program Evaluation Phase

Needs Analysis Studies in the Research

The analysis of the 25 studies examined in this research revealed that 6 studies (24%) did not include any needs analysis, while 19 studies (76%) conducted a needs analysis. When examining the methodological approaches of the studies that performed a needs analysis, it was found that 2 studies relied solely on a literature review, 1 study utilized only expert opinions, and 5 studies determined needs solely through student participation. Additionally, 5 studies involved both experts and students, while 4 studies consulted expert and student opinions in addition to conducting a literature review. Furthermore, 2 studies included the opinions of experts, students, industry representatives, and competent professionals in the needs analysis process. These findings demonstrate the diversity of needs analysis methods and the inclusion of different stakeholder groups in the process. The relevant data are presented in Figure 8.

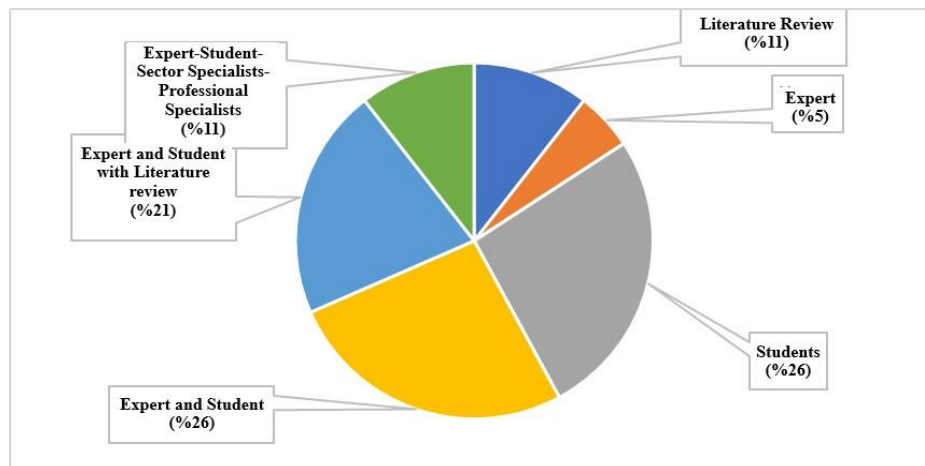


Figure 8. Needs Analysis Studies in the Research

Determination of Objectives in the Research

When analyzing the approaches to determining objectives within the scope of the examined studies, it was found that in 11 studies (44%), the objectives were formulated based on Bloom's taxonomy. On the other hand, in 14 studies (56%), no information regarding the taxonomy of objectives was available. This indicates that the objective-setting process was not clearly defined in these studies or that there was a methodological gap in this regard. The relevant data are presented in Figure 9.

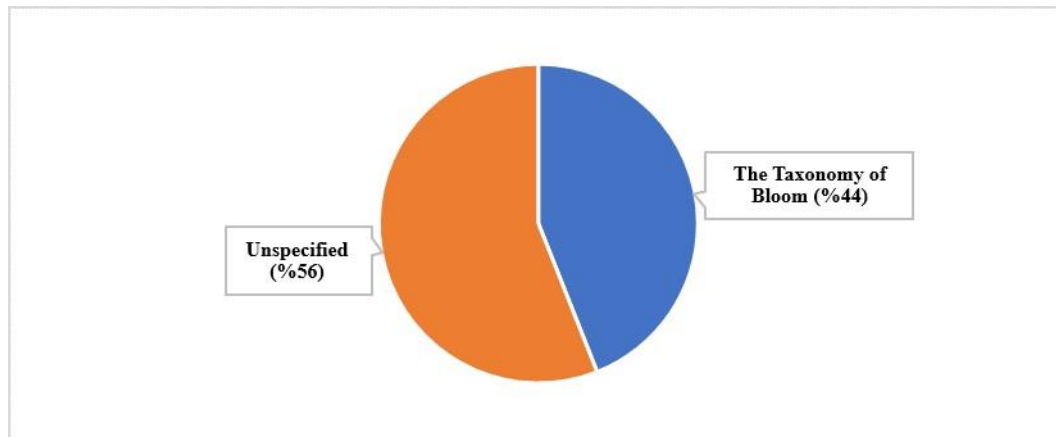


Figure 9. Determination of Objectives in the Research

CONCLUSION AND DISCUSSION

The fact that the majority of the research was published in the format of doctoral theses can be considered a significant finding in the literature. This outcome can be interpreted as being related to the comprehensive and long-term nature of program development studies. Program development processes typically involve detailed needs analysis, objective setting, content design, implementation, and evaluation stages, making it a natural tendency for such studies to be addressed within comprehensive academic works like doctoral theses (Demirel, 2015; Posner & Rudnitsky, 2006). Similarly, in the Turkish literature, it is observed that program development studies are predominantly concentrated in graduate theses. Particularly, doctoral theses in the field of educational sciences serve as an important resource for providing theoretical and practical contributions to program development processes (Şimşek, 2004; Erden, 2011). This can be explained by the interdisciplinary approach required for program development studies and the need for a long-term research process (Taba, 1962; Ornstein & Hunkins, 2018). Additionally, in foreign literature, program development studies are often addressed in doctoral-level research. For example, the program development model proposed by Tyler (1949) emphasizes the need for such studies to be conducted systematically and comprehensively. Similarly, Fullan (2007) highlights that educational reforms and program development processes should be approached with a long-term perspective. In this context, it can be said that doctoral theses provide a suitable research format for program development studies. In conclusion, the concentration of program development studies within doctoral theses can be associated with the complexity and comprehensiveness of this process. Since such studies require in-depth research both theoretically and practically, doctoral theses are considered an appropriate platform to meet this need.

When analyzing the methodological distribution of the 25 studies included in the review, it was found that 2 studies used quantitative methods (8%), 10 studies used qualitative methods (40%), and 13 studies employed mixed methods (52%). These findings indicate that qualitative and mixed methods are more commonly preferred in educational research. Among the studies using quantitative methods, one utilized the survey technique, while the other applied an experimental model. Of the studies conducted with qualitative methods, 3 were based on case study, 2 on survey models, and 2 on action research methods. This distribution demonstrates that various methods are used in educational research and that different approaches are adopted depending on the nature of the research questions (Creswell & Creswell, 2018; Büyüköztürk et al., 2020). The preference for the survey technique in quantitative studies can be associated with the opportunity to collect data from large samples and perform statistical analyses (Fraenkel, Wallen, & Hyun, 2019). Studies using experimental models are important for examining causal relationships and obtaining valid results through controlled experiments (Cohen, Manion, & Morrison, 2018). The adoption of different approaches such as case study, survey models, and action research in qualitative studies is significant for in-depth examination of research questions and consideration of contextual factors (Yıldırım & Şimşek, 2018; Merriam & Tisdell, 2016). Particularly, action research stands out as a method that allows researchers to actively engage in the process in practice-oriented studies (Stringer, 2014). The predominance of mixed methods studies can be explained by the ability to combine quantitative and qualitative data to achieve more comprehensive and holistic results (Johnson & Onwuegbuzie, 2004). Mixed methods offer advantages in educational research by integrating different data sources and examining research questions from multiple dimensions (Creswell & Plano Clark, 2018). In conclusion, the methodological distribution of the examined studies highlights the prominence of qualitative and mixed methods in educational research. This can be associated with the complex and multidimensional nature of educational processes. The lower preference for quantitative methods can be interpreted as an indicator of the need for contextual and qualitative data over numerical data in educational research (Merriam, 2009; Patton, 2015).

It was found that the program design models used in the studies were not explicitly stated in every study. This indicates a lack of methodological transparency in program development processes. However, among the studies that specified a design model, the most commonly used model was Demirel's Educational Program Development Model (DEPGEM), which was employed in 8 studies. This model is frequently preferred due to its suitability for the Turkish education system and the systematic structure of its stages (Demirel, 2015). Other design models were used only once each, including the Taba Model, Multidimensional Contemporary Teaching Model, Oliva Program Development Model, Taba-Tyler and Systems Model, Outcome-Based Design Model, ADDIE Model, Learning Trajectories in Education Model, and Taba-Tyler along with Kern and Posner Models. The diversity of these models demonstrates the adoption of different approaches in program development processes (Ornstein & Hunkins, 2018; Posner & Rudnitsky, 2006). The widespread use of DEPGEM can be explained by its suitability for the Turkish education system and its ease of application by teachers and program development experts (Demirel, 2015). The lower preference for other models may be associated with their limited recognition in the local context or the complexity of their implementation (Şimşek, 2004). For example, classical models such as the Taba Model and Tyler Model, while important for their goal-oriented approach in program development, are less preferred today due to the need for more flexible and dynamic models (Taba, 1962; Tyler, 1949). More structured and phased models like the ADDIE Model are frequently used, particularly in technology-enhanced learning environments. This model stands out for its systematic approach to program development through the stages of analysis, design, development, implementation, and evaluation (Branch, 2009). Similarly, the Outcome-Based Design Model is preferred in higher education programs for its focus on learning outcomes (Spady, 1994). Newer models, such as the Learning Trajectories in Education Model, are notable for their emphasis on individualized learning processes and flexible program design tailored to student needs (Simon & Tzur, 2004). However, the fact that this model was used only once in the examined studies suggests that it has not yet gained widespread adoption. In conclusion, the findings regarding the use of program design models reveal that local models like DEPGEM are prominent in program development studies in Turkey, while internationally recognized models are occasionally preferred. This highlights the need to adopt models that are both aligned with local needs and compatible with universal standards (Erden, 2011; Fullan, 2007).

When examining the faculties and departments where the studies were conducted, it was observed that the studies were widely distributed across various academic disciplines. According to the findings, 12 studies (48%) were carried out within education faculties, 5 studies (20%) in health sciences faculties, 3 studies (12%) in fine arts faculties, and 2 studies (8%) in tourism faculties. Additionally, other studies were conducted in institutions such as architecture faculties (4%), the International Baccalaureate Diploma Program (4%), and state conservatories (4%). This distribution demonstrates that program development studies are not limited to educational sciences but adopt an interdisciplinary approach (Demirel, 2015; Ornstein & Hunkins, 2018). Within education faculties, 3 studies were in primary school teaching, 3 in Arabic language education, 2 in music education, 1 in social studies teaching, and 1 in preschool teaching, while 2 studies were designed to encompass all departments within the education faculty. These findings highlight the central role of education faculties in program development studies and the focus on teacher training processes in this field (Erden, 2011; Şimşek, 2004). Studies conducted in health sciences faculties are important for updating vocational training programs and developing curricula that meet the needs of the healthcare sector (Harden, 2001). Studies in fine arts and tourism faculties demonstrate the adoption of creative and flexible approaches in program development processes, reflecting the practical nature of these fields (Eisner, 2002; Tribe, 2002). Studies conducted in architecture faculties, the International Baccalaureate Diploma Program, and state conservatories emphasize the interdisciplinary and international dimensions of program development processes. In particular, the International Baccalaureate Program serves as an important example for developing curricula aligned with global standards (Hill, 2012). In conclusion, the fact that program development studies are conducted in various faculties and departments underscores the need for an interdisciplinary approach and the adoption of customized models to meet the unique needs of each field. This highlights the importance of addressing program development processes in both local and universal contexts (Fullan, 2007; Posner & Rudnitsky, 2006).

It was found that 12 studies (48%) included a program evaluation phase. This finding demonstrates that the evaluation stage is recognized as an important component of program development processes. However, the fact that evaluation processes were addressed in only about half of the studies indicates the need to increase awareness and implementation levels of this stage (Demirel, 2015; Stufflebeam & Shinkfield, 2007). In 7 of these studies, only the opinions of field experts were consulted, while in 2 studies, only student feedback was evaluated. Consulting field experts is an important step in ensuring the theoretical and pedagogical validity of the program (Erden, 2011). On the other hand, studies that used student feedback provide valuable data on how the program is perceived by its users and its contribution to learning processes (Patton, 2015). Additionally, in 3 studies, data from both experts and students were analyzed together. The use of multiple data sources makes program evaluation processes more comprehensive and reliable (Creswell & Plano Clark, 2018). This approach also allows for a

balanced evaluation of both the theoretical and practical dimensions of the program (Fullan, 2007). It was also found that only 7 studies (28%) conducted pilot applications to measure the effectiveness of the program. Pilot applications play a critical role in testing the feasibility and effectiveness of programs (Posner & Rudnitsky, 2006). However, the limited use of such applications in the studies suggests that pilot testing should be more widely adopted in program development processes (Taba, 1962). These findings reveal diversity in the involvement of different stakeholder groups and the use of pilot applications in program evaluation processes. However, it is clear that evaluation processes need to be addressed more systematically and comprehensively. In particular, the adoption of mixed methods that combine quantitative and qualitative data can provide a more holistic evaluation process (Johnson & Onwuegbuzie, 2004). In conclusion, involving field experts, students, and other stakeholders in program evaluation processes enhances the validity of the program both theoretically and practically. Additionally, the more widespread use of pilot applications will be an important step in testing the feasibility and effectiveness of programs (Stufflebeam & Shinkfield, 2007).

The analysis of the 25 studies examined in this research revealed that 6 studies (24%) did not include any needs analysis, while 19 studies (76%) conducted a needs analysis. This finding aligns with studies emphasizing that needs analysis is a critical step in program development processes. For instance, Demirel (2012) states that the success of the program development process begins with a needs analysis and that skipping this stage can negatively impact the program's effectiveness. Similarly, Witkin and Altschuld (1995) highlight that needs analysis plays a crucial role in designing educational programs that align with the target audience's requirements. When examining the methodological approaches of the studies that performed a needs analysis, it was found that 2 studies relied solely on a literature review, 1 study utilized only expert opinions, and 5 studies determined needs solely through student participation. These findings demonstrate the diversity of needs analysis methods. In particular, literature reviews are frequently preferred due to their systematic approach (Given, 2008). However, it is also emphasized that needs analyses based solely on literature reviews may lead to practice-oriented shortcomings (English & Kaufman, 1975). Additionally, 5 studies involved both experts and students, while 4 studies consulted expert and student opinions in addition to conducting a literature review. This aligns with studies showing that the use of multiple data sources enhances the validity and reliability of needs analysis (Stake, 2010). Furthermore, 2 studies included the opinions of experts, students, industry representatives, and competent professionals in the needs analysis process. This finding is supported by studies demonstrating that adopting a multi-stakeholder approach in needs analysis increases the inclusivity and applicability of the program development process (Porche, 2004; Demirel, 2006). In conclusion, these findings reveal the diversity of needs analysis methods and the inclusion of different stakeholder groups in the process. This underscores the importance of needs analysis in program development processes and the necessity of a multidimensional approach.

When analyzing the approaches to determining objectives within the scope of the examined studies, it was found that in 11 studies (44%), the objectives were formulated based on Bloom's taxonomy. Bloom's taxonomy is a widely used model in educational programs that allows for the classification of educational objectives into cognitive, affective, and psychomotor domains (Bloom, 1956; Anderson & Krathwohl, 2001). The use of this taxonomy facilitates the systematic and gradual determination of objectives, contributing to more effective planning of learning processes (Demirel, 2012). On the other hand, in 14 studies (56%), no information regarding the taxonomy of objectives was available. This indicates that the objective-setting process was not clearly defined in these studies or that there was a methodological gap in this regard. The lack of clearly defined objectives can negatively impact the effectiveness of the program development process, as objectives form the foundation of educational programs and provide a framework for measuring learning outcomes (Tyler, 2013). Additionally, unclear objectives can complicate the planning and evaluation of teaching processes (Gronlund, 2000). These findings reiterate the importance of the objective-setting process in educational programs. The use of established models like Bloom's taxonomy can help ensure that objectives are determined systematically and consistently. However, the existence of studies that do not specify a taxonomy highlights the need for greater methodological rigor in this area. In light of these results, the following recommendations are proposed for future studies:

- **Prioritize comprehensive and long-term research:** The concentration of program development studies in doctoral theses underscores the need for in-depth and systematic research. Policymakers should support large-scale, interdisciplinary research projects to ensure that curricula are grounded in robust theoretical and empirical foundations.
- **Adopt qualitative and mixed methods:** The prevalent use of qualitative and mixed methods in educational research highlights the importance of contextual and holistic data. Curriculum design processes should incorporate qualitative data collection methods, such as interviews and focus groups, to capture the perspectives of teachers, students, and other stakeholders.
- **Make program evaluation a mandatory phase:** The finding that only 48% of studies included an evaluation phase reveals a significant gap in current practices. Evaluation stages should be standardized to measure the effectiveness of curricula, with feedback collected from all relevant stakeholders.

- Integrate local and international program development models: While local models like Demirel's Educational Program Development Model (DEPGEM) are effective, internationally recognized models such as ADDIE and Outcome-Based Design should also be adopted. This ensures that curricula are both locally relevant and globally competitive.
- Promote interdisciplinary collaboration: The wide distribution of program development studies across various faculties and departments highlights the importance of interdisciplinary approaches. Educational institutions should foster partnerships with industry and community stakeholders to align curricula with real-world needs.
- Establish needs analysis as a foundational step: The fact that 76% of studies included a needs analysis underscores its critical role. Curriculum designers should conduct thorough needs analyses using multiple data sources, such as literature reviews, expert opinions, and stakeholder feedback.
- Use established frameworks like Bloom's taxonomy for objective setting: The use of Bloom's taxonomy in 44% of studies demonstrates its effectiveness in guiding the objective-setting process. Curriculum designers should adopt such frameworks to ensure that learning objectives are clear, measurable, and aligned with desired outcomes.
- Expand the use of pilot applications: Only 28% of studies included pilot applications, indicating a need for greater emphasis on testing and refining curricula before full-scale implementation. Pilot programs should be standardized to identify potential issues and make necessary adjustments.
- Increase stakeholder engagement: Involving multiple stakeholder groups, including students, teachers, and industry representatives, in needs analysis and evaluation processes ensures that curricula are inclusive and practical. Policymakers should create platforms for stakeholder participation in curriculum design.
- Align curricula with global standards: The inclusion of studies from the International Baccalaureate Diploma Program and other international frameworks demonstrates the importance of aligning curricula with global standards. Policymakers should promote the integration of global competencies, such as critical thinking and digital literacy, into curricula.
- Provide training on program development models: To ensure the effective use of local and international program development models, educators and curriculum designers should receive training. This will enhance their ability to design systematic and flexible curricula.
- Use evaluation results for curriculum improvement: Data from program evaluations should be used to continuously refine and improve curricula. This ensures that educational programs remain dynamic and responsive to changing needs.
- Support technology integration: Findings on the role of educational technology in curriculum design highlight the potential of digital tools to enrich learning processes. Curricula should be designed to incorporate technology-enhanced learning environments tailored to students' individual needs.
- Integrate sustainability education into curricula: To address global challenges, topics such as sustainability and environmental literacy should be integrated into curricula. This prepares students to become responsible citizens in both local and global contexts.
- Ensure curricula are flexible and dynamic: To adapt to rapidly changing knowledge and skill requirements, curricula should be designed to be flexible and updatable. This ensures their long-term relevance and effectiveness.

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The Effect of Layered Curriculum on Academic Achievement: A Meta-Analysis Study

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ABSTRACT

The layered curriculum maintains its importance in education as it helps students gradually develop their cognitive levels, supports their academic success, and offers a structured learning process tailored to individual learning needs. This programme contributes to the development of skills such as taking personal responsibility, critical thinking, advanced problem-solving, and achieving academic success, thereby increasing its effectiveness in education over time. This study aims to analyse the results of experimental studies examining the impact of the layered curriculum on academic success through meta-analysis and to identify the effects of moderator variables, including publication type, institution, experimental process durations, and sample size. A total of 41 effect sizes derived from 13 theses meeting the inclusion criteria were included in the meta-analysis. The findings of the study indicate that the layered curriculum has a positive and moderate effect ($g=0.80$) on academic success. No significant differences were observed in the moderator variables related to publication type, institution, and experimental process durations; however, a significant difference was found regarding sample size. Based on the data obtained from the study, it is predicted that the effective implementation of the layered curriculum will enhance academic success.

Keywords: Academic achievement, Layered curriculum, Meta-analysis, Tiered instruction.

INTRODUCTION

In the Information Age, societies are faced with the need to raise individuals who can adapt to rapidly changing technology and information flow. In this context, education systems are also in an effort to transform into a structure suitable for these needs. It is observed that traditional methods applied in education are inadequate especially in skills such as issue resolution, analytical reasoning and independent learning. The deficiencies of traditional methods in achieving the goal of raising individuals who can access information quickly, analyse and apply it are becoming more and more evident. The inability of our education system to respond to the demands of this modern age at the desired level increases the need for more effective and efficient teaching approaches. At this point, the layered curriculum stands out as one of the approaches that attract attention in order to meet modern educational needs. Unlike traditional teaching approaches, the layered curriculum ensures that learning is handled as a structured process that is suitable for the individual development of the student. In addition to students' academic achievement, the development of advanced cognitive abilities including critical analysis and issue resolution has become one of the most important goals of education programmes today. In this context, the role of the programme in question is becoming increasingly important regarding not only enhance students' academic success, but also providing them with skills such as analytical thinking and developing a solution-oriented approach. This situation demonstrates why more innovative and student-oriented approaches are necessary for the education system to adapt to the Information Age and increase student achievement.

Over the past few years, demand has escalated for student-centred approaches in which students are placed at the centre of the learning procedure. In this context, important efforts are being made to expand our understanding and practice of student-centred approaches within the field of education (Seiler, 2024). The layered curriculum, which is one of the student-centred approaches, is a structuring method that supports the development of high-level thinking skills and taking individual responsibility by taking into account the differences of individuals regarding learning processes. This programme is inspired by Bloom's taxonomy of cognitive domain objectives. Step C of this curriculum, which is divided into three different levels as C, B and A, represents the basic level of the programme. This stage focuses on the learning objectives associated with the "knowledge" and "comprehension" levels in Bloom's Taxonomy and aims to ensure that students understand basic concepts and acquire knowledge. Here, students attain basic information and meanings about the course. Step B corresponds to the "application" level. It focuses on the organisation and application of the knowledge learnt at stage C. This stage

provides students with the opportunity to practice their problem solving skills. Stage A corresponds to Bloom's "analysis, synthesis and evaluation" stages. It covers enhanced-level cognitive abilities such as critical thinking and developing original ideas. The layered curriculum is a learning-teaching approach that combines learning outcomes, activities and evaluation studies structured according to the steps specified in the areas where it is applied (Gürbüztürk, 2023; Orakcı, 2020).

The layered curriculum proposed by Nunley enables students to learn in their preferred learning styles and at their own pace by organising learning processes according to their individual differences (Nunley, 1998). This programme has initiated as a consequence of the curricula developed in many countries in compliance with the constructivist approach. This programme developed in the USA bears the traces of the constructivist approach and is accepted as a teaching approach that can be applied in the classroom environment. In this curriculum, the student is at the centre and the process is carried out on the basis of activity. In this programme, which is under the responsibility of the student, the individual structures his/her own learning process. Cascade teaching is considered as an effective approach that increases student participation in the learning process with the different levels of teaching strategies it offers. Students are encouraged to actively participate in the learning process via this strategy by taking into account their individual learning needs (Yılmaz, 2022). In addition, the programme aims to determine at which stage students are in the learning process and to establish general objectives that will enable students to acquire to the maximum degree according to their learning capacities, interests and needs. It is envisaged that these objectives will be diversified and organised in a gradual structure by supporting them with activities within the framework of specific learning units. The programme is structured in three stages, consisting of levels A, B and C, and encourages student participation and involvement in creative activities. This pyramid is presented schematically in Figure 1 (Demirel, 2020).

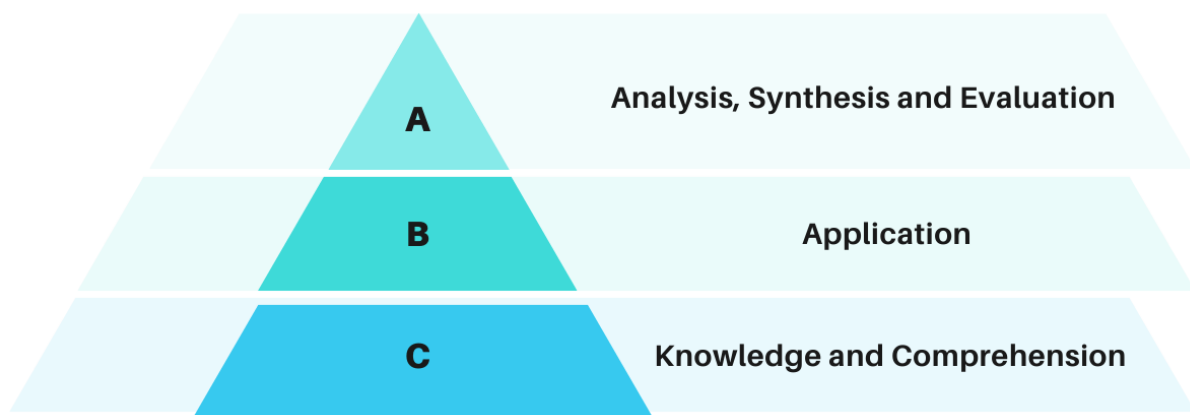


Figure 1. Levels of The Layered Curriculum

The reflections of progressive teaching on education aim to enable students to acquire and comprehend new knowledge, as well as to use this knowledge in problem solving, to analyse and thus to generate new knowledge. In this programme, it is essential that the learning environment is adapted to the unique structure of each individual. Education ought to be modelled by considering the cognitive and affective readiness levels of the individual, so that the most appropriate learning experience should be offered to the student. Since each student is different, a single teaching method or technique may not be sufficient. Therefore, learning environments should be diversified and versatile. The teacher, on the other hand, should assume a role that directs and guides the student to discovery rather than being the transmitter of knowledge. Thus, the necessary steps will be taken to make learning a more interactive and student-controlled process (Akpınar, 2014; Sönmez, 2020).

The layered curriculum is an effective educational model that customises and diversifies students' learning processes by taking into account their individual differences. One of the important arguments of this approach is that it aims to provide a learning environment adapted to the cognitive and affective readiness levels of each student. Thus, it supports each individual to learn in the most efficient way. The programme in question, which increases students' participation and encourages high-level cognitive skills such as creative thinking and problem solving, brings the guidance role of the teacher to the forefront and transforms the teaching process into an interactive and student-centred format. On the other hand, it enables students to set goals according to their different learning needs and to carry out their learning processes in a more personalised way through its three-stage structuring. As a result, it can be said that the stepped curriculum helps students to learn more deeply, increase their active participation and take responsibility for learning.

Glass (1976) defines meta-analysis as comprehensive statistical analyses carried out to bring together the findings from many individual studies. This approach aims to provide broader and more meaningful data by integrating the results of existing studies. Meta-analyses are methods and techniques used to statistically combine the results of previously conducted independent studies. When there are a lot of research addressing a particular research problem, studies testing the same hypothesis are expected to yield similar findings. Such studies are considered important in terms of making a valid generalisation. Meta-analysis can be considered as an analytical technique that summarises the findings of various studies as well as delivering the tendency to reach similar results through the effect size unit. Therefore, it stands out as an effective tool for both summarising the results and creating a solid basis for new research (Assen, et al., 2023; Bakioğlu & Özcan, 2022; Bayraktar, 2021). Meta-analysis is a method that brings together the possible findings of one or more independent studies within the framework of a subject and statistically analyses these findings. The fact that the results of different independent studies differ greatly makes it necessary to interpret these information sets in line with certain criteria and to need reliable unifying studies that will shed light on new research. Today, it is known that the number of scientific studies has significantly increased. Meta-analysis studies not only determine the general trends of research in the existing literature, but also open new horizons for future research and serve as a guide in the relevant field (Akgöz et al., 2004; Field & Gillett, 2010; Özkaya, 2021).

The number and variety of researches in educational sciences have been increasing rapidly in recent years. This increase leads to a gradual growth in the volume of information obtained. Therefore, it is necessary to interpret this knowledge with a holistic approach. It is important to know in which direction the accumulation of studies affects people and how the existing knowledge serves our position. Therefore, instead of the results obtained from individual studies, it will be more effective to present researches with common themes by combining them with effective methods. As a matter of fact, it is difficult to evaluate the findings obtained through comprehensive studies separately in a limited time. Therefore, the problem of which method to combine the studies becomes an important issue. In this case, meta-analysis can be used as an effective tool to obtain more comprehensive and meaningful results by integrating the available information (Bakioğlu & Gökteş, 2018). Meta-analysis can provide guidance for future studies by identifying gaps in the existing literature. It is skilful in revealing missing or insufficiently examined topics and can provide researchers with an important orientation in which areas they should conduct new studies. In this respect, meta-analysis can contribute to scientific progress not only by systematically compiling existing information but also by identifying inconsistencies and theoretical gaps in the field.

The changes and developments in the recent past have increased the interest in student-centred approaches in the field of education and these approaches have significantly transformed the dynamics of the educational process. Student-centred education, as the name suggests, draws attention as an approach that encourages students to actively participate in learning processes and focuses on individual needs and interests. In this framework, the layered curriculum stands out as an important programme among student-centred methods. When the literature (Aydoğuş, 2009; Başbay, 2006; Bayer, 2022; Biçer, 2011; Doğmaz, 2016; Durusoy, 2012; Genç-Tosun, 2016; Gün, 2012; Kahraman, 2020; Karagül, 2017; Koç, 2013; Öner, 2012; Özdemir, 2019; Üzümlü, 2017; Yıldırım, 2016; Yıldız, 2018; Yılmaz, 2019; Zeybek, 2016) is examined, there are many studies investigating the influence of both the layered curriculum and the layered curriculum on academic achievement. On the other hand, although there are meta-analysis studies on student-centred studies (Kurnaz & Korkutan, 2023) in the literature, it is also observed that meta-analysis studies involving the layered curriculum are included in student-centred studies (Yağan, 2022). In the study carried out by Bademci et al. (2023), studies on the layered curriculum were examined by meta-synthesis method. In his study, Caughie (2016) focused on how the layered curriculum shapes students' effective participation and performance in lessons. It is predicted that This research will add to the body of knowledge on examining the effect of the layered curriculum on academic achievement directly by meta-analysis method. In this context, it is aimed to evaluate the effect of the programme on academic achievement in a broad framework and to obtain reliable results. The research aims to reveal the benefits of the programme if it is adopted as an effective application among student-centred approaches. In this axis, the effect of the programme on academic achievement was tested by calculating the effect sizes gathered from the studies dealing with the layered curriculum. The main purpose of the study is to analyse the quasi-experimental studies examining the effects of layered curriculum on academic achievement through meta-analysis and to determine the role of certain study characteristics on this effect. In this framework, Answers to the following queries were requested in line with the sub-objectives of the study.

1. What is the effect of the layered curriculum on academic achievement?
2. Does the effect of the layered curriculum on academic achievement differ in terms of the publication type of the studies?
3. Does the effect of the layered curriculum on academic achievement differ according to the institutes where the studies were conducted?

4. Does the effect of the layered curriculum on academic achievement differ according to the experimental process duration of the studies?
5. Does the effect of layered curriculum on academic achievement differ according to the sample sizes of the studies?

METHOD

Research Model

The research was conducted by using meta-analysis technique in order to examine the effects of layered curriculum on academic achievement. Meta-analysis is a statistical method used for synthesising and interpreting by combining the results of different studies and making a general evaluation in terms of effect size (Card, 2012). Dinçer (2022) defines meta-analysis as a type of analysis performed to draw a general conclusion by combining the data obtained from various studies.

Data Collection

In order to determine the effects of layered curriculum on academic achievement, postgraduate theses in Türkiye were examined. In this context, the National Thesis Centre database of the Council of Higher Education was searched using the keywords "layered curriculum" and "academic achievement". As a result of the search, 840 theses were listed and the authorised full texts of 837 of them were accessed. As a result of additional searches with binary combinations, 18 thesis studies were reached. In line with descriptive statistics and screening strategies, 15 studies were identified, and finally 13 theses that met the inclusion criteria were gathered in the research process. A total of 41 effect sizes obtained from these theses were determined. In the 13 theses included in the research, there were a total of 801 subjects participating in experimental applications. The flow diagram of the research process is presented in Figure 2 in line with the model proposed by Moher et al. (2009).

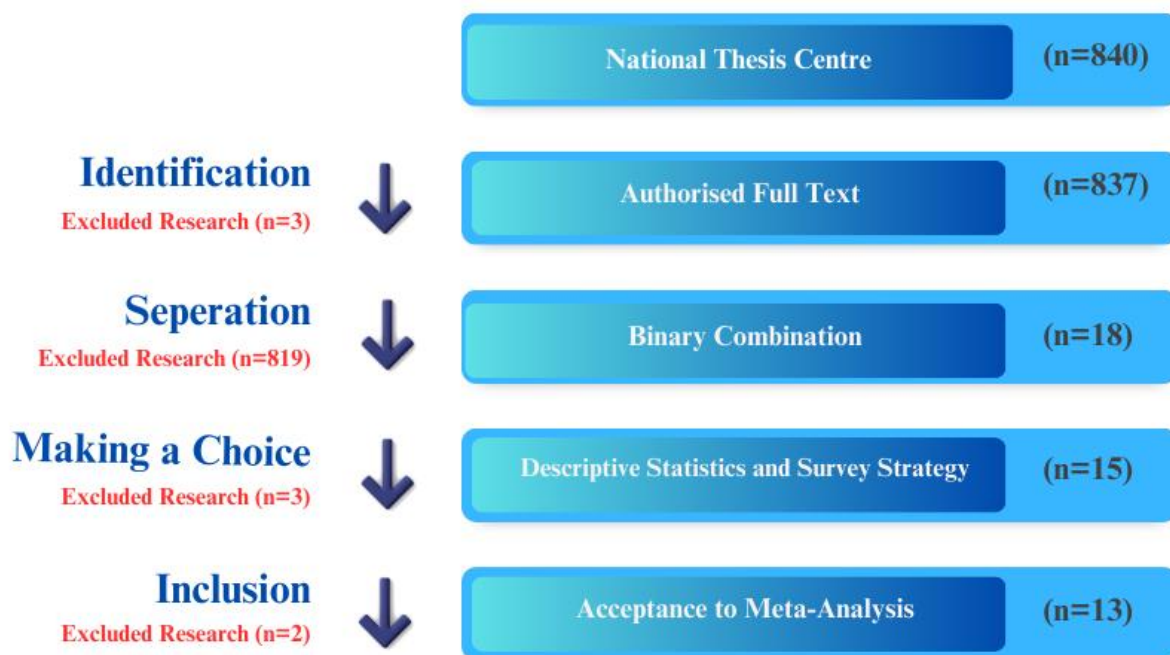


Figure 2. Flow Diagram

Inclusion Criteria

In this meta-analysis study, which was carried out to examine the effect of the layered curriculum on academic achievement, the inclusion criteria were determined as follows:

- The study is one of the postgraduate theses at the Council of Higher Education's National Thesis Center,
- Access to studies in full text,
- The fact that the analysed studies have a quasi-experimental design,
- Availability of statistical data such as arithmetic mean, standard deviation and sample size to enable calculation of effect size,
- The research must be written in Turkish or English and suitable for digital scanning.

Operating Characteristics

There are four study characteristics in the meta-analysis study titled The effect of layered curriculum on academic achievement. These consist of publication type, institute, experimental procedure duration and sample size.

Coding of Data

Within the framework of the research, the descriptive data in the quasi-experimental studies were carefully analysed and coded by the researchers. This process was carried out in line with a systematic plan. The data were meticulously processed on the coding form created using Microsoft Excel. Thus, a standardisation was achieved in the analysis of the data and an error-free data entry process was aimed.

Validity and Reliability of Coding

Within the scope of the research, validity and reliability were increased by applying expert opinion. Necessary arrangements were made in the light of the feedback received from the experts and the study characteristics were shaped in the light of this feedback. The theses included in the study were reviewed by the researchers at certain time intervals to check the accuracy and consistency of the data. During the data analysis process, the reliability of the research was measured by taking into account the reliability calculation proposed by Miles and Huberman (1994) [Reliability = (Agreement / (Agreement + Disagreement)) x 100]. Inter-coder reliability agreement was determined as 96%. This rate was determined that the level of reliability between the coders was within the acceptable axis according to the criteria put forward by Neuendorf (2002). This high reliability rate reinforced the consistency and reliability of the data coding process and strengthened the validity of the research results.

Analysing the Data

Comprehensive Meta Analysis 3 demo version statistical software was used to calculate the effect size of the studies. Hedge's g coefficient was used in the calculation of effect sizes, taking into account the sample sizes included in the study (Şen, 2019). In the analysis process, the significance level was determined as 95%. For the evaluation of the effect size, the classification proposed by Cohen et al. (2021) was taken as basis. According to this classification, effect sizes between 0 and 0.20 are considered as weak effect, values between 0.21 and 0.50 as small effect, values between 0.51 and 1.00 as moderate effect, and values above 1.00 as strong effect.

FINDINGS

In this segment, the results derived from 13 thesis research gathered in the meta-analysis and the frequency and percentage distributions of the study characteristics representing the moderator variables in the research are presented. The publication years, sample sizes and percentages of the studies are presented in Table 1.

Table 1. Publication Years, Sample Sizes and Percentages of The Studies

No	Studies	Year	Year (%)	Sample	Sample (%)
1	Aydoğuş	2009	7.69	118	14.72
2	Biçer	2011	7.69	53	6.61
3	Durusoy	2012	23.08	44	5.49
4	Gün	2012		71	8.85
5	Öner	2012		67	8.36
6	Zeybek	2016	15.38	24	2.99
7	Yıldırım	2016		107	13.34
8	Karagül	2017	7.69	44	5.49
9	Yıldız	2018	7.69	69	8.61
10	Yılmaz	2019	15.38	47	5.86
11	Özdemir	2019		69	8.61
12	Kahraman	2020	7.69	37	4.62
13	Bayer	2022	7.69	51	6.36
Total		13	100	801	100

As can be seen in Table 1, a total of 13 thesis studies were included in the scope of meta-analysis to examine the effect of layered curriculum on academic achievement. Considering the change in the studies within the scope of the research over the years, it is seen that the most studies were carried out in 2012 (n:3, 23.08%), while the least studies were administered in 2009 (n:1, 7.69%), 2011 (n:1, 7.69%), 2017 (n:1, 7.69%), 2018 (n:1, 7.69%), 2020 (n:1, 7.69%) and 2022 (n:1, 7.69%). It is noteworthy that the interest in the layered curriculum increased with three studies conducted in 2012. On the other hand, the studies in 2016 (n:2, 15.38%) and 2019 (n:2, 15.38%) reflect that the education intensified in this period and important analyses were made on teaching methods. In terms of sample sizes, the largest sample was found in the study conducted by Aydoğuş (2009) in 2009 (n:118, 14.72%)

and the smallest sample was found in the study conducted by Zeybek (2016) in 2016 (n:24, 2.99%). The fact that the sample sizes of the studies vary reveals that the studies were carried out on groups of different sizes. The total sample size included in the studies consists of 801 subjects. This shows that the influence of the layered curriculum on academic achievement was examined comprehensively with a large sample size. The frequencies and percentages of the publication types of the studies are given in Table 2.

Table 2. Frequency and Percentage Values for Types of Publication

Type	f	%
Master's Degree	7	53.85
PhD	6	46.15
Total	13	100

When the data in Table 2 are examined, it is observed that although master's theses (n:7, 53.85%) and doctoral theses (n:6, 46.15%) are close to each other among the studies included in the research, master's theses are slightly more. Therefore, it shows that the research covers the academic literature in both master's and doctoral studies and both levels are represented in a balanced manner. The frequency and percentage distributions of the universities where the studies were conducted are presented in Table 3.

Table 3. Frequency and Percentage Values of Universities

University	f	%
Adnan Menderes	1	7.69
Afyon Kocatepe	1	7.69
Ankara	1	7.69
Atatürk	3	23.08
Bartın	1	7.69
Fırat	1	7.69
Hacettepe	2	15.38
İnönü	1	7.69
Necmettin Erbakan	2	15.38
Total	13	100

As seen in Table 3, most of the studies in the research were conducted at Atatürk University (n:3, 23.08%). Atatürk University is followed by Hacettepe (n:2, 15.38%) and Necmettin Erbakan Universities (n:2, 15.38%). Adnan Menderes, Afyon Kocatepe, Ankara, Bartın, Fırat and İnönü Universities were represented with equal values (n:1, 7.69%). This distribution shows that the research includes studies carried out in different universities and that Atatürk University stands out in the studies in this field. Frequency and percentage values related to the institutes where the studies were conducted are shown in Table 4.

Table 4. Frequency and Percentage Values for Institutes

Institute	f	%
Education Sciences	9	69.23
Social Sciences	4	30.77
Total	13	100

As seen in Table 4, the studies in the study were distributed between educational sciences and social sciences institutes. While the institute of educational sciences is more represented with 9 studies (n:9, 69.23%) in total, the institute of social sciences is ranked lower with 4 studies (n:4, 30.77%). This shows that the number of studies conducted in the field of education is significantly higher than in the field of social sciences. The frequency and percentage values related to the duration of the experimental process in which the studies were conducted are shown in Table 5.

Table 5. Frequency and Percentage Values Related to Experimental Procedure Periods

Experimental Procedure Periods	f	%
4 Weeks and Below	5	38.46
5-9 Weeks	4	30.77
10 Weeks and Over	4	30.77
Total	13	100

As seen in Table 5, the studies within the scope of the research exhibit a relatively balanced distribution in terms of the duration of the experimental process. The highest number of studies were conducted in periods of 4 weeks

or less ($n:5$, 38.46%), while studies conducted in periods of 5-9 weeks and 10 weeks or more ($n:4$, 30.77%) were at lower rates. This shows that different experimental durations were used in the research process. This distribution of experimental periods offers diversity in the research field to understand the effects of different time periods.

Publication Bias

The funnel plot prepared to evaluate the publication bias in the meta-analysis study is presented in Figure 3.

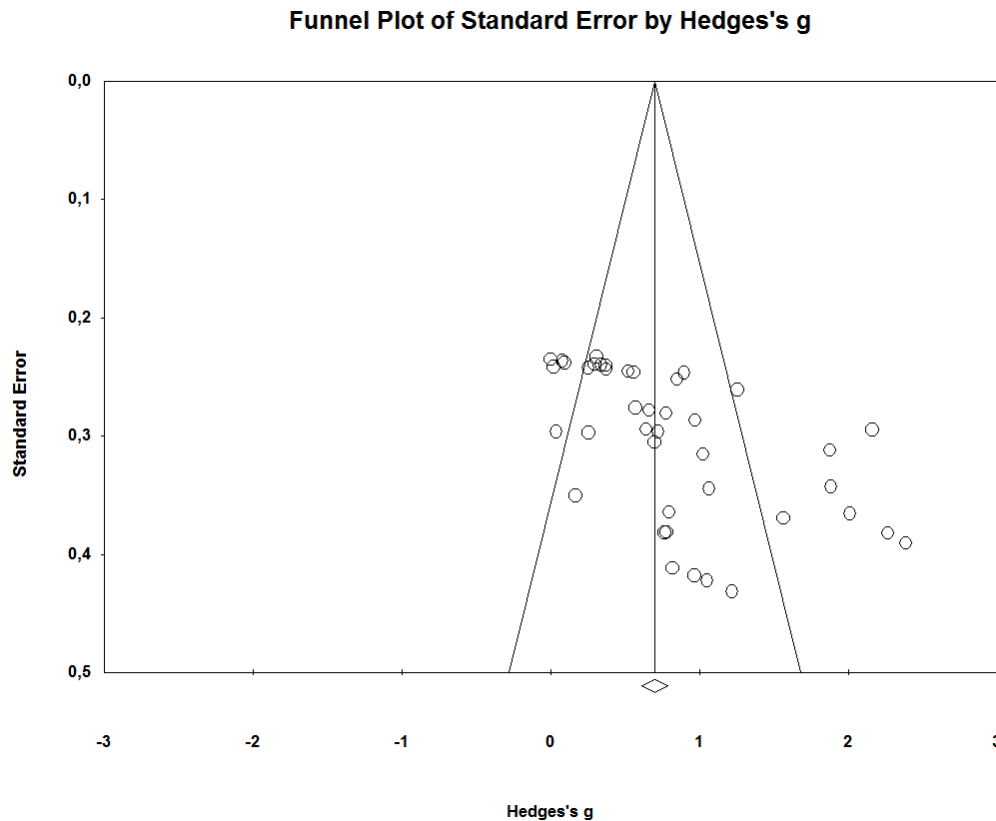


Figure 3. Funnel Plot

When the funnel plot in Figure 3 is analysed, it is observed that the effect sizes do not exhibit an asymmetric distribution. This is considered as an important indicator for the reliability of the research results. Classic fail-safe N and Orwin's fail-safe N statistics were also utilised to determine whether there is a publication bias. In this context, calculations made with the Classic fail-safe N statistic showed that 2928 additional studies were required for the effect size to reach a value above 120 ($5k+10$). This situation reveals that a large number of additional studies are required to invalidate the findings of the study. On the other hand, when Orwin's fail-safe N statistic was used, it was determined that 28609 missing studies were required to reduce Hedge's g value to a non-significant level (0.001). These findings reveal that the meta-analysis study does not contain publication bias (Dinçer, 2022; Rosenthal, 1979; Şen & Yıldırım, 2020).

Findings Related to the First Sub-Aim

In the first sub-objective of the research, the answer to the question "What is the effect of the layered curriculum on academic achievement?" was sought. In order to answer this question, the homogeneity of the studies was evaluated by using the fixed effects model to calculate the effect size. Based on the fixed effects model, the results obtained for the overall effect size and homogeneity of the studies are presented in Table 6.

Table 6. Findings on Overall Effect Size and Homogeneity of Studies

Programme Type	Es	Df	Q	X ²	p	I ²	95% Confidence Interval	
							Alt	Top
Fixed Effects Model	0.699	40	171.849	55.759	0.00	76.724	0.610	0.787

The homogeneity value of the studies included in the meta-analysis, as determined by the fixed effects model, was determined to be $Q=171,849$ based on the data in Table 6. Examining the X^2 table reveals that the comparable value, at the 95% confidence range for 40 degrees of freedom, is 55.759. It is found that the I^2 value is 77% and the Q value is more than the critical value in the X^2 distribution. According to Higgins et al. (2003), a substantial degree of heterogeneity is present when the I^2 value is more than 75%. However, because the findings of the heterogeneity test were significant ($p=0.00$; $p<0.01$), the random effects model was used for effect size estimates rather than the fixed effects model (Dinçer, 2022). Table 7 displays the general effect size results derived from the random effects model.

Table 7. Findings on the Overall Effect Size of the Studies

Programme Type	N	Z	p	SE	ES	95% Confidence Interval	
						Alt	Top
Random Effects Programme	41	8.446	0.00	0.08	0.80	0.616	0.988

The random effects model yielded an effect size value of 0.80 with a standard error of 0.08 based on the data in Table 7. The effect size had a lower limit of 0.616 and an upper limit of 0.988, as indicated by the 95% CI in Table 7. These results ($p=0.00$ and $p<0.01$) are statistically significant. The experimental group benefits from the therapy, as evidenced by the positive value of the average effect size (+0.80). According to Cohen et al. (2021), this data indicates that the layered curriculum has a moderately beneficial impact on academic attainment. Figure 4 displays the impact size values determined using the random effects software alone, without the forest plot.

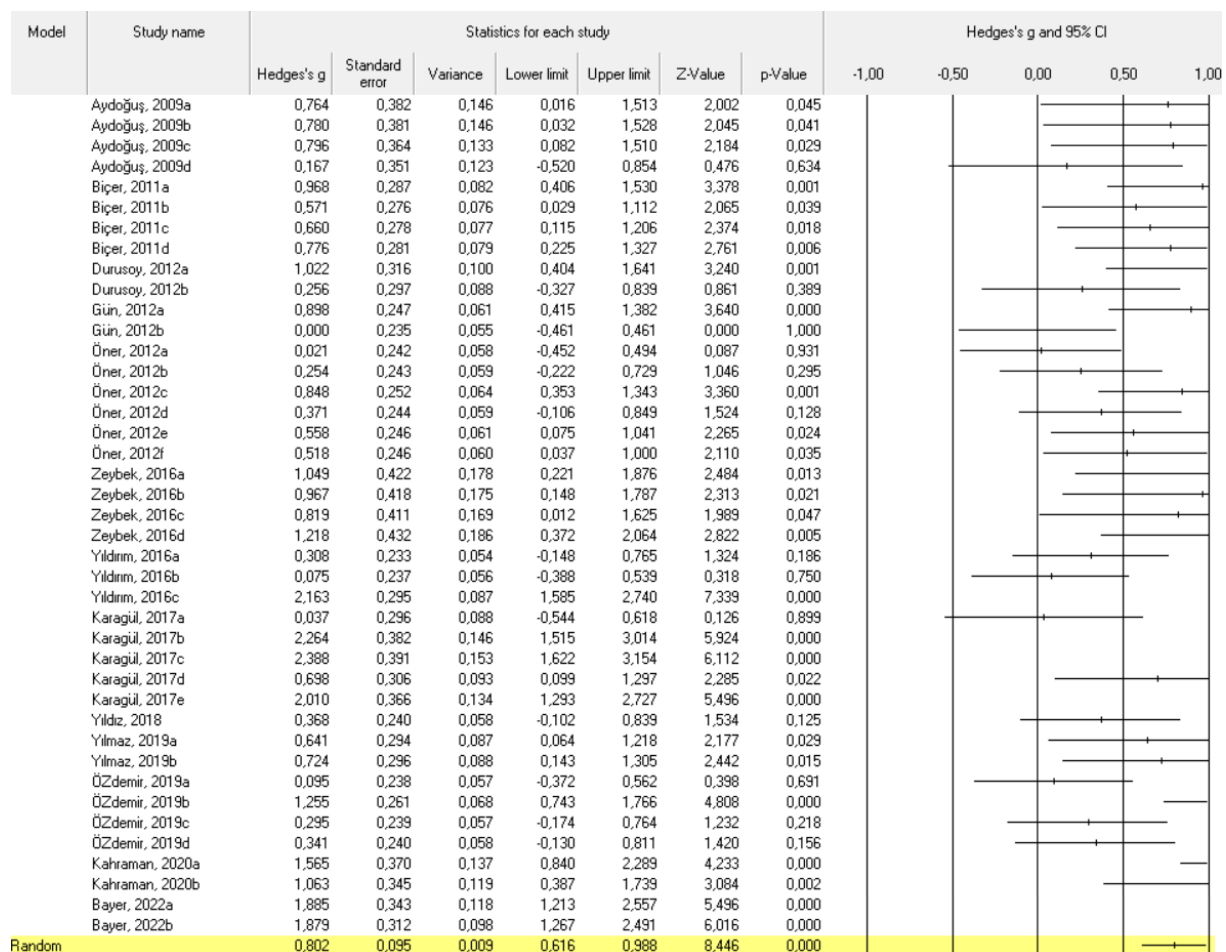


Figure 4. Effect Size Values of Studies Not Combined with Forest Plot for Effect Size

Findings Related to the Second Sub-Aim

"Does the impact of the layered curriculum on academic achievement vary depending on the publication type of the studies?" is the second sub-objective of the research. The query has been addressed. Table 8 displays the effect sizes of the studies according to the kind of publishing.

Table 8. Effect Sizes by Publication Type

Moderator Variable	Qb	p	N	ES	95% Confidence Interval	
					Alt	Top
Publication Type	0.26	0.60				
Master's Degree			17	0.85	0.62	1.09
PhD			24	0.76	0.50	1.03

As seen in Table 8, the homogeneity value (Qb) between the groups obtained on the axis of the publication type of the studies was found to be 0.26. In the X^2 table, the critical number corresponding to 95% significance level and one degree of freedom was determined as 3.84. Within the parameters of the publication type of the research, no statistically significant difference between the groups was found since the homogeneity value between the groups was less than the critical value.

Findings Related to the Third Sub-Aim

In the third sub-objective of the research, the question "Does the effect of the layered curriculum on academic achievement differ according to the institutes where the studies were conducted? The question is answered. Effect sizes according to the institutes are shown in Table 9.

Table 9. Effect Sizes According to the Institutes where the Studies were Conducted

Moderator Variable	Qb	p	N	ES	95% Confidence Interval	
					Alt	Top
Institutes	0.43	0.50				
Education Sciences			31	0.83	0.60	1.05
Social Sciences			10	0.70	0.39	1.01

According to the institutes where the investigations were carried out, the homogeneity value (Qb) between the groups is 0.43, as shown in Table 9. The crucial value, which corresponds to one degree of freedom at a 95% significance level, was determined to be 3.84 in the X^2 table. According to the institutes where the research were done, there was no statistically significant difference between the groups established since the homogeneity value between the groups was less than the crucial value.

Findings Related to the Fourth Sub-Aim

In the fourth sub-objective of the research, the answer to the question "Does the effect of the layered curriculum on academic achievement differ according to the experimental process duration of the studies?" is sought. The effect sizes of the studies according to the duration of the experimental process are given in Table 10.

Table 10. Effect Sizes of the Studies According to the Duration of Experimental Procedures

Moderator Variable	Qb	p	N	ES	95% Confidence Interval	
					Alt	Top
Experimental Procedure Periods	3.79	0.15				
4 Weeks and Below			9	0.83	0.41	1.24
5-9 Weeks			16	0.59	0.40	0.79
10 Weeks and Over			16	1.01	0.61	1.41

The homogeneity value (Qb) between the groups created based on the experimental procedure durations of the research was determined to be 3.79, as shown in Table 10. In the X^2 table, the critical value that corresponded to the 95% significance level and two degrees of freedom was found to be 5.99. There was no statistically significant difference between the groups created based on the length of the experimental procedure since the homogeneity value between the groups was less than the critical value.

Findings Related to the Fifth Sub-Aim

In the fifth sub-objective of the research, the answer to the question "Does the effect of the layered curriculum on academic achievement differ according to the sample sizes of the studies?" is sought. The effect sizes of the studies according to the sample sizes are given in Table 11.

Table11. Effect Sizes of Studies According to Sample Sizes

Moderator Variable	Qb	p	N	ES	95% Confidence Interval	
					Alt	Top
Sample Sizes	18.41	0.00				
20-39			6	1.12	0.81	1.43
40-59			15	1.08	0.73	1.44
60-79			13	0.44	0.24	0.63
80 and Above			7	0.71	0.15	1.28

The homogeneity value (Qb) between the groups created based on the study sample sizes was found to be 18.41, as shown in Table 11. In the X^2 table, 7.82 is the crucial value that corresponds to the 95% significance level and three degrees of freedom. There was a statistically significant difference between the groups created based on the study sample sizes since the homogeneity value between the groups was higher than the critical value.

DISCUSSION, CONCLUSION and RECOMMENDATIONS

In today's education system, the importance of the layered curriculum, which is one of the student-centred approaches, is increasing. Traditional education methods are insufficient to meet the needs of students with different learning styles and speeds. This may negatively affect individuals' learning experiences and reduce their academic achievement. Cascade teaching allows individuals to maximise their potential by providing students with customised learning paths. This method helps students to progress at their own pace and to interact with content that suits their interests. In addition, this approach encourages students' active participation in the learning process. This increases their motivation and learning quality (Nunley, 1998, Seiler, 2024). It is stated that cascaded teaching practices are effective in increasing student participation and meeting individual learning needs, and that it has become a critical necessity for educators to adopt such programmes in order to respond to modern educational needs. In studies conducted in the field of educational sciences, it has been determined that the layered curriculum has positive effects on the retention of knowledge as well as increasing students' academic achievement (Durusoy, 2012; Kılınçaslan & Özdemir, 2015).

Considering the effect of the layered curriculum on academic achievement, it was found that it contained a moderate effect size on the positive axis according to the effect size classification expressed by Cohen et al. (2021). This indicates that the effect of the graded curriculum on academic achievement is positive. When the literature (Bayer, 2022; Doğuş, 2009; Durusoy, 2012; Gün, 2012; Güzel-Baydoğan, 2024; Kahraman, 2020; Üzümlü, 2017; Yılmaz, 2019) was examined, it was concluded that the effect of the layered curriculum on academic achievement was more successful than traditional methods. Similarly, studies conducted by Lasovage (2006) and Noe (2008) also reported an increase in the academic achievement of learners. These findings support the results of our research.

Conversely, in the study by Başbay (2006), it was found that students loved the class, their engagement rose, and the layered curriculum significantly contributed to the learning journey. In addition, the opinions of learners, teachers and curriculum development specialists and current observations show that the learning environment has become more meaningful. In another study conducted by Yılmaz (2010), it was stated that the layered curriculum helped students to show more interest in science education and to participate more effectively in this field. In the study conducted by Gün (2012), it was emphasised that students' interest and participation in the lessons increased and the process became more enjoyable for the learners. In Öner's (2012) study, positive results different from the traditional approach on issues such as activity selection, challenging stages, liked activities, and how these methods can be applied in other courses were revealed. In another study by Durusoy (2012), it was found that the layered curriculum with creative drama not only contributed to the academic achievement of the learners but also increased the permanence of their current achievements.

In the study conducted by Koç (2013), it was observed that the programme was important in developing the metacognitive awareness and problem solving skills of the learners in the experimental group. It was observed that the programme offered a fun environment in the lesson with student-centred activities with increasing difficulty levels step by step. The layered curriculum provides students with awareness through various activities, encourages them to produce creative solutions to the problems they encounter, develops their critical thinking and allows them to choose activities suitable for their own learning styles. In addition, students reinforce their learning by transferring what they have learnt to different fields and discover different ways of learning. In Yıldırım's (2016) study, it was found that the programme had a more positive effect on students' cognitive and affective development than the existing teaching methods. In the study conducted by Zeybek (2016), it was revealed that the step-by-step

teaching programme contributed to the level of knowledge and comprehension. In Caughie's (2016) study, it was concluded that the layered curriculum had a positive effect on learners' participation and overall performance.

In his study, Üzümlü (2017) emphasised that the layered curriculum not only increased the academic achievement of the students but also provided a fun and motivating perspective to the learning process. Students participated more actively in the lesson as they took responsibility for their own learning. On the other hand, it was observed that the curriculum in question improved reading and writing, listening and speaking language skills as well as basic skills. Students stated that they increased their success in both written and practical exams with the effect of this method. Karagül (2017) stated that in addition to academic achievement, the layered curriculum positively affected students' attitudes towards Turkish lessons and enabled them to learn the lessons in a fun and enjoyable way. Students adopted this method in Turkish lessons and made the lesson more effective and enjoyable. In the study conducted by İlman (2018), it was stated that the layered curriculum is both fun and interesting, at the same time, it improves students' language skills and offers different learning opportunities through individual and group studies.

The layered curriculum allows pupils to take charge of their own education, according to Özdemir's (2019) research. It was shown that students actively participated in the teaching-learning process, and that the selection of tasks in this process was significantly influenced by elements including task convenience, instructiveness, and learning style fit. In a study conducted by Yılmaz (2019), it was concluded that the layered curriculum contributes to the classroom climate through group work, but may lead to problems of indiscipline in the classroom. This situation reveals that attention should be paid to discipline management when implementing a layered curriculum. In addition to this, it was emphasised that the layered curriculum can be preferred instead of traditional mathematics teaching methods since the curriculum develops problem solving skills and helps students to exhibit positive attitudes towards mathematics course.

In the study conducted by Kahraman (2020), it was observed that the layered curriculum increased students' confidence in the lesson and they felt more comfortable. Yavuz (2022), on the other hand, reached the view that teachers generally teach with traditional, teacher-centred methods, but in order to ensure permanent learning, methods in which the student is at the centre should be used. These studies show that, as a student-centred approach, the layered curriculum offers advantages such as actively involving the student in the education process, positively affecting the classroom environment, making learning fun by removing monotony and increasing the retention of knowledge, as well as contributing to academic achievement. On the other hand, it is understood that this programme helps students to gain self-confidence as well as developing problem solving skills.

Based on all these findings, it can be said that the layered curriculum, as a student-centred approach, not only increases students' academic achievement but also makes the learning process more meaningful, interactive and enjoyable. This teaching method encourages active participation in learning by providing learning paths suitable for students' individual speeds and interests. In addition, it creates positive effects in important areas such as problem solving skills, cognitive awareness, self-confidence development and improvement of language skills. Unlike traditional teaching methods, layered curriculum helps to increase learning retention by providing students with customised learning experiences. On the other hand, it encourages students to take responsibility, collaborate through group work and produce creative solutions. However, some practical difficulties such as discipline management may arise during the implementation of this teaching method. In conclusion, beyond increasing academic achievement, the layered curriculum has an important place as a method that reinforces students' cognitive and affective development and makes learning processes more efficient and effective. This method offers a more comprehensive educational experience than traditional approaches by making learning more active, participatory and personalised.

When the effect of the layered curriculum on academic achievement was examined in terms of the publication type of the studies, it was seen that the positive effect size was valid for both types. This situation indicates that master's and doctoral studies have a positive effect on academic achievement. However, it was observed that the distribution of the effect size of the studies classified on the axis of publication types was homogenous. As a matter of fact, although the effect size of master's studies is larger, there is no significant difference between them. The present finding can be interpreted as a consistent effect of the layered curriculum regardless of the type of publication. At the same time, the similar results of master's and doctoral studies may indicate that the programme can be evaluated as an effective tool at postgraduate education levels. On the other hand, when the literature (Akyol, 2022; Akyüz, 2022; Ekemen, 2017; Ekinçi-Ünyeli, 2024; Gürsu, 2022; Gündüz & Kutluca, 2019; Oral, 2022) is analysed, it is seen that similarly, no difference was found in terms of publication type in these meta-analysis studies.

When the effect of the layered curriculum on academic achievement was analysed in terms of the institutes in which the studies took place, it was seen that the effect size was positive and homogeneous in both institutes. It was observed that the effect size in educational sciences was higher than in social sciences. These findings indicate that the effect of the layered curriculum on academic achievement positively affects the studies conducted in both institutes and that there is no significant difference between the groups. This situation can be interpreted as more adaptation to the learning processes of the layered curriculum in the field of educational sciences, while less adaptation is achieved in the field of social sciences.

It was discovered that the effect sizes were positive and consistent across all experimental process periods when the impact of the layered curriculum on academic success was examined in terms of the studies' experimental process timeframes. This suggests that the groups are not significantly different from one another. However, it also demonstrates that one of the determining factors of the research is not the length of the experimental procedure. Nonetheless, the experimental procedures that lasted 10 weeks or more had the largest impact size, whereas those that lasted 5 to 9 weeks had the smallest. Though the optimal range is 10 weeks and beyond, the current scenario shows that all experimental method lengths have a beneficial influence on the effect of the layered curriculum on academic accomplishment. Simultaneously, the homogeneity between the experimental procedure's duration and effect size may be understood as meaning that the program's efficacy remains steady throughout the short and long term, regardless of the durational difference. The length of the experimental procedure, however, caused a notable variation in the meta-analysis studies carried out by (Akyüz, 2022; Altıntaş, 2022; Kaşarcı, 2013 and Üzümlü, 2022), according to the literature review. The results of our investigation are supported by meta-analysis studies by Ekinci-Ünyeli (2024), Kundakçı (2021), and Topan (2013), which demonstrate no significant differences in the experimental procedure length.

The effect size had a positive and varied distribution in all samples when the impact of the layered curriculum on academic success was analyzed in terms of the study sample sizes. It is possible to take this conclusion, which shows a substantial difference between the groups, as evidence that sample sizes are one of the determining factors in the research. The program had a significant impact, as evidenced by the sample size reaching the largest effect size in the 20-39 range. This can be interpreted as that small groups can be effective by providing more individual interaction and in-depth learning opportunities. As a matter of fact, in the meta-analysis studies conducted by Akyüz (2022) and Üzümlü (2022), similarly, it was observed that there was a significant difference between sample sizes. In addition to this, Üzümlü (2022) found that the effectiveness of studies with a sample size of 90 or more was quite low and that the sample group should not be crowded in order to obtain effective results. These findings support the results of our study. On the other hand, it is seen that effective results were obtained in groups with a sample size of 40-59. This situation suggests that medium-sized groups can increase the effect of training programmes. However, the decrease in the effect size as we move to larger groups may indicate that individual participation and interaction may decrease. As a matter of fact, the significant decrease in the effect size in the groups of 60-79 and over 80 may indicate that the effect of larger sample sizes may weaken and this may limit the ability of the programme to meet the educational needs. It can be considered that large sample groups may lead to increased heterogeneity by making it difficult to control variables and thus reduce the overall impact of the programme. In this respect, it may mean that more effective results can be obtained with fewer but more carefully selected participants. However, it can be concluded that the most appropriate sample size in educational applications should be carefully determined according to the programme. While small and medium-sized groups can provide better results by encouraging individual learning experiences and interactions, larger groups can be considered as negatively affecting the effectiveness of the programme.

According to the results of the research, the following suggestions can be made:

- In the research, it was concluded that the effect of the layered curriculum on academic achievement was at a moderate level. Therefore, in the context of supporting the academic achievement of learners, stepped teaching programmes should be included and awareness should be created.
- Within the scope of this research, the effect of the layered curriculum on academic achievement was examined. The effect of the current programme on attitude and retention can be examined from a broader perspective.
- In the research, the studies in the National Thesis Centre of the Council of Higher Education were used. As a matter of fact, it may be important to include theses, articles and papers from abroad within the scope of the research.
- Since holistic evaluations are reached in meta-analysis studies, it is known that it is important to present descriptive statistics, especially arithmetic mean, standard deviation and sample size clearly in the studies. In this context, researchers should be encouraged to present these statistics clearly.
- The scope of the study can be expanded by adding educational levels and various courses to the moderator variables of the study.

- In order for the layered curriculum to become more effective in education, it can be used systematically in different education levels and courses. Teaching the knowledge and skills related to this programme, restructuring the classroom environments in accordance with the programme and arranging them according to the individual learning speeds of individuals can lead to the adoption of the programme as an effective educational tool.

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The Evaluation of Students' Perception of E-learning in Higher Education

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ABSTRACT

Nowadays, with the progress of society, especially in recent years with the emergence and development of artificial intelligence, technology and the Internet have been integrated into every aspect of people's lives. In the education industry, there are also the emergence of products combining these technologies, such as webcasting classes, e-libraries, e-learning videos, e-learning APPs and so on, and E-learning system is the collective name of these products.

Since the COVID-19 outbreak, students across the globe have had to be quarantined at home, which has resulted in no way for them to get to the classroom and learn as they used to. However, it is this situation that has led to the rapid development of e-learning systems. Teachers are using live webcasts to deliver lessons to their students, schools are developing apps specifically designed to aid learning, posting e-learning videos on the web, simulating experiments on the web, and so on. Undoubtedly, e-learning systems are a good solution to the problem of geographical restrictions. However, because there is no way for teachers to grasp the learning status of students in real time as they can in the classroom, e-learning systems have still aroused the concern of many people.

Therefore, this project was to investigate the perceptions of university students who have been exposed to e-learning systems about e-learning systems. The project was able to examine the perceptions of e-learning systems among different groups of students by gender, age, year of study and study mode. At the same time, the project categorized the factors affecting e-learning systems into five factors: Autonomy Factor, Problem-solving Factor, Multimedia Factor, Teacher Factor and Student Factor. In this study, questionnaire was used to collect data. 120 questionnaires were received. Based on the results of the survey, the project will analyze the correlation between these factors and the relationship between these factors and demographic information. These results will be useful for educational institutions or individuals to improve e-learning systems in the future.

Keywords: e-learning; Autonomy Factor; Problem-solving Factor; Multimedia Factor; Teacher Factor; Student Factor.

INTRODUCTION

Nowadays, with the development of technologies such as Internet and artificial intelligence, our lives have been raised to a new level. The technology has affected perspective of our society, and one of the most important perspectives is the field of education. Moreover, after the COVID 19 pandemic, online learning has grown tremendously. The students under higher education at this time are the first bench of students who can benefit from the convenient of technology in our study since we are in our early stage of education. During our educational period, we will encounter different educational technologies, such as educational software, course management software, the Internet and video, which we call E-learning system. This E-learning system can provide an effective learning environment for students. In E-learning system, learning activities are based on learner autonomy and interactive learning actions; in addition, learning instruction is based on multiple media. Furthermore, E-learning also offers cooperative learning opportunities. Based on activity theory, the purpose of this study is to examine learners' attitudes toward E-learning systems. Indeed, understanding learners' attitudes toward E-learning systems is necessary to ensure that E-learning stands the best possible chance to succeed.

The objective of this study is to examine the cognitive characteristic of the university students, as well as to investigate the relationship among autonomy factors, problem-solving factors, multimedia learning factors, teacher factors and student factors, in order to find out students' perception towards E-learning in higher education.

LITERATURE REVIEW

1 Concept of E-learning

E-learning refers to the delivery of educational content and experiences through electronic devices such as computers, tablets, or smartphones over the internet. It can take various forms, including online courses, video lectures, interactive simulations, and virtual classrooms (Rosenberg, 2003).

E-learning has the following advantages in modern education. E-learning provides access to education for people who may not have been able to attend traditional classes due to geographical, physical, or time constraints. Learners can study at their own pace and at times that are convenient for them, allowing for a more personalized learning

experience. E-learning often reduces the need for physical resources, making it a cost-effective alternative to traditional education. With advancements in technology, E-learning platforms can offer immersive and interactive learning experiences, enhancing engagement and retention (Moore, 2006). E-learning allows educators to reach a global audience, breaking down geographical barriers and enabling collaboration across borders. E-learning supports the concept of lifelong learning by providing opportunities for continuous skill development and updating knowledge.

2 Evolution of E-learning

The roots of E-learning can be traced back to the early development of computer-based training and instructional design theories in 1960s-1970s (Bakhouyi, 2017). In 1980s-1990s, the emergence of personal computers and the internet laid the groundwork for the delivery of educational content electronically. In the 1990s, CD-ROMs allowed for interactive multimedia learning experiences, paving the way for more engaging educational materials (Smothers et al, 2009). Also, LMS software such as Blackboard and Moodle began to streamline the administration and delivery of online courses. With the popularity of smartphones and tablets, E-learning has been extended to mobile devices, enabling mobile learning. MOOC platforms have democratized access to high-quality education from top institutions. Nowadays, advanced algorithms and AI are being used to personalize learning paths based on individual student performance and preferences. Virtual Reality and Augmented Reality are being integrated into E-learning to create immersive and interactive learning experiences (Cui et al, 2008).

3 Effectiveness of E-learning

There are a lot of studies and research exploring the effectiveness of E-learning compared to traditional classroom instruction. Here are some key findings:

1. A study published in the Journal of Educational Psychology found that students in online courses performed better than those in face-to-face classes, with higher test scores and retention rates (Whitman et al, 2005).
2. The U.S. Department of Education conducted a meta-analysis of 51 independent studies and found that on average, students who engaged in online learning outperformed those receiving face-to-face instruction.
3. Research published in the Journal of Computer Assisted Learning revealed that E-learning can lead to improved student satisfaction and engagement compared to traditional classroom methods (Tirziu & Vrabie, 2015).
4. The American Journal of Distance Education published a review indicating that E-learning is particularly beneficial for learners who are self-directed and motivated, as it allows them to take control of their learning journey (Miller et al, 2017).

While these studies highlight the benefits of E-learning, it is important to note that the effectiveness of any instructional method depends on various factors. Here are some key factors influencing the effectiveness of E-learning:

1. Learner Characteristics: Self-directed learners who are able to manage their time effectively tend to reap the benefits of e-learning environments. Learners' comfort and proficiency with technology affects their engagement and success in e-learning.
2. Instructional Design: Clear learning objectives help guide the design of e-learning materials and assessments and contribute to effective learning outcomes. Interactive and multimedia content can increase learner engagement and promote understanding of complex concepts. Providing timely and constructive feedback and designing effective assessment methods are essential to measuring and enhancing learning.
3. Technological Aspects: Ensuring that e-learning platforms are accessible from a variety of devices and have user-friendly interfaces will promote a positive learning experience. A stable internet connection and reliable hardware are key to E-learning delivery. Protecting learners' data and maintaining secure communication channels are key to building trust in E-learning environments.
4. Social and Collaborative Elements: Opportunities for peer co-operation and discussion can enrich the learning experience by facilitating knowledge sharing and the exchange of different perspectives. Active participation and feedback from the instructor contribute to a sense of community and support in the E-learning environment.
5. Support Systems: Access to timely technical assistance and troubleshooting resources can minimize disruption and frustration for learners. Providing instruction in learning strategies, time management, and self-directed learning skills can empower learners to succeed in e-learning.

4 Technology Integration in E-Learning

With the growth of the Internet, more and more technology is being used in e-learning systems. These technological tools and platforms play a crucial role in facilitating e-learning by offering diverse content delivery models, facilitating interactive and immersive learning experiences, and enabling personalized teaching and learning, ultimately increasing the effectiveness and accessibility of online education. Here are some key technologies:

1. Learning Management Systems (LMS): The LMS platform simplifies the management of online courses, including content delivery, student enrolment and assessment tracking. The LMS provides a centralized hub for

hosting and delivering course materials, making them easily accessible to learners wherever they have an internet connection. Forum, chat and messaging features in the LMS can facilitate interaction between students and teachers (Konstantina et al, 2015).

2. VR and AR: VR and AR technologies provide immersive simulations and visualizations to deepen understanding of complex disciplines such as science, engineering and medical training. VR and AR can provide hands-on training experiences in virtual environments, allowing learners to practice their skills in realistic scenarios.

3. AI: Artificial intelligence algorithms can analyze learners' performance data and provide personalized learning paths based on their strengths, weaknesses and learning preferences. Artificial intelligence-powered chatbots and virtual assistants can provide instant support to learners, answering questions and guiding them through course material.

4. Video Conferencing and Webinars: Platforms for video conferencing and webinars enable live lectures, discussions, and Q&A sessions, fostering real-time interaction between instructors and students. Through these platforms, guest speakers and experts can contribute to the learning experience regardless of geographical constraints.

5. Mobile Learning Apps: Mobile apps provide learners with the flexibility to access course materials and engage in learning activities from smartphones and tablets, supporting mobility and accessibility.

5 Challenges and Barriers in E-Learning Implementation

Common challenges and barriers in implementing e-learning (Goyal, 2012) include:

1. Access to technology and internet connectivity: Many learners may not have access to reliable technology or high-speed internet, limiting their ability to fully participate in E-learning.

2. Lack of technical skills: Some learners and educators may struggle with using the necessary E-learning platforms and tools effectively, leading to frustration and disengagement.

3. Motivation and engagement: Without face-to-face interaction, some learners may struggle to stay motivated and engaged in E-learning environments.

4. Quality of content and instructional design: Ensuring that E-learning materials are engaging, effective, and well-organized can be a challenge for educators and content creators.

Potential solutions to address these challenges include:

1. Providing access to technology and internet: Schools and organizations could consider providing equipment and subsidizing the cost of access to the Internet for learners who do not have access to the Internet. They could also explore offline learning programs and distribute educational materials in physical form.

2. Offering technical support and training: Providing training sessions and resources to help learners and educators become proficient in using E-learning platforms and tools can improve their confidence and effectiveness.

3. Implementing interactive and personalized learning experiences: Incorporating interactive elements such as quizzes, discussions and multimedia content can increase learner engagement. In addition, personalized learning paths based on individual interests and abilities can help to maintain motivation.

4. Investing in professional instructional design: Employing skilled instructional designers and educators to create high-quality E-learning content ensures that materials are well-structured, engaging and aligned with learning objectives.

6 Future Directions and Emerging Trends in E-Learning

AI in E-learning: Integrating AI technologies such as personalized recommendations, adaptive learning algorithms and natural language processing has great potential to improve the efficiency and effectiveness of E-learning experiences (Elizabeth et al, 2003).

Immersive Technologies: VR and AR hold the promise of transforming e-learning by providing immersive and interactive learning environments. Future research may delve into the pedagogical implications and best practices of integrating these technologies into E-learning programs.

Data-Driven Instructional Design: Leveraging learning analytics and big data, future E-learning research could focus on using data-driven insights to inform instructional design, personalize learning pathways, and predict student performance (Verbert et al, 2012).

Workforce Development and Lifelong Learning: Research into the role of E-learning in meeting the needs of adult learners, upskilling and re-skilling the labor force and supporting lifelong learning initiatives can contribute to the development of E-learning with wider societal impact.

These future directions and emerging trends in e-learning have the potential to shape the next generation of educational technology and pedagogy, ultimately redefining the way we learn and teach in the digital age.

RESEARCH METHODOLOGY

In this project, a questionnaire survey has been conducted to collect the data in order to evaluate students' perception of E-learning in higher education. Previous studies have also used questionnaire survey to collect users' perception on technology with different scales, which were found to be effective, whereas the measurement scale

used in this project has been adopted in previous research to measure students' perception on E-learning. Moreover, the method of using survey is very effective because of being widely distributed to the students and spending less time to distribute and collect data. Thus, questionnaire survey has been chosen to collect data in this project.

1 Designing a questionnaire

The questionnaire was divided into 3 parts. For the first part, it contained the questions inquiring the personal information of the respondents, including their age, gender, the universities they attended, their current grade level and major, their mode of study and their GPA. This information was required as comparison between different age, and study mode in their perception in E-learning.

In the second part, there were questions inquiring the previous experience of using technology for learning of the respondents. This information was required as comparison between the respondents with different experience in using computer. There were 5 items in total, 1 of which was about the computer accessibility and 4 were about the quantity of their prior experience on using computer for both educational and non-educational purpose.

The third part contained the questions inquiring university students' perceptions to E-learning. There were 25 questions in this part, 6 of which are related to the Autonomy Factors (AF), 3 of which are for the Problem-solving Factors (PF), 3 for the Multimedia learning Factors (MF), 3 for the Teacher Factors (TF), and the last 10 for the Students' Attitude Factors (SF). Those items were rated from a 5-point Likert type scale, ranging from 1 "strongly disagree" to 5 "strongly agree".

2 Distribution and collection of questionnaires

After the questionnaire has been finalized, a pilot study has been done before distribution in a large scale. 5 questionnaires were distributed out to my friends from various universities, for a pilot study. Piloting the questions on a small group of people could certainly save time in the case that any problems about the questions, wording and design of the questionnaire should be discovered at this stage. They were asked to complete the questionnaires without any explanation or assistance in order to find out whether they could understand the questions by themselves. After the questionnaires have been completed and collected, they were asked to give feedback about the questionnaire individually. It was found that the questionnaire could be understood by all of the participants in this pilot study and the length of the questionnaire was found to be moderate as well.

As soon as the pilot study finished, distribution of questionnaires started. The targets of this survey were university students. They have all experienced with different extent of E-learning systems in university or in high school. So, the information about university students' perception on E-learning and the factors affecting their perception can be collected for this target group. Finally, 120 questionnaires were collected.

3 Data Preparation

After the completion of the distribution and collection of the questionnaires, questionnaire checking has to be done so as to ensure all the questionnaires were fully completed without any missing items.

All the questionnaires collected were only the raw data in this stage. The raw data will be inputted into the data-sheet so as to facilitate data analysis process. Once there was any missing item in any questionnaire, that questionnaire would be discarded.

4 Data Analysis

The statistical tool used in this project was the "Statistical Package for the Social Science" (SPSS). SPSS is a sophisticated piece of software used by many scientists and related professionals for statistical analysis. Moreover, it is user-friendly and basically capable to provide every information output we needed.

Items included in the questionnaire must be valid and reliable in order to collect useful and relevant data. The validation of the measurement scales would be evaluated so as to confirm the psychometric property of this scale is reliable and valid.

Factor analysis is used to identify groups of similar and related items, create and validate scales, ensure that items are associated with the scales, and reduce the number of variables so as to facilitate further analysis. Items should be eliminated if the factor loading or corrected item-total correlation value of the item was lower than 0.3.

The reliability of the scales would be evaluated by the Cronbach's alpha which is a measure of internal consistency indicated how close do the items related to each other. All the scales should exceed the recommended cutoff criteria, i.e. Cronbach's alpha > 0.7, then all the scales could say to be reliable.

After validating the measurement scales, the independent t-test were used for testing the differences between the means of two independent groups while one-way analysis of variance (ANOVA) was used for testing the differences between the means of several groups (more than two groups). In this study, comparison would be made between gender; full-time students and part-time students, more experience and less experience, among different age groups and among grade level.

5 Validation of Measurement Scale

As mention in last section, the validation of the measurement scale would be evaluated in order to confirm its psychometric property. Factor loading and item-total correlations of the items were found out to test for their validity. Table 1 shows the result of factor analysis.

5.1 Factor Analysis

Table 1: Factor Loading of the Measurement Scale

Item	Factor Loading
AF1	.802
AF2	.817
AF3	.813
AF4	.723
AF5	.773
AF6	.510
PF1	.825
PF2	.732
PF3	.851
MF1	.834
MF2	.880
MF3	.824
TF1	.695
TF2	.788
TF3	.776
SF1	.720
SF2	.680
SF3	.765
SF4	.425
SF5	.564
SF6	.642
SF7	.708
SF8	.602
SF9	.763
SF10	.656

The general accepted values of the factor loading and item-total correlation was 0.3. According to Table 3.0, the factor loading of all the 25 items in the questionnaire were larger than 0.3. Thus, this scale was reliable and all the items above had large variance for factor analysis.

5.2 Reliability Analysis

Table 2: Reliability Statistics for Factors

Item	Cronbach's Alpha	N of Items
AF	.929	6
PF	.877	3
MF	.909	3
TF	.836	3
SF	.940	10

The Cronbach's Alphas for each Factor are 0.929, 0.877, 0.909, 0.836, 0.940, which are all higher than the acceptable value 0.7, means that the scale was reliable. Table 2 shows the reliability of factors.

ANALYSIS OF RESULT & DISCUSSION

1 Introduction

This section analyzes the results of the survey. The demographics of the respondents are first discussed to provide some background information about the respondents such as gender, age, university attended, grade attended, major, mode of study, use of computers, and previous experiences. Based on personal information, respondents will be divided into groups for comparison purposes. Then, the descriptive statistics of the scale would be presented and gives the summary of each motivational factor. Independent samples t-test would be presented to give the comparison between gender, mode of study and prior experience. One-way ANOVA would be presented to compare between age, grade levels and access to computers.

2 Demographic Information of Respondents

A total of 120 questionnaires were collected. Among the respondents, 57.5% of the respondents are male and 42.5% are female (Table 3). Participants were with 1.7% aged <18, with 45.0% aged 18-22, with 37.5% aged 23-27, with 15% aged 28-31, and with 0.8% aged >31 (Table 4). Also, 36.7% were CityU students, 14.2% were HKU students, 20.8% were CU students, 16.7% were PolyU students, and 11.7% were from other universities (Table 5). 13.3% were Year 1 students, 17.5% were year 2 students, 15.0% were year 3 students, 34.2% was year 4 or above students, 19.2% were postgraduates, and 0.8% are under other level (Table 6). 27.5% were majored in Art/Social Science/Education, 15.0% were majored in Business, 32.5% were majored in Engineering, 9.2% were majored in Law, 14.2% were majored in Pharmacy/Medicine and another 1.7% were majored in others (Table 7). About the respondents' mode of study, 80.8% were full time students and 19.2% were part time students (Table 8). Finally, 46.6% were more experienced students and 53.4% were less experienced students. The respondent's background was summarized below.

Gender

Table 3: Percentage of Respondents' Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	69	57.5	57.5	57.5
Female	51	42.5	42.5	100.0
Total	120	100.0	100.0	

Age

Table 4: Percentage of Respondents' Age

	Frequency	Percent	Valid Percent	Cumulative Percent
<18	2	1.7	1.7	1.7
18-22	54	45.0	45.0	46.7
23-27	45	37.5	37.5	84.2
28-31	18	15.0	15.0	99.2
>31	1	0.8	0.8	100.0
Total	120	100.0	100.0	

University

Table 5 Percentage of Respondents' Studying University

	Frequency	Percent	Valid Percent	Cumulative Percent
CityU	44	36.7	36.7	36.7
HKU	17	14.2	14.2	50.8
CU	25	20.8	20.8	71.7
PolyU	20	16.7	16.7	88.3
Others	14	11.7	11.7	100.0
Total	120	100.0	100.0	

Grade

Table 6 Percentage of Respondents' Grade Level

	Frequency	Percent	Valid Percent	Cumulative Percent
Year 1	16	13.3	13.3	13.3
Year 2	21	17.5	17.5	30.8

Year 3	18	15.0	15.0	45.8
Year 4 or above	41	34.2	34.2	80.0
Postgraduate	23	19.2	19.2	99.2
Others	1	0.8	0.8	100.0
Total	120	100.0	100.0	

Major

Table 7 Percentage of Respondents' Major

	Frequency	Percent	Valid Percent	Cumulative Percent
Art/Social	33	27.5	27.5	27.5
Science/Education	18	15.0	15.0	42.5
Business	39	32.5	32.5	75.0
Engineering	11	9.2	9.2	84.2
Law	17	14.2	14.2	98.3
Pharmacy/Medicine	2	1.7	1.7	100.0
Others	120	100.0	100.0	
Total				

Mode of Study

Table 8 Percentage of Respondents' Mode of Study

	Frequency	Percent	Valid Percent	Cumulative Percent
Full time	97	80.8	80.8	80.8
Part time	23	19.2	19.2	100.0
Total	120	100.0	100.0	

3 Descriptive Statistics

3.1 Autonomy Factors

The overall mean of Autonomy Factors (AF) was around 3.25. It means that the respondents rated AF positively. From the five-point scale in the questions of AF, point 3 indicated “NEUTRAL”, therefore the respondents tend to agree that they are well able to make active use of e-learning systems to assist their learning. They rated item AF6 “I can find information actively in the e-learning system.” the highest. It indicated that university students were confident that make fully use of E-learning systems to search the information they need.

3.2 Problem-solving Factors

The overall mean of Problem-solving Factors (PF) was around 3.17. It means that the respondents rated PF positively. From the five-point scale in the questions of PF, point 3 indicated “NEUTRAL”, therefore the respondents tend to agree that E-learning systems are really effective in helping them solve problems. They rated item PF2 “The e-learning system enhances my problem-solving skills.” the highest. It indicated that university students were confident that E-learning system can enhance their problem-solving skills.

3.3 Multimedia Factors

The overall mean of Multimedia Factors (MF) was around 3.15. It means that the respondents rated MF positively. From the five-point scale in the questions of MF, point 3 indicated “NEUTRAL”, therefore the respondents tend to agree that the multimedia elements of the current E-learning system are welcome. They rated item MF1 “I like colorful pictures in e-learning instruction.” the highest. It indicated that university students found the colorful pictures in the e-learning system very useful.

3.4 Teacher Factors

The overall mean of Teacher Factors (TF) was 3.2. It means that the respondents rated TF positively. From the five-point scale in the questions of TF, point 3 indicated “NEUTRAL”, therefore the respondents tend to agree that teachers’ guidance and advice in E-learning systems went a long way. They rated item TF1 “I like the teacher’s help and suggestions in the e-learning system.” the highest. It indicated that university students were very willing to get guidance and advice from teachers in the E-learning systems.

4.3.5 Student Factors

The overall mean of Student Factors (SF) was around 3.25. It means that the respondents rated SF positively. From

the five-point scale in the questions of SF, point 3 indicated “NEUTRAL”, therefore the respondents tend to agree that the E-learning system has been very helpful and they would recommend it to others. They rated item SF4 “Time flies when I am using educational technologies.” the highest. It indicated that university students were well immersed in the use of E-learning systems.

5. Independent Samples T-test

The independent samples T-test is designed to find out whether two groups of factors are statistically different. The text consists of two parts which are “Levene’s Test for Equality of Variances” and “t-test for Equality of Means”. The Levene test is used to test whether the variances of the two groups are the same and to determine which t-value is more appropriate. If the significance level of the Levene test is greater than 0.05, i.e., the variances of the two groups are equal, the result assuming that the variances of the two groups are equal is used. Otherwise, use results that do not assume that the two groups have equal variances. Meanwhile, “t-test for Equality of Means” can be used to determine whether there is a significant difference between the two groups. If the level of significance (two-tailed) is equal to or less than 0.05, there is a significant difference between the mean scores of the two groups. Otherwise, there is no significant difference between the two groups.

5.1 Comparison of Distribution of Computer Usage between Gender

The significance value under Levene’s Test was 0.877, which was greater than 0.05. It means that we can assume that male and female had equal variances and thus the results in the row of “Equal variances assumed” was used. Hence, the value of significance (2-tailed) under “t-test for Equality of Mean” was <0.001 , which was less than 0.05. Therefore, there was statistically significant gender difference about Computer Usage Experience. The mean value for male students was 2.5362 while the mean value for females was 3.8382, which means females had more computer experience than males did.

The above phenomenon may be attributed to the fact that men use computers more for recreational activities such as video games, whereas women use computers more for solving practical problems, and in the process, women accumulate more experience in using computers than men.

5.2 Comparison of Autonomy Factors between Genders

The significance value under Levene’s Test was <0.001 , which was less than 0.05. It means that we can assume that male and female had no equal variances and thus the values in the row of “Equal variances not assumed” was used. Hence, the value of significance (2-tailed) under “t-test for Equality of Mean” was <0.001 , which was less than 0.05. Therefore, there was statistically significant gender difference about Autonomy Factors.

The mean value for male students was 2.7005 while the mean value for females was 3.9967, which means females were more self-directed learners than males in E-learning systems.

The above phenomenon may be attributed to the fact that women are naturally more stable and down-to-earth than men, and are able to immerse themselves in e-learning systems and actively explore knowledge more readily than men.

5.3 Comparison of Student Factors between Genders

The significance value under Levene’s Test was <0.001 , which was less than 0.05. It means that we can assume that male and female had no equal variances and thus the values in the row of “Equal variances not assumed” was used. Hence, the value of significance (2-tailed) under “t-test for Equality of Mean” was <0.001 , which was less than 0.05. Therefore, there was statistically significant gender difference about Student Factors.

The mean value for male students was 2.7058 while the mean value for females was 3.9843, which means female students were more suited to learning with E-learning systems than their male counterparts.

5.4 Comparison of Students’ Prior Experience between Study Modes

The significance value under Levene’s Test was <0.001 , which was less than 0.05. It means that we can assume that full-time and part-time students had no equal variances and thus the values in the row of “Equal variances not assumed” was used. Hence, the value of significance (2-tailed) under “t-test for Equality of Mean” was <0.001 , which was less than 0.05. Therefore, there was statistically significant study mode difference about Prior Experience.

The mean value for full-time students was 3.3763 while the mean value for part-time students was 1.8804, which means full-time students had more experience with computers than part-time students.

The reason for this may be that full-time students have more computer time than part-time students and can spend

more energy researching computer use.

6 One-way ANOVA

One-way ANOVA is used to find out if there is a significant difference between the means of two or more independent groups. If the ANOVA significance level is equal to or less than 0.05, then there is a significant difference between the mean scores of the different groups. Otherwise, there is no significant difference between the mean scores of different groups.

6.1 Comparison of Students' Prior Experience between Ages

The significance level under ANOVA was <0.001 ($F=11.154$, $p<0.05$). This indicated that the age groups had significant difference in Students' Prior Experience of computer. From Table 4.25, it showed the mean values for five age groups, which were 1.5000 for aged <18 , 3.0926 for aged 18-22, 3.6556 for aged 23-27, 1.7917 for 28-31, and 4.0000 for aged >31 . It implied that students aged 18-27 had more experience with computers than any other age group. This is because most undergraduate and postgraduate students are in this age group and will have more opportunities to utilize computers in their academic lives to aid their learning. Therefore, students in this age group are naturally more experienced in computer use than students in other age groups.

6.2 Comparison of Autonomy Factors between Study Years

The significance level under ANOVA was <0.001 ($F=53.001$, $p<0.05$). This indicated that the study years had significant difference in Autonomy Factors. From Table 4.27, it showed the mean values for six study year groups, which were 1.8646 for Year 1, 1.9841 for Year 2, 2.3796 for Year 3, 4.2114 for Year 4, 4.2681 for Postgraduates, and 5.0000 for Others. The mean values increased while the study year increased. It implied that students in the upper grades were able to learn more consciously and actively in the E-learning system than those in the lower grades. This may be due to the fact that more emphasis is placed on student autonomy in acquiring knowledge at the university level than passively receiving knowledge output from teachers. As a result, as the academic year progresses, students become more capable of independent learning.

7. Pearson Correlation among Motivational Components

Pearson Correlation measures the strength of the relationship between two variables and the direction of the relationship between two variables, i.e., positive and negative correlations. If the Pearson's correlation coefficient (r) is positive (+), it means that the value of one variable increases as the value of the other increases and vice versa. If the Pearson correlation coefficient (r) is negative (-), it means that as the value of one variable increases, the value of the other variable decreases. The Pearson correlation coefficient (r) ranges from -1 to +1. If the Pearson's correlation coefficient (r) is close to +1 or -1, the relationship between the two variables is strong and changes in one variable are closely related to changes in the second variable. If the Pearson's correlation coefficient (r) is close to 0, the relationship between the two variables is weak and changes in one variable are not correlated with changes in the second variable. If the significance (2-tailed) value is less than or equal to 0.05, there is a statistically significant correlation between the two variables. If the significance (2-tailed) value is greater than 0.05, there is no significant correlation between the two variables.

7.1 Relationship between Exp and AF

For the relationship between Students' Experience of Computers (Exp) and Autonomy Factors (AF), the Pearson correlation coefficient was 0.782 ($p<0.01$) and the impact of Exp and AF was positive and significant as predicted. Since the Pearson correlation coefficient between Exp and AF was +0.782, the relationship between them was positive and significant. As mentioned by Cohen, the value of r ranging above 0.5 would be classified as a strong correlation. There was a strong positive correlation between Exp and AF. The reason for the above phenomenon may be that proficiency in operating electronic devices such as computers and mobile phones may affect the students' experience of using the e-learning system for learning. Students who are proficient in operating computers will have a better learning experience in the process of e-learning, which will stimulate their enthusiasm for active learning. On the contrary, if they are not proficient in the operation of electronic devices, students need to spend more energy on learning to use the e-learning system, which will weaken their enthusiasm for learning.

7.2 Relationship between AF and PF

For the relationship between Autonomy Factors (AF) and Problem-solving Factors (PF), the Pearson correlation coefficient was 0.893 ($p<0.01$) and the impact of AF and PF was positive and significant as predicted. Since the Pearson correlation coefficient between AF and PF was +0.893, the relationship between them was positive and significant. As mentioned by Cohen, the value of r ranging above 0.5 would be classified as a strong correlation. There was a strong positive correlation between AF and PF. This is because for students who are more proactive in using e-learning systems, they are more adept at utilizing e-learning systems to help them when solving problems. This virtuous circle makes these proactive students perceive the e-learning system as a powerful tool for

solving problems encountered in their daily studies and vice versa.

7.3 Relationship between PF and TF

For the relationship between Problem-solving Factors (PF) and Teacher Factors (TF), the Pearson correlation coefficient was 0.842 ($p < 0.01$) and the impact of PF and TF was positive and significant as predicted. Since the Pearson correlation coefficient between AF and PF was +0.842, the relationship between them was positive and significant. As mentioned by Cohen, the value of r ranging above 0.5 would be classified as a strong correlation. There was a strong positive correlation between PF and TF.

CONCLUSION

This project has gathered the perceptions of students from different universities on E-learning systems. All collected data were imported into SPSS software for data collation and analysis. This report is a study of students' perceptions of E-learning systems based on the results of data analysis.

The study found that respondents' gender, age, study year, and study mode had an impact on students' perceptions of e-learning systems. This is demonstrated by the following:

1. Female respondents were more favorable to E-learning systems than Male.
2. Respondents aged 18-27 had the best perceptions of E-learning systems.
3. The more advanced the college student, the more favorably he or she viewed the e-learning system.
4. Full-time students were more favorable to E-learning systems than part-time students.

Also, this project has examined the relationship between some of the factors that influence the E-learning systems and demographic information. The following are the conclusions reached:

1. Female respondents had more experience with computers than male respondents.
2. Females were more self-directed learners than males in E-learning systems.
3. Full-time students had more experience with computers than part-time students.
4. Students in the upper grades were able to learn more consciously and actively in the E-learning system than those in the lower grades.

Finally, the study found that there is also a correlation between the different factors affecting the E-learning system. Here are the conclusions:

1. There was a strong positive correlation between students' experience of computers and autonomy factors.
2. There was a strong positive correlation between autonomy factors and problem-solving factors.
3. There was a strong positive correlation between problem-solving factors and teacher factors.

These are all the conclusions drawn from this project. This information is very useful for organizations or individuals who want to use E-learning systems to aid teaching and learning. This is because they can use this information to optimize the e-learning system and the way it is used to get the most out of the e-learning system.

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The Impact of Smartphone Use on University Students' Education

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ABSTRACT

This study aims to examine in detail the impact of smartphone use on university students' academic processes. As the role of technology in education continues to grow, smartphones have become an integral part of students' daily lives. Therefore, understanding the effects of these devices on academic performance, time management, and study habits is crucial. The study analyzes the influence of smartphone usage duration, purpose of use, and addiction level on students' academic success, time management skills, and academic procrastination behaviors. The research was conducted using a descriptive survey model, with a study group consisting of 637 university students enrolled at Ankara Medipol University. Participants provided data through an online survey, and the collected data were analyzed using SPSS 27 software. The statistical methods employed in this study include correlation analysis, descriptive statistics, normality tests, reliability analysis (Cronbach's Alpha), Chi-Square Tests, Mann-Whitney U Test, and Kruskal-Wallis H Test. These methods allowed for a multidimensional examination of the relationship between smartphone use and academic performance.

The study results indicate that as smartphone usage time increases, academic performance shows a significant decline. Particularly, excessive use of social media and entertainment applications was found to reduce study time and make concentration more difficult. However, students with higher academic achievement were more likely to use their smartphones for accessing course materials, sharing notes, and conducting academic research. In contrast, students with lower academic performance were found to spend more time on social media, online games, and other distracting content. Additionally, students with higher levels of smartphone addiction exhibited more academic procrastination behaviors. The study also revealed that smartphone usage habits vary based on factors such as gender and education level. Female students were found to spend more time on social media platforms, while male students predominantly engaged with online games and digital entertainment tools. However, the effects on academic performance were not solely related to screen time but were directly linked to the purposes for which students used their smartphones. This finding suggests that focusing solely on smartphone usage duration may not be sufficient for understanding its impact on academic success. Based on the findings, the study emphasizes the need for a more conscious approach to smartphone use in educational processes. Promoting digital literacy training can help students integrate technology more effectively into their academic journeys. Additionally, improving time management skills, reducing distractions during study sessions, and encouraging the use of academic mobile applications are recommended. Using smartphones not just as entertainment devices but as academic support tools may contribute positively to student success. Future research should explore the connections between smartphone addiction, academic performance, and psychological factors in greater detail. Specifically, experimental studies should be conducted to examine the long-term effects of smartphone use on study habits and cognitive attention processes. Such studies could also contribute to the development of educational policies and academic support programs for students.

Keywords: Smartphone use, Academic performance, Technology in education, Digital media, Media literacy.

INTRODUCTION

With the influence of the Information Age, rapid advancements in information and communication technologies (ICTs) and economic conditions have led to extraordinary transformations and changes across numerous fields (Yılmaz, 2018, p. 888). The digitalization process, in particular, has been recognized for its profound impact on societal structures, economic models, and individuals' daily habits (Kılıç, 2023). This transformation is also reflected in the field of education and has gained importance in this context (Küçüktamer & Yardibi, 2017). One of the most prominent examples of this transformation is the increasing role of smartphones in individuals' lives. Smartphones have transcended their primary function as communication devices, becoming essential tools for accessing information, facilitating learning processes, and integrating into everyday life (Ak, 2024).

The use of smartphones in education has transformed learning methods and introduced new opportunities for students. From the perspective of university students, integrating smartphones into educational processes offers a more flexible and interactive learning experience compared to traditional methods (Durukal & Armağan, 2022). However, the academic literature also addresses the negative aspects of smartphone use, including distractions, time management issues, and adverse effects on academic performance (Tavas, Ayyıldız, & Kuzkaya, 2022). Research indicates that students frequently use smartphones not for educational purposes but for social media and entertainment content, which negatively affects their study habits (Yaman, Çubukçu, Küçükali, & Kabakçı Yurdakul, 2020). Given this reality, examining the negative effects of excessive and unconscious smartphone use on academic success is of critical importance.

The primary aim of this study is to provide a comprehensive analysis of the impact of smartphone use on university students' educational processes. Specifically, it seeks to scientifically evaluate the relationship between students' social media and internet usage and their academic performance. In this context, the study addresses both the advantages of smartphone use in education and the potential risks of excessive usage, offering recommendations for more effective usage strategies.

The integration of technological advancements into educational processes, particularly the efficient use of widely adopted tools such as smartphones in learning environments, is crucial for the future of education. The existing literature presents diverse perspectives on the role of smartphones in education. For example, some studies argue that smartphones contribute positively to mobile learning processes (Borak & Beki, 2021), while others suggest that excessive smartphone use negatively impacts academic performance (Gezgin, 2019). Therefore, further scientific research is needed to understand the impact of smartphones on academic achievement and to determine how they can be used most effectively in education.

This study is based on survey findings conducted to evaluate the impact of social media use on academic performance among university students. The survey data were analyzed to explore the role of smartphone usage in educational processes and its relationship with academic success. The sample of this study consists of 637 students enrolled at Ankara Medipol University, of whom 68.4% are female and 31.6% are male. Data were collected through an online survey method, and the findings were evaluated using descriptive statistics, reliability analyses, and hypothesis testing. The results provide a comprehensive discussion of the advantages and potential risks of smartphone use in education.

Mass Media and Its Social Impacts

In contemporary societies, mass media plays a crucial role in shaping various aspects of individuals' lives, ranging from access to information to social norms and cultural interactions. The rapid advancement of technology has facilitated the widespread use of media, leading to significant transformations in social, cultural, and political tendencies (Yılmaz, 2022). Mass media is generally categorized into two main types: traditional media (television, radio, newspapers) and digital media (the internet, social media platforms). Both types serve as key instruments in shaping societal dynamics (Karaca, 2017).

In the process of globalization, mass media has emerged as one of the most influential factors accelerating the transformation of social values. While communication in traditional societies was primarily conducted face-to-face, modern societies experience rapid shifts in social norms and cultural values through media (Yılmaz, 2022; Kara, 2023). Media enables individuals to access information from diverse cultural backgrounds instantly, leading to significant transformations in identity perceptions (Aktay, Hamzaçebi, & Kara, 2021). Particularly, younger generations adapt more quickly to global culture through digital media; however, this adaptation process may also contribute to the erosion of local values over time (Kumcağız et al., 2020).

Mass media exerts profound effects on various aspects of individual and societal life, including consumption habits and moral values. The messages embedded in media content possess the power to shape public perceptions, directly influencing individuals' thought patterns and behavioral tendencies. For instance, advertisements and television programs promote specific consumption behaviors, directing individuals' lifestyles and accelerating the adoption of new consumption patterns (Yılmaz, 2022). Moreover, with the proliferation of social media platforms, social norms are evolving, traditional communication practices are being replaced by virtual interactions, and face-to-face communication among individuals is gradually diminishing (Karaca, 2017).

One of the most significant impacts of mass media is the transformation of intergenerational communication. Yılmaz (2022) highlights that digital media-driven changes in intergenerational communication have made it more challenging to preserve traditional family structures and transfer societal values across generations. For example, while younger generations predominantly access information through social media, older generations tend to prefer

traditional media. This discrepancy hinders intergenerational knowledge sharing and complicates the preservation of shared family values (Yılmaz, 2022).

As inherently social beings, humans have historically maintained interactions and collaborations with their environments to sustain their existence. Over time, these social interactions have undergone a transformation due to the integration of digital technologies into everyday life (Yılmaz & Palabıyık, 2022, p. 81). In this context, digital media has redefined social interaction patterns among individuals. Today, rather than meeting in physical spaces, people primarily communicate through social media and digital platforms. This shift has the potential to weaken social bonds and diminish face-to-face communication skills (Kumcağız et al., 2020). However, digital media also provides individuals with a vast pool of information, thereby enhancing democratic participation and strengthening freedom of expression (Karaca, 2017).

The societal effects of mass media extend across a wide spectrum, from lifestyle changes to social norms. With globalization, the influence of media has increased, fostering interactions between local cultural values and global norms. In particular, digital media has transformed communication patterns and introduced intergenerational differences in communication styles. In this process, enhancing media literacy skills and encouraging individuals to critically evaluate media content have become crucial components of adapting to the evolving media landscape.

The Use of Technology in Academic Achievement

The integration of technology into educational processes significantly influences students' academic success. Digital learning materials, online learning platforms, and smart devices enable students to access information more quickly and make their learning processes more efficient (Karaca, 2017). Through smartphones, tablets, and computers, students can easily access course materials, review lessons, and utilize various digital tools to enhance their academic performance (Kumcağız et al., 2020).

Academic achievement is a broad indicator of an individual's performance in the education process and is influenced by various factors, including cognitive abilities, motivation, learning strategies, and environmental factors (Aktay, Hamzaçebi, & Kara, 2021). The impact of technology on academic success can be better understood when analyzed in interaction with these factors.

Compared to traditional teaching methods, digital educational materials contribute to a more efficient learning process. Online education platforms, e-books, and academic databases help students gain a broader perspective on course topics and process information more quickly (Karaca, 2017). Particularly, internet-based learning resources provide students with personalized learning experiences, allowing them to improve their academic performance (Kumcağız et al., 2020).

For example, a meta-analysis study conducted by Deniz (2019) examined the effects of technology-assisted instruction on academic achievement and attitudes in mathematics and geometry courses. The results indicated that technology-supported teaching had a moderate to high positive impact on students' success in mathematics and geometry.

In terms of academic achievement, time management is a crucial factor that directly affects student success. Technological tools assist students in organizing their study schedules, developing effective study habits, and managing their academic plans more efficiently (Aktay et al., 2021). However, excessive use of technology, particularly the overconsumption of social media platforms, negatively affects time management and leads to a decline in academic performance (Kumcağız et al., 2020).

International assessment programs such as PISA and TIMSS analyze students' academic success and the factors influencing it. Turkey's performance in these assessments provides important insights into the role of technology in education. OECD's PISA studies evaluate students' reading, mathematics, and science performance and assess the effectiveness of educational policies. These evaluations reveal that the effective use of technology in education positively contributes to students' academic achievement. According to TIMSS 2019 results, Turkish students in grades 4 and 8 performed above the international average in mathematics and science.

The impact of technology on academic achievement is twofold. When used correctly, it serves as a valuable tool that enhances learning efficiency and supports educational processes. However, excessive use or misuse of technology can lead to distractions and a decline in academic performance (Karaca, 2017). With the widespread adoption of smartphones, students frequently experience interruptions from notifications, which negatively impact their focus and academic success (Kumcağız et al., 2020).

The 2020 Global Education Monitoring Report by UNESCO highlights that digital technologies improve teaching and learning but also exacerbate existing social inequalities and pose privacy concerns.

A study conducted by Gezgin (2019) revealed that university students' excessive smartphone use was associated with a decline in academic performance. The findings emphasized that this decline was linked to attention deficits, lack of motivation, and difficulties in focusing on coursework. Additionally, the study found that students developed excessive dependence on social media and mobile games, which reduced their study time (Gezgin, 2019).

Similarly, Karadağ and Kılıç (2019) found that technology addiction directly negatively affects academic achievement. Their research indicated that students engage in various digital habits, including social media addiction, online gaming addiction, and instant messaging addiction, which contribute to a decline in academic performance. The study also reported that students who frequently check their phones while studying exhibited shorter attention spans and experienced difficulties in preparing for exams (Karadağ & Kılıç, 2019).

A study by Borak and Beki (2021) demonstrated that social media addiction negatively impacts high school students' academic performance. The research revealed that many students preferred spending time on social media rather than studying, which led to a decline in academic success. Furthermore, the findings indicated that increased internet usage was associated with lower academic achievement (Borak & Beki, 2021).

Based on these findings, it is evident that the integration of technology into education is an inevitable reality in modern learning environments. However, the effects of this integration on academic success must be evaluated from both positive and negative perspectives. In particular, the excessive use of smartphones and social media contributes to shorter attention spans, declining academic performance, and disruptions in study habits.

The Use of Smartphones in Education Within the Context of Digital Transformation

Digital transformation has led to fundamental changes in education systems, with smartphones emerging as one of the most crucial tools in this process. As traditional teaching methods are increasingly being replaced by digital platforms, the integration of smartphones into educational processes has introduced new learning models (Karaca, 2017). By enhancing access to information, these devices not only facilitate personalized learning experiences but also promote equal opportunities in education.

Smartphones offer significant advantages in educational settings. Students can instantly access lecture notes, e-books, and academic articles, while mobile learning applications provide opportunities for individualized learning experiences. Additionally, real-time notifications and reminders assist students in developing time management skills (Kumcağız et al., 2020). Furthermore, interactive learning materials and augmented reality applications make the learning process more engaging and effective.

From the perspective of educators, smartphones provide new opportunities for diversifying lesson content and capturing students' attention. Integrated with online tests, digital classroom applications, and interactive whiteboards, mobile devices contribute to a more interactive learning process. Educators can tailor instructional materials to match students' individual learning paces, thereby personalizing the learning experience (Kumcağız et al., 2020).

However, the use of smartphones in education also brings some negative consequences. Constant online connectivity may lead to distractions, reducing students' academic performance. Social media, mobile games, and other digital distractions can make it difficult for students to concentrate on their coursework (Karaca, 2017). Moreover, excessive screen time can result in eye strain and sleep disturbances. Additionally, for students from low socioeconomic backgrounds, the intensive use of mobile devices in education may contribute to digital inequality. When equal access to education is not ensured, some students may be unable to fully benefit from technology-based learning processes.

The impact of smartphones in education depends on how students utilize this technology. When balanced and mindful use is maintained, smartphones can serve as powerful tools to enhance students' academic performance. However, unregulated and excessive use may be detrimental to academic success. Therefore, it is essential to promote digital literacy among students and encourage productive technology usage habits.

METHOD

This study is a quantitative research designed within the framework of a relational survey model to examine the relationship between university students' social media usage habits and their academic performance. Quantitative

research involves a systematic data collection process based on observable and measurable data (Kazan, 2016). In such studies, statistical methods are used to determine the relationships between variables, thereby increasing the objectivity of the research (Daşdemir, 2016). The relational survey model is a research method used to identify relationships between two or more variables without seeking causality; rather, it aims to present the existing situation (Balci, 2013). The population of the study consists of all undergraduate and associate degree students enrolled at Ankara Medipol University. In sampling selection, the voluntary sampling technique, a non-probability sampling method, was employed. In this method, participation in the study depends on individuals' voluntary choice, making it a widely used technique in non-probability sampling methods (İslamoğlu & Alınacı, 2016). Participation in the study was entirely voluntary, and students from all faculties and class levels were included in the research. This sampling method aimed to broaden the study's scope by incorporating students from various academic programs and class levels. A structured questionnaire consisting of three main sections was used as the data collection tool. Surveys are among the most commonly used data collection techniques in quantitative research, as they aim to systematically measure participants' opinions on specific topics (Aziz, 2013). The first section of the questionnaire included dichotomous (yes/no) questions measuring smartphone usage and online gaming habits. The second section comprised 5-point Likert scale questions assessing the impact of internet and social media usage habits on academic performance. Likert scales are valid and reliable measurement tools widely used to assess individuals' attitudes (Kozak, 2018). The third section contained 5-point Likert scale questions evaluating academic procrastination and time management behaviors. Additionally, the questionnaire included demographic questions to determine participants' personal information and family educational background. The collected data were analyzed using SPSS Statistics Software, version 27.

FINDINGS

The research findings indicate that internet usage duration does not have a direct effect on Grade Point Average (GPA). Similarly, the purposes of internet usage, such as completing assignments, reading news, listening to music, playing games, or general browsing, do not have a statistically significant impact on academic performance. Likewise, social media usage and the preferred type of social media platform were not found to have a significant relationship with GPA. These findings suggest that internet usage alone is not a determining factor in academic performance.

Table 1: Age Distribution of Participants

Age Range	n	%
17-22	551	86.50
23-28	77	12.10
29-34	8	1.30
35 and above	1	0.20
Total	637	100.00

Not. N = 637.

Upon examining **Table 2**, which presents the **age distribution of participants**, it is observed that the **majority of the sample**, consisting of **637 individuals**, falls within the **young age group**. The highest participation rate is in the **17–22 age range**, with **551 participants (86.50%)**. The **second-largest age group** is **23–28 years old**, comprising **77 participants (12.10%)**. In the **29–34 age range**, there are **8 participants (1.30%)**, while only **1 participant (0.20%)** falls into the **35 and older** category. The **demographic structure of the sample** indicates that the **majority of participants are young adults**, particularly **university-aged individuals**, who are **highly represented in the study**.

Table 2: Internet Usage Habits

Daily Usage (Hours)	n	%
0-2	52	8.20
3-5	292	45.80
6-8	197	30.90
8-10	71	11.10
12 and above	25	3.90
Total	637	100.00

Not. N = 637.

Table 4 provides a detailed overview of participants' daily internet usage habits. The sample consists of **637 individuals**, and internet usage duration has been categorized into **five different groups**. One of the most notable findings of the study is that **the majority of participants use the internet for 3–5 hours per day**. This group comprises **292 individuals, representing 45.80% of the sample**. The **second most common usage range** is **6–8**

hours per day, with **197 participants (30.90%)**. Those who use the internet for **0–2 hours daily** constitute **8.20% (52 participants)**, while **11.10% (71 participants)** use the internet for **8–10 hours per day**. The smallest group consists of individuals who use the internet for **12 hours or more per day**, comprising **only 25 participants (3.90%)**. The data clearly indicate that **the vast majority of participants (76.70%) use the internet between 3 to 8 hours per day**.

Table 3: Primary Purpose of Internet Usage

Purpose	n	%
News-Newspaper	18	2.80
Internet Browsing	70	11.00
Music-Games	45	7.10
Assignments-Research	103	16.20
Social Media	401	63.00
Total	637	100.00

Not. N = 637.

Table 5 presents a detailed overview of the primary purposes of internet usage among participants. Within the sample of 637 individuals, **social media** emerges as the most prevalent reason for internet use by a significant margin. **63.00% (n = 401) of participants identified social media as their primary purpose for using the internet.** The second most common purpose is **homework and research**, with **16.20% (n = 103) of participants selecting this option.** **General browsing ranks third**, accounting for **11.00% (n = 70) of responses**, while **music and gaming-related usage follows at 7.10% (n = 45).** The least common purpose for internet usage is **following news and newspapers**, chosen by **only 2.80% (n = 18) of participants.** The findings clearly indicate that **social media plays a dominant role in internet usage among young participants.**

Table 4: Academic Performance Distribution

GNO	n	%
0.50-0.99	8	1.30
1.00-1.49	7	1.10
1.50-1.99	11	1.70
2.00-2.49	57	8.90
2.50-2.99	157	24.60
3.00-3.49	257	40.30
3.50-4.00	140	22.00
Toplam	637	100.00

Not. N = 637. GNO = Grade Point Average (GPA).

Table 7 presents a detailed distribution of participants' Grade Point Average (GPA). Within the sample of 637 individuals, the **largest group** in terms of **academic performance** consists of students with a **GPA range of 3.00–3.49**, comprising **257 participants (40.30%)**. The **second-largest group** includes students with a **GPA range of 2.50–2.99**, representing **24.60% (n = 157)** of the sample. The **high academic performance category (GPA 3.50–4.00)** consists of **140 participants (22.00%)**. In the **moderate performance category (GPA 2.00–2.49)**, **57 participants (8.90%)** were identified. In the **low academic performance categories (GPA 0.50–1.99)**, a total of **26 students (4.10%)** were recorded. The findings clearly indicate that **the vast majority of participants (86.30%) have a GPA of 2.50 or higher**, demonstrating **moderate to high academic performance**.

Table 5: Device Usage for Internet Access

Device Type	n	%
Smartphone	564	88.50
Laptop	21	3.30
Desktop Computer	16	2.50
Tablet	36	5.70
Total	637	100.00

Not. N = 637.

Table 8 provides a detailed overview of the types of devices participants use to access the internet. Within the sample of 637 individuals, **smartphones** stand out as the **most widely used internet access device** by a significant margin. **88.50% (n = 564) of participants reported using a smartphone for internet access.** The **second most preferred device** is the **tablet**, used by **5.70% (n = 36) of participants.** **Laptops** account for **3.30% (n = 21)**, while **desktop computers** are the least commonly used device, with **2.50% (n = 16) of participants**

selecting this option. The findings clearly indicate that **mobile devices, particularly smartphones, have become the dominant means of internet access among young participants.**

Table 6: Daily Smartphone Usage Duration

Usage Duration	N	%
3-5 hours	290	45.50
6-8 hours	192	30.10
0-2 hours	72	11.30
8-10 hours	65	10.20
12 hours and above	18	2.80

As part of the study, participants' **daily smartphone usage duration** was examined. The findings indicate that the **majority of participants (45.50%, n = 290) use their smartphones for 3–5 hours per day.** This is followed by **30.10% (n = 192) of participants who use their smartphones for 6–8 hours daily.** Additionally, **11.30% (n = 72) of participants reported using their smartphones for 0–2 hours per day,** while **10.20% (n = 65) use them for 8–10 hours daily.** The **lowest proportion** consists of participants who use their smartphones for **12 hours or more per day (2.80%, n = 18).** These findings clearly indicate that **the majority of participants (75.60%) use their smartphones for 3–8 hours per day.**

Table 7: Kolmogorov-Smirnov Normality Test Results for Survey Items

Items	İstatistik	df	p
When my phone does not have signal or I cannot access a wireless Internet connection, I constantly check whether there is a signal or if I can find a wireless connection.	0.442	637	<.001
If I have not looked at my smartphone for a while, I feel a strong urge to check it.	0.355	637	<.001
When my smartphone is not with me, I feel discomfort due to not being able to stay updated on social media and other online networks.	0.440	637	<.001
I believe that students should be allowed to use smartphones during class.	0.378	637	<.001
There have been times when I missed classes because I stayed up late playing online games.	0.537	637	<.001
My sleep schedule has been disrupted due to playing online games.	0.503	637	<.001
I have postponed my tasks in order to achieve my goals in online games.	0.481	637	<.001
Online gaming is a source of income for me.	0.540	637	<.001
I feel that the time I spend on the Internet is not sufficient for me.	0.318	637	<.001
In my free time, I check whether my friends have updated their profile pictures.	0.337	637	<.001
I cannot stop myself from thinking about what kind of posts I should share online to attract attention.	0.446	637	<.001
The time I allocate for chatting with my friends on social networks is insufficient.	0.325	637	<.001
I cannot keep a social media account deactivated for more than 24 hours, even if I want to stop using it.	0.325	637	<.001
I fail in my attempts to reduce my Internet usage.	0.225	637	<.001
I cannot refrain from accessing the Internet during class breaks.	0.192	637	<.001
When my Internet connection is lost, I feel incomplete.	0.200	637	<.001
İnterneti uzun zaman kullanmadığım durumlarda kendimi daha sinirli hissedirim.	0.315	637	<.001
If I do not use the Internet for a long time, I become more irritable.	0.228	637	<.001
I use the Internet beyond the daily time limit I have planned.	0.212	637	<.001
After completing my necessary online tasks, I cannot stop my desire to continue using the Internet.	0.221	637	<.001
I avoid making a plan regarding my Internet usage duration.	0.381	637	<.001
If I do not receive any notifications from the Internet, I check whether my friends are online.	0.191	637	<.001
I feel the urge to use social media during class.	0.178	637	<.001
I believe that in order to achieve greater academic success, I should use social media less.	0.166	637	<.001
I have used social media as a way to escape from negative emotions related to my courses.	0.262	637	<.001

Items	İstatistik	df	p
I am not interested in what is taught at school; what I learn from social media is more instructive.	0.222	637	<.001
Even when I need time to study, I spend time on social media and do not realize how hours pass.	0.208	637	<.001
When I have assignments to complete, I first try to seek support from social media.	0.208	637	<.001
Social media increases my motivation for courses.	0.253	637	<.001
Social media enhances the retention of course content.	0.199	637	<.001
I postpone studying for exams or completing my assignments until the last minute.	0.222	637	<.001
Even though I am aware that I need to study for exams or complete my assignments, I do not do so.	0.240	637	<.001
When I am given a task related to my coursework, I usually put it aside and almost forget about it until the deadline approaches.	0.202	637	<.001
I frequently realize that I procrastinate on completing important tasks.	0.208	637	<.001
While studying for an exam or working on my assignments, I get distracted by entertaining content on the Internet.	0.160	637	<.001
I believe that reducing the time I spend on social media will enhance my academic performance.	0.164	637	<.001
When I aim to manage my time more effectively, my social media addiction prevents me from doing so.	0.207	637	<.001
If I do not use the Internet for a long time, I feel empty and struggle to concentrate on my coursework.	0.227	637	<.001
When I make a plan to manage my time, I have difficulty adhering to it due to my interest in social media.	0.243	637	<.001

Note. $N = 637$. All tests were found to be significant at the $p < .001$ level, indicating non-normal distributions. The Lilliefors significance correction was applied.

In order to test whether the survey items used in the study met the assumption of normal distribution, the Kolmogorov-Smirnov test was conducted. The test results indicated that all items ($N = 637$) yielded statistically significant results ($p < .001$). The highest test statistic value was observed for the item "Online gaming is a source of income for me" (Statistic = 0.540), while the lowest test statistic value was found for the item "While studying for my exam or working on my assignments, entertaining content on the Internet distracts me" (Statistic = 0.160). According to the test results, which were adjusted using the Lilliefors significance correction, none of the items exhibited a normal distribution. These findings suggest that non-parametric statistical methods should be employed in the study. The non-normal distribution of the data indicates that participants' responses regarding their Internet and social media usage habits are concentrated in specific directions.

Table 8: Scale Reliability Statistics (AT).

Reliability Criterion	Değer	N
Cronbach's α	.634	8
Cronbach's α (Standardized)	.654	8

The reliability analysis results of the scale measuring smartphone usage indicate that the Cronbach's alpha coefficient for the 8-item scale is .634. The standardized Cronbach's alpha value was calculated as .654. These values suggest that the scale has an acceptable level of internal consistency reliability. The small difference between the standard and standardized alpha values (.02) indicates that there are no substantial variations in the variances of the scale items.

Table 9: Item-Level Descriptive Statistics (AT).

Item	M	SD	N
When my phone does not have a signal or I cannot access a wireless Internet connection, I constantly check whether there is a signal or if I can find a wireless connection.	0.70	0.46	637
If I have not looked at my smartphone for a while, I feel a strong urge to check it.	0.47	0.50	637
When my smartphone is not with me, I feel uncomfortable because I cannot stay updated on social media and other online networks.	0.31	0.46	637
I believe that students should be allowed to use smartphones during class.	0.57	0.50	637
I have missed classes because I stayed up late playing online games.	0.07	0.26	637

Item	<i>M</i>	<i>SD</i>	<i>N</i>
My sleep schedule has been disrupted due to playing online games.	0.17	0.38	637
I have postponed my tasks to achieve my goals in online games (such as leveling up or earning points).	0.22	0.42	637
Online gaming is a source of income for me.	0.06	0.23	637

The descriptive statistics of the items related to smartphone usage ($N = 637$) indicate that the item "When my phone does not have signal or I cannot access a wireless Internet connection, I constantly check whether there is a signal or if I can find a wireless connection" has the highest mean score ($M = 0.70$, $SD = 0.46$). This is followed by the items "I believe that students should be allowed to use smartphones during class" ($M = 0.57$, $SD = 0.50$) and "If I have not looked at my smartphone for a while, I feel a strong urge to check it" ($M = 0.47$, $SD = 0.50$). The items with the lowest mean scores are "Online gaming is a source of income for me" ($M = 0.06$, $SD = 0.23$) and "There have been times when I missed classes because I stayed up late playing online games" ($M = 0.07$, $SD = 0.26$). These findings suggest that students exhibit a high tendency to check their Internet connection and feel a strong urge to use their smartphones, whereas the negative impact of online gaming on their academic life appears to be relatively low.

Table 10: Summary Statistics for Scale Items (AT).

İstatistik	<i>M</i>	Min	Max	Range	Max/Min	Variance	<i>N</i> Items
Item Means	0.32	0.06	0.70	0.64	12.33	0.06	8
Item Variances	0.17	0.05	0.25	0.20	4.68	0.01	8
Inter-Item Covariances	0.03	0.00	0.11	0.11	-32.76	0.00	8
Inter-Item Correlations	0.19	-0.03	0.58	0.62	-18.85	0.02	8

Note. $N = 637$. M = Mean, SD = Standard Deviation, Min = Minimum, Max = Maximum.

The summary statistics for the scale items measuring smartphone usage ($N = 637$) indicate that item means range from 0.06 to 0.70, with an overall mean of 0.32. Item variances range from 0.05 to 0.25, with an average variance of 0.17. Inter-item covariance values vary between 0.00 and 0.11, with a mean covariance of 0.03. Inter-item correlations range from -0.03 to 0.58, with an average correlation of 0.19. The maximum/minimum ratios were calculated as 12.33 for item means and 4.68 for item variances. For inter-item covariance and correlations, these ratios yielded negative values (-32.76 and -18.85, respectively). These findings suggest that the scale items exhibit a moderate level of association with each other and that the internal consistency of the scale is at an acceptable level.

Table 11: Scale Reliability Statistics (KA).

Reliability Measure	Value	<i>N</i> of Items
Cronbach's α	.904	21
Cronbach's α (Standardized)	.903	21

The reliability analysis results for the scale measuring avoidance habits indicate that the Cronbach's alpha coefficient for the 21-item scale is .904. The standardized Cronbach's alpha value was calculated as .903. These values suggest that the scale has a high level of internal consistency reliability. The minimal difference between the standard and standardized alpha values (.001) indicates that there are no significant variations in the variances of the scale items.

Table 12: Scale Reliability Statistics (ZY).

Reliability Measure	Value	<i>N</i> of Items
Cronbach's α	.922	10
Cronbach's α (Standardized)	.924	10

Scale Reliability Analysis Results and Academic Performance Findings

The reliability analysis results indicate that the Cronbach's alpha coefficient for the 10-item scale is .922, while the standardized Cronbach's alpha coefficient is calculated as .924. These values suggest that the scale has a high level of internal consistency. Given that these reliability coefficients are well above the generally accepted cutoff point of .70, the scale provides consistent and reliable measurements.

From a demographic perspective, Grade Point Average (GPA) was found to differ based on gender, nationality, academic department, and year of study. Specifically, a significant relationship was observed between smartphone

usage duration and GPA among female students, whereas no such relationship was found among male students. Among Turkish citizens, a significant relationship was identified between smartphone usage duration and GPA, while for international students, a significant relationship was found between the type of social media used and GPA.

One of the most critical findings of the study is the negative impact of smartphone and online gaming addiction on academic performance. As addiction levels increased, GPA decreased, while internet and smartphone usage duration increased. This effect was particularly pronounced among students aged 17-22, international students, and first-year undergraduate students. Similarly, an increase in social media addiction was associated with a decrease in GPA and an increase in internet and smartphone usage duration.

Regarding time management skills and academic procrastination behavior, a decline in time management skills and an increase in procrastination behavior were found to be associated with lower GPA and increased internet and smartphone usage. This effect was particularly evident among undergraduate students, Turkish citizens, and individuals aged 17-22. However, among graduate students, these effects were found to be less pronounced or statistically insignificant.

From a socioeconomic perspective, the family's monthly income level was found to have a significant impact on internet usage, smartphone usage, and social media consumption. Additionally, significant differences were observed between the geographical region in which the family resides and both GPA and social media usage. While parental education levels influenced GPA, the mother's education level was also found to impact the purpose of internet usage.

Although addiction levels did not show significant differences based on gender or age groups, partial differences were found among different academic programs. While no significant difference was observed in the mean scores of smartphone and online gaming addiction across educational programs, significant differences were found in social media addiction, time management, and procrastination habits.

This study demonstrates that the impact of technology usage on academic success is not direct but rather mediated by addiction levels and usage purposes. Specifically, smartphone, online gaming, and social media addiction negatively affect time management skills, thereby reducing academic performance. In light of these findings, it is essential to regulate university students' technology usage habits, enhance time management skills, and promote conscious and responsible use of the internet and smartphones.

Smartphone Usage and Academic Achievement

The study examined the relationship between students' Grade Point Average (GPA) and smartphone usage duration. The findings indicate a negative correlation between increased smartphone usage time and academic achievement. Specifically, students who used their smartphones for eight or more hours per day exhibited significantly lower GPA scores.

Additionally, the relationship between the purpose of smartphone usage and academic achievement was analyzed. Students who used their smartphones for studying and academic research had higher GPA scores, whereas those with higher rates of social media and entertainment-related smartphone usage demonstrated lower academic performance.

Smartphone Usage and Academic Procrastination

A significant relationship was found between smartphone usage duration and academic procrastination tendency. Specifically, students who used their smartphones for six or more hours per day were more likely to postpone their assignments and exam preparations. Additionally, participants with higher levels of smartphone addiction experienced greater difficulties in time management. This finding highlights the negative impact of smartphone usage on academic processes. The analyses revealed that as smartphone addiction increased, students' academic procrastination behaviors also increased. Furthermore, students who exhibited academic procrastination tendencies allocated more time to entertainment-oriented smartphone activities, such as social media and gaming.

Gender and Smartphone Usage

The study also examined the relationship between gender, smartphone usage duration, and academic achievement, yielding the following results. Female students generally spent more time using smartphones and had higher social media usage rates. In contrast, male students engaged more frequently in gaming and other online activities. Overall, female students exhibited lower academic procrastination tendencies compared to male students. These findings suggest that gender may be a determining factor in smartphone usage habits.

The results of the study indicate that the impact of smartphone usage on the educational process varies depending on the purpose and duration of use. Students who used their smartphones for studying, academic research, and completing assignments demonstrated higher academic achievement, whereas social media and gaming-oriented smartphone use negatively affected academic performance. Additionally, academic procrastination and time management difficulties became more pronounced as smartphone usage time increased. These findings emphasize the importance of students regulating their smartphone usage habits and managing their academic processes more efficiently.

Conclusion and Recommendations

This study was conducted to examine the impact of smartphone usage on university students' educational processes. The findings indicate that the duration and purpose of smartphone usage significantly affect students' academic achievement, time management skills, and academic procrastination behaviors.

The results suggest that an increase in smartphone usage duration may lead to a decline in academic performance. In particular, the widespread use of smartphones for social media and entertainment purposes negatively influences academic processes. Key factors determining academic success include students' study duration, academic motivation, and time management skills. However, excessive smartphone use directly affects these factors, leading to adverse outcomes for academic achievement.

Another critical finding of this study is the significant relationship between smartphone addiction and academic procrastination. A considerable proportion of students acknowledge that prolonged smartphone use negatively impacts their academic processes. Specifically, students who use their smartphones for six or more hours per day exhibit a higher tendency toward academic procrastination. Delayed initiation of studying, missed assignment deadlines, and last-minute exam preparations directly influence students' academic performance.

Furthermore, smartphone usage habits vary based on gender and purpose of use. Female students are more likely to engage in social media, while male students spend more time on online gaming and entertainment-related activities. However, excessive smartphone use negatively affects academic performance for both groups.

The study's findings highlight multiple ways in which excessive smartphone use adversely affects academic processes:

- Using smartphones during class disrupts students' attention and concentration, hindering the learning process.
- Students often underestimate their actual screen time, spending more time on their smartphones than they initially planned.
- The tendency to procrastinate academic tasks increases as smartphone usage duration rises.
- Late-night smartphone use reduces sleep duration, negatively affecting academic performance.
- Excessive smartphone use fosters addiction-like tendencies, reducing students' motivation for academic engagement.

Given these adverse effects, raising awareness about smartphone usage and improving time management skills are of significant importance.

Recommendations

Based on the study's findings, the following recommendations are proposed to help students use smartphones more effectively and manage their academic processes more efficiently:

- Universities should organize seminars and training programs to raise awareness about the impact of excessive smartphone use on academic achievement. Students should be encouraged to use their smartphones not only for entertainment and social media but also for academic purposes. Mobile learning applications, digital libraries, and academic podcasts could serve as valuable tools in this regard.
- Developing students' digital literacy skills should be a priority. Universities may offer digital media literacy courses and introduce students to concepts such as digital minimalism.
- Students should be encouraged to use digital time management tools such as the Pomodoro technique, digital calendars, and to-do list applications to organize their academic schedules more effectively. Additionally, reminders, note-taking apps, and audio lecture recordings could enhance students' productivity.
- Periodic social media and smartphone detox programs could be implemented at universities to support students' academic success. Universities could also offer training on digital awareness and minimalism, encouraging students to set usage limits, disable notifications, and monitor screen time.

- Instructors should implement strategies to limit smartphone use during class and integrate course materials into digital platforms. Tools such as QR codes, digital assessments, and interactive learning materials could promote the use of smartphones as an educational resource.
- Universities should provide digital opportunity equity programs, including free internet access, digital library resources, and device support programs for students from low socioeconomic backgrounds. Additionally, academic materials should be available not only online but also in printed or offline-accessible formats.
- AI-assisted personalized learning tools could be introduced to adapt to individual students' learning paces and improve academic performance.
- Workshops and counseling services should be offered to teach students effective time management strategies.
- Game-based learning methods could be incorporated into educational programs to enhance student motivation.

Future Research Directions

This study highlights the significant effects of smartphone use on university students' academic processes. The findings suggest that academic success can be improved by consciously regulating smartphone usage habits. Raising awareness about the adverse effects of excessive smartphone use, implementing time management strategies, and utilizing technology effectively for educational purposes are crucial steps in mitigating its negative impacts.

Future research should further investigate the relationship between smartphone addiction and academic performance by considering additional variables such as social media addiction, attention deficit, and anxiety. Understanding these relationships in greater depth could contribute to the development of targeted intervention programs. Additionally, examining the association between smartphone addiction and academic achievement in different contexts may provide insights into how students can integrate technology into their academic lives more consciously and effectively.

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The Impact of Social Media Marketing in the Real Estate Sector on Consumer Behavior and Consumer Education

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ABSTRACT

With the advancements in communication technologies, the widespread use of the internet has introduced new platforms, methods, and opportunities for businesses to reach their customers. In this context, marketing strategies in the real estate sector have undergone a significant transformation with digitalization and the rise of social media. Social media platforms play a crucial role in reaching potential buyers and tenants, enhancing brand awareness, and strengthening customer trust. Professional visuals, virtual tours, content marketing, and targeted advertising strategies improve customer experience in the real estate sector while making marketing processes more effective and measurable. The increasing dominance of social media-driven marketing strategies over traditional methods has become an inevitable necessity for firms seeking a competitive advantage. This study adopts a quantitative and descriptive research model to analyze the attitudes, perceptions, and decision-making processes of consumers engaged in real estate marketing through social media. The findings indicate that variables such as gender, marital status, income level, and occupational group significantly influence perceptions of social media marketing. It was found that female participants are more sensitive to social media marketing compared to males, married individuals show greater interest in fashion-related content, and private sector employees react more strongly to entertainment and fashion content on social media than public sector employees. While educational level does not appear to be a decisive factor in the perception of social media marketing, an individual's occupational group significantly affects their social media consumption habits. As consumers' perceptions of social media marketing increase, their purchase intentions also rise. Particularly, entertainment and fashion-oriented content strongly influences consumer purchasing decisions. Consistent with previous studies, social media advertisements are found to guide consumer behavior, facilitate the formation of an emotional connection with brands, and encourage impulse purchasing decisions.

Keywords: Social Media Marketing, Information and Communication Technologies, Consumer Behavior, Real Estate Marketing, Consumer Education.

INTRODUCTION

As an indispensable element of our era, digitalization has become a regulatory force and key actor in everyday life, social interactions, consumer behaviors and habits, and businesses' marketing tools. Parallel to advancements in communication technologies, a new social structure and consumer awareness have emerged, driven by cultural industries, shaped through advertisements, and prioritizing commercial characteristics (Yılmaz, 2022, p. 149). In this context, digital marketing offers more advantages and conveniences compared to traditional marketing practices and methods. Traditional marketing communication methods are often insufficient in reaching buyers in the real estate sector. Consequently, businesses have been compelled to conduct marketing activities in virtual environments known as social media. In this regard, social media marketing practices have gained significant importance in the real estate industry, as companies operating in the sector use social networks to promote their listings.

In recent years, in addition to traditional marketing methods, the necessity for companies to establish a presence on social networks has become essential in terms of cost efficiency, consumer accessibility, and brand prestige. For this reason, appropriate marketing strategies must be identified to enhance sales through consumer/buyer-oriented marketing techniques in the real estate sector.

Social media marketing in the real estate industry plays a crucial role in shaping consumers' purchasing decisions, increasing brand awareness, and enhancing customer engagement. Additionally, the informative content provided

through social media platforms contributes to consumers making more informed and educated decisions regarding real estate investments and property acquisition.

The Impact of Social Media on Consumer Behavior in Purchasing and Decision-Making Processes

The influence of social media on consumer behavior has become a significant topic in the field of marketing in recent years. As the use of social media continues to increase, its impact on consumers' purchasing and decision-making processes has become more pronounced. Understanding how social media affects consumer purchasing behavior plays a crucial role in helping businesses determine their marketing strategies and effectively reach their target audiences (Thompson & Martinez, 2020, p. 85).

The impact of social media on consumer behavior manifests in several ways. First, social media platforms provide consumers with access to information about products and services, enable the sharing of product reviews, and facilitate access to user comments (Özdemir & Yılmaz, 2021, pp. 60–73). Consumers tend to observe the experiences of other users with products on social media and make purchasing decisions based on these experiences. Consequently, social media has become a critical factor influencing consumers' purchasing decisions (Williams, 2020, pp. 55–68).

The Contribution of Social Media to Consumer Education

Social media significantly contributes to consumer education in the real estate sector by helping buyers and investors make informed decisions. The informational content provided on various platforms guides consumers on topics such as the home-buying process, investment strategies, mortgage and financing options. Video content, blog posts, interactive live broadcasts, and expert opinions enable consumers to stay updated on industry developments and make well-informed decisions. Additionally, the interactive communication environment facilitated by social media allows consumers to ask questions, share experiences, and receive direct information from experts. As a result, social media functions not only as a marketing tool but also as an effective educational resource that informs and guides consumers (Jones & Davis, 2014; Kara, 2022).

The Role of Social Media in Real Estate Marketing

Real estate marketing facilitates the swift and effective sale or rental of properties. A well-planned marketing strategy attracts potential buyers and tenants while helping property owners maximize the value of their assets. Real estate marketing ensures that properties reach the right target audience. Targeted marketing campaigns capture the interest of buyers and tenants, encouraging them to engage with the property (Tuncer, 2016, pp. 45–56).

Effective marketing can enhance the appeal of a property and make potential buyers more willing to pay higher prices. Real estate marketing can be leveraged to gain a competitive advantage. A well-executed marketing strategy allows firms to stand out among competitors and attract the attention of potential buyers and tenants. Additionally, marketing helps track industry trends and understand customer needs. Successful marketing techniques in the real estate sector are employed to attract potential buyers and tenants, increase sales, and enhance brand awareness (Yavuz, 2017, p. 300). The most effective real estate marketing techniques include the following:

Virtual Tours and 3D Modeling: Virtual tours and interactive 3D modeling provide potential clients with the opportunity to explore properties remotely. These technologies are particularly useful for attracting buyers and tenants from a distance and allow for a more detailed examination of properties. Virtual reality (VR) enables potential buyers and tenants to experience properties in real-time. Through VR technology, users can virtually tour properties, inspect rooms, and closely observe details. VR tours, brochures, videos, and other promotional materials help potential buyers and tenants explore and envision properties more comprehensively. Real estate developers can also utilize augmented reality (AR) and virtual reality (VR) technologies to create project showcases and promotional stands. These tools allow potential buyers and investors to examine projects more closely and experience their completed form virtually (Doğan, 2020, pp. 85–96).

Online Marketing and Digital Platforms: The internet plays a crucial role in real estate marketing. Real estate companies can showcase their property portfolios through websites and social media platforms, reaching potential clients and increasing brand awareness.

Targeted Advertising and Marketing Strategies: By identifying the target audience, marketing campaigns can be tailored to their preferences and needs. For example, marketing strategies targeting young families looking to buy a home would differ from those aimed at investors.

Real Estate Listings and Platforms: Real estate companies list properties on real estate listing websites and advertise on various platforms to capture the attention of potential buyers and tenants. These listings and platforms

serve as an effective means of promoting properties to a wide audience. Since these platforms are accessible online, potential buyers and tenants can easily browse properties, thereby expanding the reach of marketing efforts (Aydm, 2018, p. 66). Real estate professionals can create premium property listings, run advertisements, or publish sponsored content. This variety enhances marketing flexibility and enables companies to reach diverse target audiences (Demir, 2017, pp. 71–88).

Content Marketing: Content marketing in the real estate sector is used to educate and inform potential buyers through blog posts, e-books, video guides, and infographics. This approach can enhance customer loyalty and build trust (Erdoğan, 2019, pp. 105–116).

METHOD

In this study, a quantitative and descriptive research model was adopted to analyze the attitudes, opinions, and decision-making processes of consumers engaged in real estate marketing through social media. The judgmental sampling method was used to collect data from foreign consumers, who were consciously selected. The data were obtained through a survey method and analyzed using SPSS software, ensuring participant anonymity and encouraging objective responses. The findings highlight the key determinants of consumer perception regarding social media marketing, providing valuable insights into digital marketing strategies in the real estate sector.

Since there are studies in the literature supporting the use of parametric methods for Likert-type scales, these methods were applied in the comparison of scale scores (Norman, 2010). Accordingly, independent samples t-tests were used for comparisons between two independent groups, while one-way analysis of variance (ANOVA) was conducted to test hypotheses involving more than two group means. For values found to be statistically significant in groups with more than two categories, Tukey's post hoc test results were evaluated.

Descriptive statistics for continuous variables were expressed as mean (M), standard deviation (SD), minimum (Min.), and maximum (Max.) values, while frequency (n) and percentage (%) were used for categorical variables. The reliability of the scale was assessed using Cronbach's Alpha coefficient. Data analysis was conducted using IBM SPSS 22, and the statistical significance level was set at 0.05.

RESULTS

The study examines participants' **demographic characteristics, social media usage habits, and attitudes toward real estate listings**. According to the findings, a significant portion of participants (47.5%) reported using social media for **0–2 hours daily**, while **78.4%** stated that they had received real estate listings through social media. When evaluating the impact of listings on **purchasing decisions**, **39.5%** found them to be influential, and **17.0%** considered them highly influential.

Among the most **inspirational social media channels**, **Instagram (32.3%)**, **Facebook (22.3%)**, and **YouTube (14.8%)** were the most prominent. The most critical factors in real estate listings were identified as **location and surrounding area information (25.9%)**, **interior photos (18.4%)**, and **price/payment conditions (17.7%)**. Participants also indicated that **furnished rooms and detailed descriptions** made listings more attractive.

The analyses revealed that **perceptions of social media marketing** were significantly associated with **gender, income level, occupational group, and social media usage duration**. Specifically, **women, high-income groups, and private sector employees** exhibited a higher perception of **social media marketing**. Furthermore, a strong correlation was identified between the **type of social media content** and **purchase intention**.

Table 1: Distribution of Participants' Social Media Usage Habits and Interest in Real Estate

		n	%
Approximately how much time do you spend on social media channels per day?	0-2	209	47,5
	3-5	187	42,5
	6-8	38	8,6
	More than 8 hours.	6	1,4
Have you ever received a real estate listing through any social media channel?	Yes	345	78,4
	No	59	13,4
	I do not recall	36	8,2
How influential do you think social media posts about real estate properties are on your purchasing decision??	No influence	15	3,4
	Slight influence.	49	11,1
	Moderate influence.	127	28,9
	Influential.	174	39,5
	Highly influential.	75	17,0
	Facebook	98	22,3
	Instagram	142	32,3

Which social media channel do you find the most inspiring for real estate properties?	Twitter	28	6,4
	Pinterest	12	2,7
	Snapchat	1	0,2
	TikTok	58	13,2
	Twitter	3	0,7
	XING	3	0,7
	YouTube	65	14,8
	Other	30	6,8

Table 1 presents data on participants' social media usage habits and their perceptions of the real estate sector. Approximately **47.5%** of participants spend **0–2 hours** per day on social media channels, **42.5%** spend **3–5 hours**, **8.6%** spend **6–8 hours**, and only **1.4%** report spending more than **8 hours** daily. Additionally, **78.4%** of participants stated that they had received a **real estate listing through a social media channel**, while **13.4%** reported having no such experience, and **8.2%** indicated that they did not recall.

Regarding the perceived influence of social media posts on **real estate purchasing decisions**, **39.5%** of participants considered them **influential**, **17.0%** found them **highly influential**, **28.9%** reported a **moderate influence**, **11.1%** indicated a **slight influence**, and **3.4%** stated that they had **no influence** on their decision-making.

When asked about the **most inspiring social media channel for real estate properties**, participants most frequently selected **Instagram (32.3%)**, followed by **Facebook (22.3%)**, **YouTube (14.8%)**, and **TikTok (13.2%)**. Meanwhile, **LinkedIn, Pinterest, Snapchat, Twitter, XING, and other platforms** were reported at lower rates.

Table 2: Frequency Distribution of Consumer Attitudes Toward Real Estate Listings

		n	%
I am more interested in listings that show only the exterior (facade) of the property.	Strongly Disagree	68	15,5
	Disagree	128	29,1
	Neutral	100	22,7
	Agree	110	25,0
	Strongly Agree	34	7,7
I am more interested in listings that show only the interior (rooms) of the property.	Strongly Disagree	61	13,9
	Disagree	110	25,0
	Neutral	112	25,5
	Agree	111	25,2
	Strongly Agree	46	10,5
I am more interested in listings that display empty rooms.	Strongly Disagree	65	14,8
	Disagree	143	32,5
	Neutral	129	29,3
	Agree	77	17,5
	Strongly Agree	26	5,9
I am more interested in listings that display furnished rooms.	Strongly Disagree	34	7,7
	Disagree	107	24,3
	Neutral	122	27,7
	Agree	106	24,1
	Strongly Agree	71	16,1
Listings in which the location of the property is clearly visible.	Strongly Disagree	33	7,5
	Disagree	34	7,7
	Neutral	79	18,0
	Agree	145	33,0
	Strongly Agree	149	33,9
Listings in which the sale or rental price of the property is clearly stated.	Strongly Disagree	29	6,6
	Disagree	27	6,1
	Neutral	53	12,0
	Agree	157	35,7
	Strongly Agree	174	39,5
I would like to see the floor plan of the property within the listing.	Strongly Disagree	32	7,3
	Disagree	43	9,8
	Neutral	79	18,0

The more written information about the property, the better.	Agree	167	38,0
	Strongly Agree	119	27,0
	Strongly Disagree	37	8,4
	Disagree	36	8,2
	Neutral	98	22,3
	Agree	136	30,9
The more images of the property, the better.	Strongly Agree	133	30,2
	Strongly Disagree	36	8,2
	Disagree	41	9,3
	Neutral	88	20,0
	Agree	120	27,3
	Strongly Agree	155	35,2
AI-supported listings attract my attention.	Strongly Disagree	57	13,0
	Disagree	80	18,2
	Neutral	126	28,6
	Agree	104	23,6
	Strongly Agree	73	16,6

Table 2 presents detailed insights into how different presentation elements in real estate listings influence participants' interest. When **only the exterior (facade) of the property** was displayed in listings, **44.6%** of participants (**15.5% "strongly disagree" and 29.1% "disagree"**) expressed a negative attitude, while **32.7%** (**25.0% "agree" and 7.7% "strongly agree"**) responded positively; the remaining **22.7%** remained **neutral**. Similarly, when **only interior (rooms) images** were included in listings, **38.9%** (**13.9% + 25.0%**) reacted negatively, **35.7%** (**25.2% + 10.5%**) responded positively, and **25.5%** were **neutral**.

For **listings showcasing empty rooms**, approximately **47.3%** (**14.8% + 32.5%**) of participants showed **disinterest**, while only **23.4%** (**17.5% + 5.9%**) reacted positively. Conversely, **listings featuring furnished rooms** were viewed more favorably, with **24.1% "agree" and 16.1% "strongly agree"**, whereas negative responses (**7.7% + 24.3%**) remained lower.

In listings where the **property's location was clearly presented**, **67.0%** of participants (**33.0% + 33.9%**) found this feature **useful**, while only **15.2%** (**7.5% + 7.7%**) rejected it. Similarly, when **sales or rental prices were explicitly stated**, **positive responses reached 75.2%** (**35.7% + 39.5%**), while negative reactions remained limited to **12.7%**.

Including a **floor plan** in the listing was positively received by **65.0%** of participants (**38.0% + 27.0%**), and **detailed written descriptions** were also favorably perceived, with **61.1% approval** (**30.9% + 30.2%**).

The **availability of multiple property images** was a preferred feature, with **62.5%** of participants (**27.3% + 35.2%**) supporting it. **AI-supported listings** attracted **40.0%** (**23.6% + 16.6%**) of participants, while **31.2%** (**13.0% + 18.2%**) viewed this feature negatively; the remaining participants remained **neutral**.

Table 3: The Most Inspiring Social Media Channel for Real Estate Properties

		S.					p
		N	Place.	Deviation	Min	Max	
Entertainment	Facebook	98	10,53	3,06	3,00	15,00	0,020
	Instagram	142	10,61	2,89	3,00	15,00	
	Twitter	28	10,89	2,23	6,00	15,00	
	Pinterest	12	10,08	2,27	5,00	13,00	
	Snapchat	1	12,00		12,00	12,00	
	TikTok	58	11,31	2,26	5,00	15,00	
	Twitter	3	7,00	1,73	6,00	9,00	
	XING	3	13,67	1,53	12,00	15,00	
	YouTube	65	10,88	2,41	3,00	15,00	
	Other	30	9,43	2,90	3,00	13,00	
Engagement	Facebook	98	6,51	2,16	2,00	10,00	0,185
	Instagram	142	6,30	2,06	2,00	10,00	
	Twitter	28	6,29	1,98	3,00	10,00	

	Pinterest	12	5,00	1,13	3,00	6,00	
	Snapchat	1	4,00		4,00	4,00	
	TikTok	58	6,34	2,14	2,00	10,00	
	Twitter	3	4,00	0,00	4,00	4,00	
	XING	3	7,67	1,15	7,00	9,00	
	YouTube	65	6,23	1,96	2,00	10,00	
	Other	30	6,10	2,06	2,00	10,00	
Fashion	Facebook	98	6,96	2,19	2,00	10,00	0,004
	Instagram	142	6,91	2,08	2,00	10,00	
	Twitter	28	7,75	1,76	4,00	10,00	
	Pinterest	12	6,42	1,51	3,00	9,00	
	Snapchat	1	5,00		5,00	5,00	
	TikTok	58	7,81	1,82	2,00	10,00	
	Twitter	3	6,33	0,58	6,00	7,00	
	XING	3	9,33	0,58	9,00	10,00	
	YouTube	65	7,18	1,94	2,00	10,00	
	Other	30	6,23	1,99	2,00	10,00	
Perceived Social Media Score	Facebook	98	24,00	6,71	8,00	35,00	0,030
	Instagram	142	23,82	6,22	7,00	35,00	
	Twitter	28	24,93	5,02	13,00	35,00	
	Pinterest	12	21,50	4,40	11,00	28,00	
	Snapchat	1	21,00		21,00	21,00	
	TikTok	58	25,47	5,12	9,00	35,00	
	Twitter	3	17,33	1,53	16,00	19,00	
	XING	3	30,67	2,52	28,00	33,00	
	YouTube	65	24,29	5,34	7,00	35,00	
	Other	30	21,77	6,16	8,00	33,00	

p: One-Way Analysis of Variance

Table 3 presents the comparison of participants' perceived social media sub-dimensions and total scores based on the social media channels they find most inspiring for real estate properties. There is a **significant difference in entertainment scores** among participants based on their preferred inspiring social media channels ($p = 0.020$). According to the **post hoc test results**, this difference exists between **TikTok and Other groups** ($p < 0.05$). No significant difference was observed in **engagement scores** among participants based on their preferred inspiring social media channels ($p = 0.185$). A **significant difference** was found in **fashion scores** among participants based on their preferred inspiring social media channels ($p = 0.004$). The **post hoc test results** indicate that this difference is between **TikTok and Other groups** ($p < 0.05$). Additionally, there is a **significant difference in perceived social media scores** among participants based on their preferred inspiring social media channels ($p = 0.030$). The **post hoc test results** show that this difference is also between **TikTok and Other groups** ($p < 0.05$).

DISCUSSION

The findings indicate that variables such as gender, marital status, income level, and occupational group significantly influence perceptions of social media marketing. It was observed that female participants are more sensitive to social media marketing than males, married individuals show greater interest in fashion-related content, and private sector employees exhibit a stronger response to entertainment and fashion content on social media compared to public sector employees. While educational level was not found to be a determining factor in perceptions of social media marketing, an individual's occupational group was shown to play a significant role in shaping social media consumption habits. Additionally, it was identified that individuals living alone tend to engage more with fashion content, and European participants demonstrated a higher perception of fashion-related content compared to other groups. These findings suggest that consumer reactions to social media content are shaped by demographic and cultural factors.

One of the most significant findings of the study is that as consumers' perceptions of social media marketing increase, their purchase intentions also rise. Specifically, entertainment- and fashion-oriented content was found to strongly influence consumer purchasing decisions. Consistent with previous research, social media

advertisements were observed to guide consumer behavior, facilitate emotional connections with brands, and encourage impulsive purchasing decisions. In this context, it is concluded that brands should customize their social media marketing strategies based on the varying needs of different demographic groups and consumer trends. Considering the interactive opportunities provided by social media platforms, the development of more targeted and personalized marketing strategies will play a critical role in increasing consumer purchase intentions.

CONCLUSION

This study provides a comprehensive analysis of the relationship between social media marketing perception, consumer behavior, and demographic factors. According to SPSS analysis results, variables such as gender, income level, occupational group, family structure, time spent on social media, and content type have a significant impact on social media marketing perception. It was found that women have a higher perception of social media marketing compared to men, middle-income groups are more sensitive to social media advertisements, and private sector employees perceive social media marketing more strongly. Additionally, consumers showed greater interest in advertisements with high visual quality, detailed information, and AI-supported content. However, education level and nationality did not have a significant effect on social media marketing perception. The study highlights the need for customizing social media marketing strategies based on demographic and behavioral characteristics and emphasizes the critical role of content type in marketing success. The findings provide valuable insights for brands and industry professionals aiming to optimize their social media marketing strategies.

By examining the relationship between social media marketing, consumer behavior, and demographic factors, this study contributes to the development of target audience-oriented strategies. The findings suggest that women are more sensitive to social media marketing than men, married individuals exhibit higher purchase tendencies, and private sector employees are more responsive to social media advertisements. In terms of content types, entertainment- and fashion-themed posts attract consumer interest, while location, price transparency, and visual richness emerge as the most critical factors in real estate listings. Furthermore, increased time spent on social media enhances marketing perception and directly influences purchase intentions. User reviews, influencer collaborations, and interactive advertising campaigns have been found to significantly shape consumer decisions. Future research should further investigate the variations in social media marketing perception across industries, its relationship with consumer loyalty, and the long-term effects of AI-supported advertisements. In this context, adapting social media marketing strategies to cultural and geographical differences is becoming a strategic necessity for brands.

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The Role of Technology, Communication and Education in Increasing National and International Visibility and Recognition

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ABSTRACT

Developments in new communication and media technologies have created new areas of use. In addition to providing users with certain authorities and new opportunities, these technologies have also transformed users into active participants within the system, leading to widespread interest globally. Considering the ongoing scientific and technical revolution, the transfer of desired amounts of knowledge and skills through the global concepts of education has become even more significant at the beginning of the 21st century. The level of education is influenced by teaching strategies and the creative use of new electronic environments in classrooms. In this technological world, it is particularly important for individuals to understand the concepts of modern technology, comprehend their functions, and feel comfortable using them. Due to these and other reasons, the value and importance of technology-related education have been widely recognized. Most technology education programs on a global scale aim to develop skills such as analytical thinking, creativity, problem-solving, teamwork, personal responsibility, initiative, and curiosity. Many leaders have also begun to use these technologies to communicate directly with users. The use of these technologies by leaders within the framework of specific communication strategies in international relations has given rise to new forms of relationships and competitive environments. This article examines the strategies for enhancing the visibility and recognition of individuals or figures at national and international levels through media. By analyzing traditional and digital media channels, public relations methods, social media strategies and brand positioning techniques, the study focuses on the fundamental components of an effective media plan.

Keywords: National Media, International Media, Media Visibility, Media Technology, Media-Education Relationship.

INTRODUCTION

Just as being loved, respected, and valued by others is important for individuals, these emotions and values are equally significant for institutions. Undoubtedly, the foundation of this respect, trust, and appreciation lies in the contributions that an institution makes to its stakeholders and society. Today, institutions are not only striving to maintain financial credibility but also to be admired and appreciated by their stakeholders and the public. The emergence of this struggle has undoubtedly been influenced by the transformations in marketing, changes in consumer behavior, and the phenomenon of globalization.

For a long time, there has been a strong reciprocal relationship and interaction between society and technology. Technology is created by society, yet human behavior and thoughts are also shaped by technology (Postman, 2016, p. 18). This statement aligns with Marx's assertion in *Capital*, which suggests that "humans invent technology, but technology, in turn, transforms human nature." Therefore, if human nature is partially the result of technological development, it becomes crucial to understand the relationship between technology and society to reveal the impacts of technological history and analyze technology itself. This issue also raises questions about how the future of society will be shaped. There is no definitive answer to whether the dominant communication technologies of the twentieth century were radio, television, the internet, and telephones, or whether all these technologies have converged into a single device through technological convergence. In this context, human nature is shaped by the usage and applications of these technologies (Morrisett, 2003, p. 22).

In recent years, the concept of the "mass" has gained considerable prominence within the paradigms of culture and democracy. Concepts such as mass culture, mass democracy, and mass communication, despite carrying negative connotations, are frequently used due to historical social tendencies. The first tendency is related to population growth and urbanization in industrial cities. The second is the concentration of workers in factories, and finally, the organization of labor movements based on these conditions. According to Williams, no one perceives

themselves as part of the mass, as the term implies a negative lower-class connotation. In this context, another negative meaning of the term is that it refers to the rule of the masses in democracy (Arik, 2012, p. 338).

Mass communication tools have the ability to reach broad segments of society and shape opinions, which is why many groups strive to take advantage of these opportunities through new communication technologies (Hermanns, 2017, p. 6). One of the fundamental elements of democratic regimes is ensuring that the public has direct, unmediated, and complete access to information on issues that concern them, enabling them to exchange views, express their thoughts freely, discuss societal matters transparently, and participate in decision-making processes. Indeed, new communication technologies have created novel public spheres through innovations. If these spaces are not regulated and structured by legitimate authorities, they pose a risk of being exploited by global crime, interest, and terrorist organizations. This situation also provides an opportunity for states to influence public opinion, shape policies, and create a base of support in their international relations and conflicts with external actors. Therefore, new communication technologies have introduced new dimensions to public opinion formation and international relations (İçel, 2017, p. 50).

McQuail's influence model suggests that new communication technologies are used to design content and produce broadcasts aimed at shaping society's attitudes, behaviors, agendas, perspectives, and preferences. Through these broadcasts and content, the responses of individuals and societies to certain events are measured. Additionally, the dissemination and speed of distribution of this content across societies and nations further highlight the power of these tools. In response to these developments, societies and nations must assess, interpret, and critically reflect on the events and content they encounter in daily life. Ultimately, when an event occurs, applying this model helps determine whether it has led to institutional changes at the societal or international level and aids in understanding its outcomes and consequences (Usluata, 2003, p. 89).

In the field of international relations, Machiavelli's *The Prince* presents a perspective in which all means and methods are considered permissible to maintain power. The primary means in this regard have traditionally been conventional military warfare. However, in the modern world, wars are increasingly shifting away from physical confrontations. Given the economic costs of war and the speed of information dissemination, waging wars in the realm of perception has become more efficient. In these wars, perception management and manipulation play a crucial role in media strategies. Since media outlets inherently engage in selective reporting, they influence public perception through deliberate editorial choices. Especially in processes where emotions are prioritized over rational arguments, individuals become highly susceptible to manipulation. In this regard, social media, rather than fostering public awareness, deprives individuals of their ability to make personal choices, forcing them to conform to the phenomena it presents (Al, 2017, pp. 207-209).

With the advancement of new communication and media technologies, perception management efforts have reached new dimensions (İnceoğlu, 2015, p. 147). Throughout history, nearly all powerful states and empires have invented and utilized communication tools to serve their interests (Innis, 2006). Perception management has never ceased but has evolved, adapting to technological advancements to serve strategic objectives. Today, perception management strategies exploit the vulnerabilities of social media platforms to interfere in other countries' domestic affairs and assert dominance over their political regimes. Among the countries most adept at identifying these vulnerabilities—despite not owning major social media platforms—is Russia (Akyıl, 2017).

Developing a Global Perspective on Education and Technology

Over the past 50 years, particularly with the rise of digital technologies, the information society has facilitated the global dissemination of knowledge and shaped a world order where regionally and locally focused economic and political events, such as the Arab Spring, have global implications. Selwyn highlights this transformation in this chapter by discussing the role of individuals in the knowledge economy. Examining the transformative impact of educational technologies on individuals, the author argues that the concept of "globalization" is complex, multidimensional, and often misdefined. Instead of viewing globalization as a process, Selwyn approaches it as a discourse.

Criticizing the dilution of the term "globalization" and its portrayal as a panacea in educational discussions, Selwyn explores different perspectives on globalization and examines the role of education within these various approaches. While attempting to present an objective analysis, the author rejects both overly globalist and excessively skeptical perspectives on the globalization of education. Concluding the chapter with questions regarding the relationship between globalization's four dimensions—economic, political, social, and cultural—and education and technology, Selwyn seeks to answer these questions throughout the rest of the book. In a way, the first chapter serves to frame the book's overall discussion. By addressing the multidimensionality of

globalization beyond a shallow, catch-all term, the chapter serves as a guiding reference for readers throughout the book. In this sense, it also paves the way for a critical approach.

Technology Acquisition

Technology encompasses all the knowledge and skills required to effectively and efficiently execute an industrial process, including research, development, production, marketing, sales, and after-sales service.

Technology transfer is broadly understood in the international community as "the transfer of production techniques and knowledge from developed countries to developing countries." However, developed countries themselves use the term "technology transfer" as a process-oriented definition. This refers to the transfer of knowledge from a country's fundamental science and technology institutions to its industrial sector. In this process, knowledge and techniques related to a high-technology field that is believed to have reached an industrialization stage are transferred to the relevant sector—namely, the industry—to generate the expected high added value.

Possessing technology, however, should be understood as the ability to define, design, develop, produce, test, operate, provide logistical support for, and manage a modern system that meets user needs. To own technology in a particular field means having a specific set of knowledge, skills, and capabilities related to that domain. Thus, just as with any other skill or competence, acquiring technological capability is not a matter of simple ownership, such as purchasing goods. Instead, it is an evolutionary competence-building process that involves education, investment, effort, and knowledge accumulation. Just as one cannot purchase the skill of painting, the ability to develop original products and production technologies cannot be bought.

While components and parts necessary for production can be purchased from any country, the most critical aspect is the ability to design. The first step is to determine which systems require design expertise. The core foundation of technology is design technology. Self-sufficiency is only possible when a nation possesses this capability.

The process of acquiring technology can be defined as the activities necessary to gain the knowledge, infrastructure (facilities, machinery, equipment, skilled workforce, etc.), and skills required for identifying, designing, developing, producing, deploying, supporting, institutionalizing, and managing a product or production method through its derivative applications. In modern understanding, the level of integration between fundamental research activities and new product and production technology development efforts within a country is considered an indicator of that country's level of development (Zaim, 2001, p. 1).

Achieving competence in science and technology does not solely mean excelling in "producing science and technology." A nation can only gain a competitive advantage in global markets and have a say in global processes if it possesses the ability to rapidly transform scientific and technological research findings into economic and societal benefits—such as marketable new products, new systems, new production methods, and new public services. In short, the ability to innovate and renew itself is crucial in ensuring technological and economic leadership.

Education Policies

In recent years, as rapidly developing technology has brought societies closer together and made inter-societal interaction inevitable, the dominance of education systems over individuals has been a matter of concern for almost all nations. The approach of absolute truths in teaching has been replaced by more sensitive and intuitive approaches. Consequently, people are increasingly recognizing the necessity of ecological integrity and adopting a lifestyle that is in harmony with all living species and nature. In this context, the distinction between learning and teaching becomes noteworthy. In learning, the student is the determinant, whereas in teaching, the teacher assumes this role. This seemingly minor difference necessitates transforming the school from a teaching environment into a learning environment. In such an environment, the concept of "Teacher" is replaced by "Learning Partner," emphasizing student participation. Under these new conditions, the learning partner must continuously equip themselves with new knowledge—financial circumstances permitting—act as an effective guide, and view examinations not as leverage or a threat against students but as an integral part of the learning process. The new millennium will witness the success of societies composed of individuals who do not merely pursue utility or evade responsibility but can appreciate the beauty of differences, discover themselves, live in harmony with themselves, be conciliatory, productive, problem-solving, and perceive the universality of aesthetic criteria (Yaşar, 2001, p. 1).

The most crucial component of a society, whether technologically advanced or not by today's standards, is human capital. Human capital is generally dependent on education and, more specifically, on real and up-to-date knowledge. While dollar investments can be easily evaluated based on profit or loss, human investment is

challenging to assess due to its qualitative nature. Although part of a nation's wealth is expressed in dollars, a more significant portion lies in human knowledge and its application. Human capital cannot be bought or sold like marketable products, yet it constitutes the most vital infrastructure for a country's technology, economy, and politics. People form the most critical and fundamental part of a society, and their contributions to society rely on their continuous education. The extent and scope of high technology primarily depend on people and how well they are educated and can utilize their skills (Strandberg, 2002, p. 3).

Fears that the current technological revolution will lead to widespread global unemployment are increasing. These concerns are particularly voiced in Europe, where, despite all preventive measures, the unemployment rate among the 15-64 age group remains above 35% of the total population (Employment in Europe 2002, 2002, p. 15). Even in the United States, where the unemployment rate is half the European average, some predict that three out of four jobs will be taken over by robots and computers. However, a review of the technological revolutions of the past 200 years shows that while each revolution has displaced some workers, it has also created numerous new jobs. The key issue is the ability to train individuals with the qualifications demanded by new technology. This requires serious efforts in teaching and education (Başargan, 2000, p. 1).

Educational Technologies

Today, ways of living, learning, and working are rapidly changing. In an environment where all these transformations are taking place, it is impossible for education systems, which bear the mission of preparing individuals for life, to remain unchanged and still fulfill their designated role. In order for individuals to compete in a highly dynamic and volatile labor market and maintain their economic status, they need to acquire and continuously develop and renew their "employability" skills. This ongoing necessity, which becomes increasingly significant throughout individuals' lives, is considered to have led to the emergence and widespread adoption of the "lifelong education" approach. According to Küçüktamer and Yardibi (2017), lifelong learning emerges as a solution for people of different ages and areas of interest.

Lifelong education can be regarded as synonymous with lifelong learning, lifelong integrated learning, continuous learning, and continuing education (Kara, 2023). The origin of these terms lies in the understanding that education is not limited to an initial and final experience confined to childhood but should instead be a continuous process throughout life.

Life itself is a continuous learning process. However, for individuals to keep pace with technological and societal changes, to be prepared for changes related to their personal circumstances (such as marriage, parenthood, career transitions, or aging), and to fully realize their potential for personal development, they need to engage in purposeful and sequential learning. Lifelong education encompasses both intentional and incidental learning experiences. Behavioral changes that occur as a result of an individual's interaction with family, peer groups, and the surrounding environment constitute incidental education, whereas education obtained from formal and non-formal educational institutions is classified as intentional education.

With the widespread use of Internet technologies, one-way learning methods, such as those facilitated by television and video, have been replaced by interactive, electronic learning models. Electronic learning (E-learning) or distance education can be defined as a web-based education system delivered via the Internet, an intranet, or a computer network. While the most apparent difference between e-learning and traditional education may seem to be the technological component, in reality, e-learning represents a fundamental transformation. This approach prioritizes the learner, motivating them to access knowledge and placing them at the center of the learning process. In e-learning, educational activities take place without requiring the teacher and student to be physically present in the same environment at the same time. E-learning is generally conducted in two ways:

1. Individuals engage in self-directed learning at a computer.
2. A group of students and an instructor meet synchronously in a virtual classroom for live instruction.

In developed countries, e-learning is particularly preferred by adults. It is a cost-effective option for businesses in the medium and long term, as it eliminates the need for employees to be away from their workplaces for extended periods during in-service training. With this method, employees can revisit topics they find difficult to comprehend as often as needed, and through multimedia materials—including auditory, visual, and interactive applications—they can enhance their learning experience. Although e-learning remains a relatively new method and discussions regarding its long-term educational outcomes and standardization continue, institutions and organizations in Turkey are already utilizing e-learning and achieving positive results. More effective outcomes will be achieved when e-learning resources are integrated with face-to-face, traditional educational environments and methods. Supporting the in-service training of educational administrators and teachers through new information and communication technology tools—namely, e-learning—should be a short-term goal.

In the new century, the Turkish education system is striving toward a vision in which individuals fully benefit from all the opportunities provided by information and communication technology. In this regard, the Turkish education system should serve as a model and driving force for other institutions and organizations (Aytaç, 2003, p. 1).

Contemporary Technology Education

The most significant impact of technology on individuals and society pertains to their way of life, namely their culture. In the interaction and adaptation between individuals and their environment, science and technology precede changing values. Today, technological culture has become one of the most influential factors shaping and regulating the culture of values. Consequently, integrating individuals with the technological culture they interact with also serves as the foundation for their social adaptation. In other words, for individuals to keep pace with rapidly advancing technological developments and increasingly complex societal structures, they must be equipped with contemporary knowledge, skills, and attitudes. This is only possible through an education system that enables individuals to acquire the competencies required by technological advancements.

Education is both a fundamental right that should be accessible to every individual and a significant tool for shaping the future of society (Akkaya, 2023). One of the primary tools for adapting to a technologically driven cultural environment within the formal education process is technology education. The key aspect of this education is to emphasize contemporary applications of technology, thereby establishing a bridge between the present and the future (Uluğ, 2003, p. 1).

While general education aims to develop shared knowledge, skills, and values for all individuals, vocational and technical education focuses on imparting specialized skills that provide employment opportunities in specific fields. However, it is not possible to draw strict boundaries between general education and vocational-technical education. A modern society requires both forms of education.

Technology education is an educational discipline that integrates these two areas. In an industrialized society, it is impossible for individuals to remain detached from general knowledge of science, technology, and industry. Regardless of the career path individuals choose, general education should provide them with fundamental knowledge about different professions, essential attitudes, skills, and competence in using modern technology. This can only be achieved through technology education, which complements general education. Vocational and technical education, on the other hand, provides individuals with the essential knowledge, skills, and attitudes required for a specific profession.

From the perspective of personal development, technology education plays a crucial role in self-expression and uncovering individual talents. Thus, it introduces new dimensions to education and constitutes one of its fundamental components. Through this education, students gain the ability to make important decisions that will impact their professional lives. The primary objective of Industrial Arts and Technology Education is to help individuals understand the dynamic nature of technology and enable them to utilize it in the most efficient way possible (Şenel & Erden, 1996).

Reflections of Developments in New Communication and Media Technologies on National Policies

With the scientification of politics and the advancement of communication technologies, these two concepts have begun to be addressed under the discipline of political communication. Political actors implement political communication strategies to persuade target groups, masses, or nations to accept and act upon certain ideological objectives (Aziz, 2013, p. 4). During election periods, the use of appropriate methods and techniques increases the likelihood of winning elections. Additionally, these efforts are utilized to pass certain laws in parliament or to persuade public opinion. Beyond shaping public opinion, both ruling and opposition parties resort to such tools to set or shift the political agenda. Political communicators, in addition to leveraging the opportunities provided by traditional media, strive to maximize the use of new communication technologies to outmaneuver their competitors or compete on equal footing (Öztürk, 2014, p. 404; Ekinci, 2016, p. 45).

Recent political and electoral campaigns have demonstrated a strong and dynamic connection between new communication and media technologies (Hermanns, 2017, p. 6). Politicians' adoption of these technologies to communicate with their electorate has led to significant conceptual shifts in the field (Postman, 2016, p. 19). Through new communication and media technologies, political leaders maintain continuous and direct interaction with voters without intermediaries. They exchange ideas on new projects and policies, encourage voter participation in decision-making processes, shape public opinion, gauge societal sentiment, and sustain political support (Rothkopf, 1998, p. 329).

These new media and communication channels enable politicians not only to reach their own supporters but also to send messages to the followers of rival parties and leaders. By making voters feel valued, they expand their voter base and increase their electoral support. These political strategies contribute to the engagement of followers, ensuring their continued interaction within the system and preventing them from seeking alternative sources of political information. This, in turn, helps to establish political and social stability. In an era where the traditional political system is being questioned and representative democracy is perceived as inadequate, such communication technologies provide new opportunities for politicians. The conscious and strategic use of these technologies by politicians is expected to have a positive impact on citizens, fostering a more informed and engaged electorate (Nixon & Johansson, 1999, p. 137).

One of the most distinctive features of new communication technologies is their ability to facilitate multidirectional communication, fostering interaction among users. However, some political leaders have been observed to use these technologies in a one-sided and authoritarian manner. This suggests a lack of understanding of the nature of these technologies, leading to ineffective results and a waste of energy and time. Each new communication technology has its own inherent applications and areas of impact (Yağmurlu, 2019). In this context, new communication technologies should not be treated merely as extensions of traditional media. Using them within the framework of traditional media practices does not offer any added value to users. Thus, merely creating social media accounts and sharing content is different from utilizing these technologies in a manner that aligns with their unique nature and purpose.

Each communication technology has distinct applications and spheres of influence. Generally, the emergence of a new communication technology does not eliminate or replace existing ones. However, some technological devices have successfully integrated multiple applications through technological convergence. Consequently, the consolidation of various communication channels into a single device has led to increased investment in new communication technologies. Additionally, interactive elements such as mentions and hashtags have facilitated the integration of these technologies into politicians' daily communication strategies (Koyuncu & Medin, 2017). As the necessity for both users and politicians to learn and adapt to these new communication technologies becomes increasingly apparent, those who fail to do so face diminishing prospects of political success (Öztürk, 2014, pp. 410–415; Šimunjak & Caliendo, 2019, p. 14).

Conclusion, Discussion, and Recommendations

The increasing visibility in the media can have both positive and negative consequences for individuals and institutions. While this process can enhance personal branding, it may also lead to negative perceptions. In this context, the effects of media visibility have been examined in various academic studies.

Firstly, media visibility has been noted to contribute to individuals' social capital. For instance, Smith (2018) highlights in his study that increased visibility on media platforms expands career opportunities and strengthens social connections. This phenomenon accelerates the personal branding process, particularly in the digital era (Brown, 2020).

However, media visibility also has some adverse effects. In particular, the dissemination of false or misleading information can negatively impact the reputation of individuals and institutions (Jones & Taylor, 2019). Additionally, as media visibility increases, the risk of privacy violations also escalates. Miller (2021) states that the growing presence on social media exacerbates privacy breaches and psychological pressure.

From an institutional perspective, while media visibility enhances brand awareness, it also makes crisis management more crucial. Lee and Kim (2022) assert that as brand visibility increases on social media, crises spread more rapidly, and if not managed effectively, they can harm brands. Therefore, media visibility should be strategically addressed, and crisis communication plans should be developed.

Although media visibility has positive effects on science and education, it also presents certain drawbacks. The rapid spread of misinformation, distortion of scientific facts, and the rise of anti-science sentiments can be significant issues, especially through social media. Misleading perspectives, such as vaccine opposition and climate change denial, reach large audiences, leading to public misguidance and a decline in trust in scientific knowledge. Media visibility offers substantial opportunities in the fields of science and education, facilitating the dissemination of knowledge to wider audiences and contributing to the development of innovative educational methods. However, the risks associated with the spread of misinformation should not be overlooked. Therefore, the responsible and informed use of media in science and education is of great importance.

In conclusion, the increasing visibility in the media presents both opportunities and risks for individuals and institutions. When managed correctly, this process can yield positive outcomes; however, if left uncontrolled, it can result in significant negative consequences. Thus, strategies for enhancing media visibility should be evaluated within the framework of ethical principles and reliability.

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How Successful are Artificial Intelligence Chatbots on Higher Education Entrance Physics Exams in Turkey

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ABSTRACT

In this study, the performance of artificial intelligence chatbots—OpenAI's ChatGPT, Google Gemini, and Microsoft's Copilot—was evaluated and compared based on their responses to questions from the Turkish Higher Education Entrance Physics Examination over the past three years. Analysis of the chatbots' responses to TYT Physics questions showed that ChatGPT correctly answered 38.09% of the questions, while both Gemini and Copilot achieved a correct answer rate of 28.57%. For AYT Physics questions, ChatGPT demonstrated a higher success rate, correctly answering 45.23% of the questions, compared to 26.18% for Gemini and 14.28% for Copilot. While ChatGPT exhibited the best performance overall, Copilot performed the worst. Nonetheless, the overall performance of all three chatbots was insufficient for providing consistently accurate answers to both TYT and AYT questions.

Keywords: Chatbots; ChatGPT; Gemini; Copilot; Physics; Higher Education Entrance Exam; and Turkey

INTRODUCTION

Artificial Intelligence (AI) refers to the ability of computer systems to perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving, and decision-making. It involves developing mathematical models and algorithms that enable machines to process data, identify patterns, and make predictions or decisions based on available information (Minkinen & Mäntymäki, 2023). Recent advancements in AI have significantly influenced various aspects of life, including education, where AI tools are increasingly integrated to enhance learning experiences and outcomes (Mustofa et al., 2024). However, keeping pace with the rapid evolution of AI tools can be challenging. For instance, Microsoft has embedded GPT-4 into Bing Chat and Windows 11 under the Copilot branding, OpenAI has introduced new features in ChatGPT and launched GPT-4o, and Google has integrated Bard into its ecosystem, rebranding it as Gemini to appeal to a wider audience (Siddharth, 2024). According to Actor-Network Theory (ANT), productive AI bots like OpenAI's ChatGPT, Microsoft's Copilot, and Google's Gemini function as active actors within networks of embedded cognition and action (Latour, 2007). These non-human agents interact with human users by processing inputs, generating outputs, and updating information. They contribute to learning and cognitive development by facilitating discussions, providing information, encouraging reflective thinking, and fostering problem-solving skills (Santos, 2023). Rudolph, Tan, and Tan (2023) highlight the competitive growth of these AI-driven tools, including Bard/Gemini, Bing Chat/Copilot, and ChatGPT, which are powerful writing aids with distinct features that are transforming educational practices, despite inherent limitations. Notably, copilot leverages GPT-4, while Gemini operates on the PaLM-2 model (Google AI PaLM 2 – Google AI, n.d.).

Initially designed to process and generate natural language, Large Language Models (LLMs) have also demonstrated utility in generating programming and symbolic languages, such as mathematics. OpenAI's ChatGPT exemplifies this capability. As a Generative Pre-trained Transformer (GPT), ChatGPT simulates human-like conversation by generating and responding to text using advanced LLMs. Its methodology and success in everyday interactions underscore the potential of AI-assisted physics education (Bitzenbauer, 2023; Kortemeyer, 2023; MacIsaac, 2023; Polverini & Gregorcic, 2024; Yeadon & Hardy, 2023).

Microsoft Copilot is a generative artificial intelligence (AI) chat engine developed by Microsoft, integrated into Edge, Office applications, and Bing. A dedicated Copilot app for Windows was announced in January 2024. Copilot utilizes the Microsoft Prometheus model, built on OpenAI's GPT-4 large language model, and is optimized through both supervised and reinforcement learning techniques. While most features are available to free preview users, paid subscribers gain access to additional functionalities, including the ability to create private chats through "Microsoft Copilot Pro." Similarly, Gemini, developed by Google AI, is a versatile family of large language models designed for tasks such as writing, productivity, and learning. Gemini models are tailored for different purposes and resource constraints, and its ongoing evolution is expected to enhance its utility across various applications (Google, 2024).

Artificial intelligence (AI) has made remarkable progress in emulating human cognitive functions; however, its ability to learn is still hindered by inherent limitations. These constraints can be better understood by examining established cognitive theories, such as Bloom's Taxonomy and Cognitive Load Theory (CLT). These frameworks offer valuable insights into the processes of knowledge acquisition and processing, applicable to both human learners and AI systems.

AI Learning and Bloom's Taxonomy

Bloom's Taxonomy classifies cognitive skills into six hierarchical levels: remembering, understanding, applying, analyzing, evaluating, and creating (Bloom et al., 1956; Anderson and Krathwohl, 2001). AI systems navigate these levels with varying degrees of proficiency, but they encounter inherent limitations.

1. Remembering and Understanding: AI excels in foundational cognitive skills such as memorization and pattern recognition. Large language models (LLMs) like ChatGPT can store and retrieve vast amounts of information, yet their grasp of understanding is often shallow, lacking genuine semantic comprehension (Bender and Koller, 2020).
2. Applying and Analyzing: AI can adeptly apply learned rules and analyze structured data, but its capacity to generalize to new, unstructured challenges remains constrained. In contrast to human learners, who rely on contextual reasoning and experiential knowledge, AI often struggles with transfer learning and integrating complex concepts (Marcus, 2018).
3. Evaluating and Creating: Higher-order thinking encompasses judgment, synthesis, and innovation, which AI approaches through probabilistic models rather than true critical reasoning. Despite the progress seen in generative AI, such systems do not possess intrinsic creativity or metacognitive awareness, setting them apart from human cognitive abilities (Boden, 2004).

AI Limitations and Cognitive Load Theory

Cognitive Load Theory, introduced by Sweller in 1988, suggests that the efficiency of learning is influenced by three types of cognitive loads: intrinsic, extraneous, and germane. Similarly, AI systems face comparable limitations in their processing abilities:

1. Intrinsic Load: The complexity of a task directly impacts the cognitive effort required for understanding it. AI models, while capable of learning intricate patterns from vast datasets, rely heavily on computational power. They lack the innate intuition that characterizes human learning, resulting in a rigid and data-dependent approach to knowledge acquisition (Lake et al., 2017).
2. Extraneous Load: Inefficient instruction can lead to unnecessary cognitive strain, which ultimately hampers the learning process. AI models, especially neural networks, are not immune to this issue; they often experience "catastrophic forgetting." This phenomenon occurs when new information disrupts previously learned knowledge, thereby diminishing overall efficiency (French, 1999).
3. Germane Load: Developing meaningful schemas is crucial for achieving deep learning. Unlike humans, AI systems cannot independently refine and restructure their knowledge without external guidance. Although reinforcement learning algorithms can enhance performance, they do not possess the kind of conceptual flexibility that humans naturally exhibit (Hassabis et al., 2017).

Enhancing AI Performance with Improved Training Methods

Recent advancements in AI training methodologies seek to overcome existing limitations and enhance the performance of chatbots. Two notable techniques, Few-Shot Prompting and Reinforcement Learning with Human Feedback (RLHF), show great promise in this regard:

1. Few-Shot Prompting: This approach allows AI to learn and generalize from a limited number of examples, minimizing its dependence on large pretraining datasets. By utilizing contextual cues from just a few instances, AI systems can significantly improve their application and analytical abilities, addressing issues commonly associated with transfer learning (Brown et al., 2020).
2. Reinforcement Learning with Human Feedback (RLHF): By incorporating human evaluators into the training process, RLHF fine-tunes AI responses based on qualitative human input. This iterative feedback loop enhances the AI's capability to assess and generate responses that resonate with human expectations, thereby bolstering its higher-order cognitive skills, such as judgment and contextual reasoning (Christiano et al., 2017).

These methodologies help alleviate unnecessary cognitive load by simplifying training processes and improving AI's ability for organized learning. Additionally, they tackle challenges in schema development by promoting adaptive learning mechanisms that allow AI to continually enhance its understanding in a dynamic way.

AI Accuracy in STEM Assessments

Recent empirical studies have explored the effectiveness of AI-driven assessments in STEM education, providing valuable insights into their accuracy and applicability. A systematic review conducted by Xu and Ouyang (2022) analyzed 63 empirical studies on AI in STEM from 2011 to 2021. The review highlighted that AI applications in this field serve various functions, including evaluating academic performance, assessing learning progress, and analyzing instructional quality. These AI-driven assessments have shown promise in improving both the efficiency and quality of STEM education by delivering timely and objective feedback. Further, Zhai, Nyaaba and Ma (2024) investigated the performance of generative AI models, specifically ChatGPT and GPT-4, on the 2019 National Assessment of Educational Progress (NAEP) science assessments. The findings revealed that both AI models consistently exceeded the performance of most students across different grade levels. Remarkably, the AI models maintained a stable level of performance, even as the cognitive demands of the tasks increased, indicating their capability to effectively manage complex problem-solving challenges. In addition, Zhai (2024) explored the revolutionary impact of AI and machine learning on science assessments, underscoring a transition towards performance-based evaluations. These new methods encourage students to actively participate in scientific practices, including modeling, explanation, and argumentation. The findings of the study revealed that AI-driven assessments can deliver timely and objective feedback, thereby easing the workload for educators and improving the overall assessment process. These studies collectively highlight significant advancements in AI-driven assessments, particularly in their ability to accurately evaluate complex cognitive tasks within STEM education. The incorporation of AI into educational assessments not only boosts efficiency but also aligns with modern educational goals that prioritize higher-order cognitive skills.

Using AI tools in Physics Education

In physics education research, the capabilities and impacts of AI tools like ChatGPT, Gemini, and Copilot have been increasingly studied. Bitzenbauer (2023) conducted a pilot study in secondary education, where students posed physics questions to ChatGPT and evaluated its responses. The study found that interacting with ChatGPT positively influenced students' perceptions of AI tools. Yeadon and Halliday (2023) analyzed the performance of GPT-4 and GPT-3.5 on 593 questions from 42 exams spanning 10 courses at Durham University (2018–2022). Their results showed that GPT-4 consistently scored around 50%, indicating some progress but highlighting challenges with university-level physics questions.

Dahlkemper et al. (2023) demonstrated that ChatGPT can evaluate answers to complex physics questions at a level comparable to that of researchers. However, Gregorcic and Pendrill (2023) published a case study showing that ChatGPT-3.5's responses to simple mechanics problems often included contradictions and inaccuracies. Similarly, dos Santos (2023) compared the performance of ChatGPT-4, Bing, and Bard, concluding that ChatGPT-4 outperformed the others by providing more accurate and detailed answers.

Kortemeyer (2023) assessed ChatGPT-3.5's performance on Force Concept Inventory (FCI) questions, finding that it scored between 50% and 60%, comparable to novice students. West (2023) corroborated these findings, reporting that upgrading from ChatGPT-3.5 to ChatGPT-4 significantly improved performance on FCI questions. Specifically, ChatGPT-4 scored between 90% and 100%, comparable to expert physicists. West also noted that while ChatGPT-3.5 often produced inconsistent results across tests, ChatGPT-4 displayed greater reliability with minimal variation. Yeadon and Hardy (2023) further evaluated ChatGPT-3.5's ability to solve physics test questions across three educational levels—from high school to university entrance—and found that at the university entrance level, it provided correct solutions 30% to 40% of the time.

Although Artificial Intelligence (AI) offers numerous benefits to physics and physics education, it also presents significant limitations and drawbacks that need to be addressed. A primary concern is the accuracy and reliability of AI-generated content. For example, studies have shown that while GPT-3.5-turbo achieves an accuracy of 83.4% on GCSE-level physics questions, its performance drops significantly to 37.4% on more complex problems, such as those encountered at A-level or university levels (Yeadon & Hardy, 2024). Furthermore, as a developmental tool, AI has demonstrated significant inaccuracies, particularly when addressing straightforward questions like multiple-choice items. These inconsistencies pose challenges for educators relying on AI for accurate assessment and feedback (Yeadon & Hardy, 2024).

While existing research has extensively explored the performance of AI chatbots on physics exams at high school and university levels, studies focusing on non-English contexts, such as Turkish, remain limited. Addressing this gap, the present study seeks to answer the following research question: How successful are Artificial Intelligence Chatbots (Microsoft Copilot, Google Gemini, and OpenAI ChatGPT) in Higher Education Entrance Physics Exams in Turkey?

METHODOLOGY

To address the research question, this study employed a qualitative case study approach (Yin, 2009), which is particularly suited for understanding phenomena within specific contexts (Stake, 1995). In this case, the study evaluated the effectiveness of AI language models—ChatGPT, Gemini, and MS Copilot—in solving Higher Education Entrance Physics Exam questions. In Turkey, students must pass two distinct exams to gain admission to universities: the TYT (Basic Competency Test) and the AYT (Field Competency Test). The TYT, the first stage of the university entrance exams, assesses students' basic knowledge and skills, while the AYT, the second stage, evaluates subject-specific knowledge and competencies. The TYT includes four main sections: Turkish, Social Sciences, Science, and Mathematics, comprising a total of 120 multiple-choice questions. In contrast, the AYT covers three fields: Social Sciences, Science, and Literature-Humanities, with 80 multiple-choice questions. The combined results from these exams are used for university placement. These exams are conducted annually in June, and students are encouraged to consult official sources for the latest information on the format, syllabus, and application dates. In the TYT, 7 of the 20 science questions are physics-based, while in the AYT, 14 of the 30 science questions focus on physics. The Student Selection and Placement Center (ÖSYM) administers these exams, and detailed information is accessible on their official website (ÖSYM, 2024).

The physics questions used in this study to assess the three chatbots (ChatGPT, MS Copilot, and Gemini) were sourced from past TYT and AYT exams available on the ÖSYM website (ÖSYM, 2024). All chatbot responses are compared and validated against official answer keys given by ÖSYM. Currently, all three AI tools can process image-based questions. However, the free trial version of ChatGPT 4.0o imposes a daily limit on the number of image-based questions that can be analyzed. TYT and AYT physics questions are a mix of text-only questions and questions containing both figures and text. For the latter, the illustrated questions were photographed and input into the chatbots, while text-only questions were directly presented with the simple prompt: "What is the answer to this question?"

In line with Brown et al. (2020), rapid prompting techniques such as Zero-Shot and Few-Shot prompting significantly influence the quality of AI-generated responses. Zero-Shot method is particularly useful when extensive training data is unavailable. By giving the model a handful of examples, it can generalize from these examples to perform similar tasks more accurately. Zero-Shot prompting involves asking a question without providing any prior context or examples, while Few-Shot prompting includes presenting examples to the model beforehand. This study utilized Zero-Shot prompting for all interactions. However, when chatbots provided irrelevant answers to illustrated questions, the illustrations were described textually in rephrased questions to maintain the integrity of the original content.

The chatbots were asked a total of 21 multiple-choice physics questions from the TYT and 42 from the AYT, all sourced from the exams administered between 2022 and 2024. Their responses were recorded, compared, and evaluated (sample answers are provided in the Appendix). Answers unrelated to the questions or not among the provided options were coded as "N" and deemed incorrect (see Tables 1 and 2).

FINDINGS AND INTERPRETATION

This section is divided into two main parts. The first part analyzes and presents the answers provided by chatbots to TYT physics questions, while the second part focuses on the answers given to AYT physics questions.

Findings Related to Chatbots' Answers to TYT Physics Questions

An analysis of the answers provided by chatbots to TYT Physics questions over the past three years reveals the following performance: ChatGPT answered 38.09% of the questions correctly, while both Gemini and Copilot each answered 28.57% of the questions correctly. These results suggest that the current performance of chatbots in correctly answering TYT Physics questions is relatively low. A summary of the answers provided to the TYT questions is presented in Table 1. The data is compared across different years and chatbots.

Table 1: Summary Table of Answers Given by Chatbots to TYT Physics Questions

Ques tions	2024				2023				2022			
	Ans wer	Chat GPT	Copil ot	Gemi ni	Ans wer	Chat GPT	Copil ot	Gemi ni	Ans wer	Chat GPT	Copil ot	Gemi ni
1	E	N	D	C	A	D	E	A	B	D	C	E
2	A	D	E	C	D	E	C	C	E	E	E	E
3	D	D	E	D	B	B	B	D	E	C	A	N
4	B	B	B	A	B	B	B	B	A	A	A	D
5	E	A	N	A	A	E	C	C	E	N	D	N
6	A	B	C	N	C	N	N	N	D	A	D	C

7	D	D	C	D	C	C	N	C	A	D	C	B
Correct (%)		42,86	14,28	28,57		42,86	28,57	42,86		28,57	42,86	14,28

Note: N indicates that given answer not acceptable/irrelevant or not related to question. The web link of exam questions and related answers is given in reference section.

Comparison of answers to TYT 2024 physics questions

ChatGPT correctly answered 42.86% of the 2024 TYT Physics questions, while Copilot and Gemini answered 14.28% and 28.57%, respectively. A detailed comparison of the responses provided for each question is outlined below (Note: Sample chatbot responses to some questions are given in the appendix).

In the first question from the TYT 2024 Physics exam, a mass-volume graph depicting two different water samples and two different powder paints with varying densities was presented. The question required identifying which water or water mixture could be used to create a tulip with a red flower and a green stem on water, according to the art of marbling. Based on the graph, water A had the highest density, followed in decreasing order by red dye, green dye, and water B. ChatGPT analyzed the question step by step according to the graph and concluded that all the given statements were correct, selecting option E ("all of the above") as the answer. However, option E only correctly included Statements I and III, and there was no option that accurately represented all the Statements as correct. Consequently, ChatGPT's answer was marked as incorrect and categorized as "N" (irrelevant). Copilot provided entirely unrelated explanations and selected option D. Similarly, Gemini offered explanations unrelated to the question and chose option C. For instance, Gemini provided information about the process of marbling and erroneously claimed that no brush is used in marbling and that it is a traditional Turkish art. It is crucial to understand that the density of the paint must be smaller than the density of the liquid used, a detail not explicitly stated in the question. Thus, the densities of the dyes should be smaller than that of the least dense liquid or mixture. Therefore, water A, being denser than the dyes, as well as a mixture of water A and B, could be used, which is correctly indicated by option E. All three chatbot tools overlooked this detail.

In the second question, it was stated that three blocks of different masses, composed of distinct materials, remained stationary on a horizontal plane when the same horizontal force F was applied separately to each block. Each block had a unique coefficient of static friction with the horizontal surface. The question asked for a comparison of the magnitudes of the friction forces acting on the blocks. ChatGPT and Copilot applied the relation $f_s = kN$ to each block individually and provided answers based on this formula, without considering whether the masses would move. ChatGPT identified the correct answer as option D, whereas Copilot, despite using the same reasoning, incorrectly selected option E. Gemini compared the forces using the friction coefficients alone and selected option C. However, according to Newton's third law, since the applied force does not move the objects, the frictional force acting on each block must equal the applied force F . Therefore, the correct answer was option A, where all frictional forces are equal.

In the third question, which focused on the buoyancy of liquids, iron, aluminum, and wooden balls of equal volumes were slowly released into a large container of water. Among these, two sank, and one floated. The question provided three Statements regarding this scenario and asked which were true. ChatGPT and Gemini correctly explained and inferred the right answer, while Copilot provided a completely incorrect response. Copilot mistakenly claimed that iron is denser than aluminum and, therefore, experiences more buoyancy because it sinks more. Additionally, it incorrectly stated that the wooden ball displaces more water than the others. In reality, the iron and aluminum balls sink, while the wooden ball floats. Since all the balls have equal volumes, the buoyant forces acting on them are equal. However, the wooden ball does not displace more water than the other two. Thus, with the first two Statements being true, the correct answer is option D.

In the fourth question, heat exchange, heat, and temperature conditions were analyzed. A box of milk, cheese, and olives, initially at room temperature, was placed in a refrigerator at $+4^{\circ}\text{C}$. Afterward, the refrigerator's electricity was cut off, and the items were kept in the refrigerator until thermal equilibrium was reached. Three Statements were provided about the final state, asking which were true. ChatGPT and Copilot answered correctly, while Gemini incorrectly stated that statement-II was false and Statement-I was true. The correct answer is option B, which states that the final temperatures of the milk, cheese, and olives are equal, while the other two Statements are false.

In the fifth question, three identical lamps were connected in parallel to a generator, and their potential-current (V - I) graph was provided. The question asked to compare the potential differences between the lamps and the energy they consume per unit of time. ChatGPT and Gemini ignored the fact that the lamps were connected in parallel,

solving the question solely based on the resistance values derived from the V-I graph. Both determined the answer to be option A. Copilot, on the other hand, failed to perform any calculations, instead posing unrelated questions in its reasoning, ultimately providing irrelevant answers and selecting option A. As a result, Copilot's response was marked as "N" (irrelevant). According to the V-I graph, lamp A has the largest resistance, while lamp C has the smallest resistance. Since the lamps are connected in parallel, their potential differences are equal. The lamp with the smallest resistance (lamp C) will consume the most power, while the lamp with the largest resistance (lamp A) will consume the least power ($P=V^2/R$). This relationship is correctly stated in option E.

In the sixth question, a snapshot of a wave traveling in the x-direction along an ideal arc was provided. The question asked for the vibration direction of three distinct points on the wave. ChatGPT correctly determined the wave's propagation direction from the graph but incorrectly identified the vibration directions of the three points, selecting option B while describing the vibration directions consistent with option D. Gemini incorrectly answered option A with an unrelated solution, stating that the wave moves to the left instead of the right and analyzing the vibration directions of four unrelated points (A, B, C, D instead of K, L, M). Copilot also provided incorrect vibration directions without a detailed explanation. According to the wave's propagation direction, points K and M vibrate in the +y-direction, while point L vibrates in the -y-direction, correctly stated in option A.

In the seventh question, a scenario involving a concave mirror with coincident axes, a converging lens, and a light source was presented. It was stated that red light emitted from the light source, positioned at the mirror's focal point, first reflects off the mirror, then refracts through the lens, and passes through point K. The question asked through which point blue light would pass after being reflected and refracted in the same manner if emitted instead of red light. Since blue light refracts more than red light, it will not pass through point K or any point beyond K along the axis. Instead, it will pass through a point between points T and K. The correct answer, therefore, is option D. ChatGPT and Gemini correctly identified this answer, while Copilot incorrectly selected option C without providing a solution.

Comparison of Answers to TYT 2023 Physics Questions

In the first question, it was planned to perform atmospheric measurements at different altitudes using a balloon on a newly discovered planet. A mass-volume graph of four gases (at constant temperature and pressure) was provided. Assuming the planet's atmosphere has a constant temperature, the question asked about the composition of the planet's atmosphere and the gases that could be used to fill the balloon. For the balloon to ascend, the gas filling it must have a lower density than the planet's atmosphere. Based on the graph, this condition is met if gas A constitutes the atmosphere, and a mixture of gases B and D is used to fill the balloon. This scenario corresponds to option A. ChatGPT and Copilot incorrectly answered the question by only interpreting the graph values, while Gemini correctly evaluated the provided information and selected the correct option.

In the second question, it was stated that the total displacement of a car moving on a highway for 30 seconds was equal to the total distance it traveled during this period. The question asked which of the three Statements related to this scenario were true. Despite providing detailed solutions, ChatGPT and Gemini reached incorrect conclusions. Copilot, however, directly stated the correct answer as option C without offering a detailed explanation. For the car's displacement to equal its total distance, it must move along a straight path in a single direction. However, it is not certain whether the car travels at a constant speed. Therefore, Statements II and III are correct, and the correct answer is option D. ChatGPT and Gemini exhibited a general misunderstanding of speed in their solutions.

In the third question, the energy consumption of three different lamps with equal illumination intensity, operating for an equal amount of time, was compared. The lamps were a 75-watt incandescent lamp, a 13-watt LED lamp, and a 40-watt fluorescent lamp. The incandescent lamp, with the highest power rating, consumed the most energy, while the LED lamp, with the lowest power rating, consumed the least energy. This outcome is correctly provided in option B. ChatGPT and Copilot accurately calculated the energy consumption for each lamp and selected the correct answer, while Gemini provided an incorrect answer without performing any calculations.

In the fourth question, the modes of heat transfer—radiation, conduction, and convection—were examined. The question specifically asked how heat from the Sun reaches Earth. The correct answer is option B, as the Sun's heat reaches Earth through radiation. All three bots answered this question correctly.

In the fifth question, six identical lamps were connected to an electrical circuit. The question asked which lamps retained the same brightness when the switch was moved from position 1 to position 2. Only lamp K maintained the same brightness, making option A the correct answer. All three bots answered this question incorrectly, indicating that the circuit's schematic and its implications were not fully understood.

In the sixth question, a point K and a light source were placed at the center of a lampshade suspended at a certain height from the ground. The question described three scenarios: (1) replacing the lampshade with a transparent one of smaller radius, (2) painting the entire lampshade with a translucent material, and (3) shortening the chain suspending the lampshade. The question asked which of the options correctly described the changes in light intensity, illuminance, and luminous flux. At the end of the second scenario, the illuminance at point K decreased, but the descriptions of the other scenarios were incorrect. This outcome corresponds to option C. Both ChatGPT and Gemini provided detailed explanations but incorrectly concluded that there was more than one correct answer. Copilot failed to solve the problem, stating that additional information about light intensity was needed.

In the seventh question, an astronaut was tasked with placing three systems on the Moon: (1) two plane mirrors, (2) a plane mirror and a concave mirror, and (3) a plane mirror and a convex mirror. A diagram showed a laser beam from Earth entering each system, and the question asked which systems would reflect the light beam back to Earth. By analyzing the reflections, systems I and II reflect the light beam back to Earth, while system III does not. The correct answer is option C. ChatGPT and Gemini correctly answered this question, while Copilot provided a completely irrelevant explanation unrelated to the question.

In summary, ChatGPT and Gemini performed equally, each answering 42.86% of the questions correctly. Copilot, on the other hand, achieved a lower accuracy rate, correctly answering only 28.57% of the questions.

Comparison of Answers to TYT 2022 Physics Questions

ChatGPT correctly answered 28.57% of the 2022 TYT Physics questions, Gemini answered 14.28%, and Copilot answered 42.86%. Below is a detailed comparison of the answers provided by each chatbot to the respective questions (Note: The answers provided by the chatbots to some questions are given in the appendix).

In the first question, three different scenarios involving variations in gravity were presented, and it was asked which of these scenarios required the construction of an item with a larger mass. In Scenario 1, a dining table for four people is replaced with a larger table for six people; in Scenario 2, a vase of flowers is replaced with a heavier vase of the same size and shape to prevent it from being blown away by the wind; and in Scenario 3, a light dessert spoon is replaced with a heavier spoon. Among these scenarios, only the heavier vase in Scenario 2 definitively requires the use of a larger mass, while no certainty exists for the other scenarios. Therefore, the correct answer is B. All three chatbots answered this question incorrectly due to misinterpretations. Notably, Copilot provided different answers when asked the same question on multiple occasions.

In the second question, a teacher placed a 1 kg book on a horizontal table and asked students to discuss the forces acting on the book. Since no additional forces are acting on the book or the table, the students cannot draw the given inference. According to the principle of action-reaction, the force exerted by the book on the Earth, the Earth on the book, the book on the table, and the table on the book is 10 N. However, it cannot be concluded that the force exerted by the Earth on the table is also 10 N. Therefore, the incorrect inference is given in Option E. All three chatbots answered this question correctly.

In the third question, water was flowing through pipes of varying diameters, and certain sections of the pipes were damaged, causing water to gush out. In the first pipe, water gushed from the section with a larger diameter, while in the second case, water gushed from the narrower section. The question required comparing the height of the gushing water at these points and the velocities of the flowing water in the respective sections of the pipes. According to Bernoulli's principle, as the cross-sectional area of the flowing water decreases, pressure decreases while velocity increases. Consequently, water gushing from a larger diameter pipe should rise higher, while the velocity of water flowing through the narrower pipe should be greater. This comparison is accurately represented in Option E. Although all three chatbots provided partially correct explanations, they ultimately answered the question incorrectly. Gemini mentioned Bernoulli's principle but incorrectly compared the velocities between the two points and chose Option E as the correct answer, explaining that Statements I, II, and III were correct under this option. However, since the question did not include Statements and only required a single answer option, this response was categorized as unrelated (N).

The fourth question focused on heat conduction. Ayşe held two metal plates that had been in the room for a long time and observed that Plate K felt colder than Plate L. A piece of ice was placed on each plate, and the question asked which plate would melt the ice first and why. Since Plate K, which feels colder, has a higher thermal conductivity, the ice on this plate will melt first. This explanation corresponds to Option A. Both ChatGPT and Copilot answered this question correctly, while Gemini provided an incorrect response.

In the fifth question, a positively charged comb touched a neutral piece of paper, causing the paper to touch the comb and hang in the air. The section of the paper in contact with the comb was labeled A, while the other section was labeled B. The forces acting on these sections, denoted as F_a and F_b , respectively, and the gravitational force acting on the paper, denoted as G , were analyzed. Three statements were provided about these forces, and the question asked which of them were correct. The correct explanations are that F_b acts vertically downward and F_a is greater than G . Thus, the correct option is E. Statement I, which claims that F_a acts vertically downward, is incorrect since A will be pulled while B is pushed. All three chatbots answered this question incorrectly. ChatGPT claimed that none of the statements were correct, while Gemini asserted that Statements I and II were correct, although this was not among the answer options. Copilot incorrectly stated that the correct answer was D.

The sixth question asked about the behavior of wavefronts as they move from the open sea toward the shore, where they become denser. The question required determining which of the quantities—wavelength, frequency, and speed—would decrease as the waves approached the shore. While the speed and wavelength decrease, the frequency remains constant because the source's frequency does not change. The correct answer is D. All three chatbots incorrectly stated that the frequency decreases alongside the wavelength as the waves approach the shore. This question involved a diagram, and the incorrect responses from all three chatbots suggest potential challenges in interpreting diagrams or figures.

In the seventh question, parallel stairs were depicted, one leading from the ground floor to the first floor and another from the first to the second floor. Ali and another person behind him were ascending the lower staircase. The lower part of the upper staircase acted as a plane mirror. The question asked which directions Ali should look in to first see the person behind him and then see his own reflection in the mirror. Ali should look in Direction I to see the person behind him and in Direction II to see himself. Directions II and IV can also be used to observe an area ahead. The correct answer is A.

Findings Related to Chatbots' Answers to AYT Physics Questions

When analyzing the responses provided by chatbots to the AYT Physics questions over the past three years, their performance in terms of correct answers is as follows: ChatGPT correctly answered 45.23%, Gemini correctly answered 26.18%, and Copilot correctly answered 14.28%. These percentages indicate that the accuracy of the chatbots in answering AYT questions remains relatively low, like their performance on TYT questions. A detailed comparison of the answers given to the AYT questions by year and chatbot is presented in Table 2 below.

Table 2: Summary Table of Answers Given by Chatbots to AYT Physics Questions

Questions	2024				2023				2022			
	Answer	Chat GPT	Copilot	Gemini	Answer	Chat GPT	Copilot	Gemini	Answer	Chat GPT	Copilot	Gemini
1	D	E	A	N	D	C	N	C	D	C	B	E
2	E	E	A	E	C	C	C	C	D	E	C	C
3	B	E	D	A	A	E	N	N	A	D	E	D
4	B	D	D	E	D	D	B	D	A	C	N	D
5	E	E	B	N	C	C	B	N	A	A	N	N
6	B	C	C	E	D	D	D	D	B	C	C	D
7	A	A	C	A	E	E	C	N	E	C	C	A
8	A	B	C	A	B	B	E	D	E	E	N	N
9	C	C	C	N	D	D	E	D	C	E	A	A
10	B	A	N	N	C	D	D	N	A	D	D	D
11	C	C	C	D	C	C	D	D	E	E	E	E
12	A	E	E	E	B	B	N	C	D	D	E	D
13	B	C	E	C	D	B	B	N	D	D	D	D
14	C	N	N	N	C	C	A	D	A	D	D	A
Correct (%)		35,71	14,28	21,42		71,42	14,28	28,57		28,57	14,28	28,57

Note: N indicates that given answer not acceptable or there is more than one answer. The web link of exam questions and related answers is given in related reference section.

Comparison of answers to AYT 2024 physics questions

ChatGPT answered 35.71% of the 2024 AYT Physics questions correctly, while Copilot answered 14.28% and Gemini answered 21.42%. (Note: The answers given by the bots to some questions are given in the appendix).

In the first question, two people are swimming in the same direction in a still pool, and another person is moving parallel to these swimmers. The speeds of Levent and Mert are $3v$ and $2v$, respectively, while the speed of Sarp outside the pool is v . Which of the following is true about the comparison of the relative speeds of Levent, Mert, and Sarp in this race? When the relative speeds are compared, the magnitudes of the speeds of Mert relative to Levent and Mert relative to Sarp are equal. This is given in option D. However, option E, which states that the speeds are equal (not the magnitudes of the speeds), is incorrect because speed is a vector quantity and cannot be equal without considering direction. In this question, ChatGPT selected E, Copilot selected A, while Gemini claimed that none of the options were correct. ChatGPT and Copilot ignored the vector nature of velocity and gave the answer as E, reflecting a general misconception.

In the second question, a ball with a mass of 1 kg and a bird with a mass of 1 g are released from a height of 5 m above the ground in an environment where air resistance is neglected. The question asks which of the quantities of force, acceleration, and fall time are expected to be equal for these two objects. The acceleration and fall time acting on the two bodies are the same, but the force acting on them cannot be the same. Accordingly, the correct answer is option E. In this question, ChatGPT performed the correct calculations and reached the correct result. Additionally, Gemini provided the correct explanation but incorrectly labeled the answer as B. This was accepted as correct due to the right solution and explanations. Copilot, on the other hand, explained the situation but failed to state that the net force acting on the objects was not equal, resulting in an incorrect answer.

In the third question, the trajectory of an object thrown obliquely at a certain angle on a flat surface where friction is neglected is given. Three points are marked on the trajectory: point K is located before L, the maximum height of the flight, and point M is located before the ground impact. Since the magnitude of the linear momentum is $p=mv$ and the mass does not change throughout the motion, the magnitude of the velocity at each point is used to compare the momenta at those points. Therefore, the correct comparison is given in option B: the largest momentum is at M and the smallest at L. All three chatbots gave wrong answers in this question. ChatGPT mistakenly focused on angular momentum, Copilot on potential energy, and Gemini attempted to find the velocities but misinterpreted the points K, L, and M, leading to an incorrect comparison of velocities and momentum.

In the fourth question, it is stated that in an environment where friction is neglected, a heavy stone block is pulled at constant speed up an inclined plane instead of being lifted to place it on a 2-meter-high wall. The question asks which of the following objectives are realized: I. saving path; II. applying smaller force; and III. doing less work? All three chatbots gave wrong answers. ChatGPT and Copilot both said the correct answer was D, while Gemini said the answer was E, stating that all Statements were correct. Here, saving work is not possible, and only force is gained at the expense of distance. Thus, the correct answer is B, meaning only Statement II is true.

In the fifth question, three-point charges with equal magnitudes are placed equally spaced in the same direction. Two of these charges are positive, and the one on the far right is negative. Between the charges, points L and M are given, and the ratio of the potentials at these points is asked. Since potential is a scalar quantity, the ratio can be found by summing the potentials of the three charges at the given points. When these calculations are performed, the ratio is 5. This is given in option E. Only ChatGPT solved this question correctly with the correct steps, while Copilot gave the wrong answer, and Gemini provided an answer not listed among the options, stating that the potential at each point was equal.

In the sixth question, the paths of four particles of equal mass are drawn as they enter a uniform magnetic field perpendicular to the plane of the page. Particle K rotates clockwise, particle L moves straight without deviation, particle M rotates counterclockwise, and particle N rotates clockwise. The question asks which of the given options correctly identifies the sign of the charges based on their movements. Since the direction of the magnetic field is not provided, it should be considered as either in or out of the plane of the page, and the right-hand rule should be applied to the particles accordingly. Considering these situations, K and N can be positive, M can be negative, and L can be neutral. This is given in option B. All three chatbots gave wrong answers to this question, indicating a failure to apply the right-hand rule correctly according to the magnetic field direction.

In the seventh question, it is stated that a resistor, a coil, and a capacitor are connected in series to an alternating voltage source. The question asks which of the following quantities will increase by increasing the frequency of the applied alternating voltage when this circuit is operating at resonance frequency: I. Impedance of the circuit, II. Effective current of the circuit, and III. Capacitance of the capacitor. Increasing the frequency will increase the inductance and decrease the capacitance, leading to an increase in impedance. Since the effective current depends on the maximum current, this value will remain the same. The only increasing quantity in the answer is the impedance of the circuit, that is, option A. ChatGPT and Gemini answered this question correctly, while Copilot gave the wrong answer by repeating the Statements and selecting C.

In the eighth question, three individuals compete in a race on a circular track with a common center. Each runner starts from a different point on the track and aims to reach the same finish line. Assuming all runners maintain constant speeds, the race commences simultaneously. The scenario reveals that Kardelen, who begins furthest behind, and Tulip, starting slightly ahead, complete the race at the same time. However, Violet, who had the initial lead, finishes last. The question then requires the comparison of the angular velocities of these runners with respect to the center of the circle. Given that Kardelen, despite starting from the furthest back, finishes first, and Violet, who began ahead, finishes last, it can be deduced that Kardelen possesses the highest angular velocity, while Violet exhibits the lowest. Tulip's angular velocity falls between these two extremes. This relationship is correctly identified in option A. Only Gemini provided the correct answer to this question, while ChatGPT and Copilot erred in their comparison of angular velocities.

In the ninth question, a satellite is depicted orbiting Earth at a constant speed R from the center, with external influences disregarded. Three Statements regarding the satellite's motion are presented, and the task is to determine their veracity. Statement-I states that the work done by gravity on the satellite during one complete revolution is zero. Statement-II asserts that the satellite's angular momentum remains constant. Statement-III claims that the net force acting on the satellite is zero. Since the satellite maintains a constant speed, it experiences a centripetal force, rendering statement III false. However, the satellite's angular momentum remains constant, and the work performed by gravity over one revolution is indeed zero. Therefore, Statements I and II are true. The correct answer is given in option C. ChatGPT, despite correctly identifying Statements I and II, incorrectly selected option D. Gemini, while correctly stating that Statements II and III are true, was classified as "N" as this combination was not among the provided options. Copilot initially failed to provide a solution when presented with the question accompanied by an image, likely due to language processing limitations. However, when the question was presented in textual format, Copilot successfully provided the correct answer.

In the tenth question, a metronome bar, considered massless, is equipped with a slider that can be treated as a point mass at its end. This system undergoes simple harmonic motion, akin to a simple pendulum. The slider's position can be adjusted, altering the oscillation period by varying the distance between the slider and the fixed points. The environment remains constant, and the period of oscillation of the rod is denoted as T_K when the slider is at point K (1 unit from the center) and T_L when the slider is at point L (3 units from the center). The question seeks the ratio of these periods (T_K/T_L). Recognizing that the period is directly proportional to the square root of the length, the ratio ($1/\sqrt{3}$) is determined. While ChatGPT selected option A, both Copilot and Gemini provided answers not listed among the options, resulting in their responses being classified as "N."

In the eleventh question, the siren of a stationary ambulance emits sound waves with a frequency of 1600 Hz. As the ambulance commences its journey along a linear path at a constant speed, it continues to emit sound waves at the same frequency. Simultaneously, the ambulance approaches Asuman while moving away from Altay. Ahmet, seated within the ambulance, observes the sound waves. The question inquires which of the given options accurately describes the frequencies of the sound waves perceived by Ahmet, Asuman, and Altay while the ambulance is in motion. The Doppler effect dictates that an observer approaching a sound source perceives a higher frequency, whereas an observer moving away from the source perceives a lower frequency. However, since Ahmet is within the ambulance, the frequency of the sound waves he perceives remains unchanged, matching the source frequency. Consequently, the correct answer is C, and the frequency heard by Asuman may indeed be 1700 Hz (indicating an increase). ChatGPT and Copilot correctly answered this question, while Gemini provided an incorrect response.

In the twelfth question, it is established that when a U-235 nucleus captures a low-energy neutron, it undergoes fission, resulting in the formation of two product nuclei, denoted as K and L, along with the release of a few neutrons. Numerous binary product combinations of different K and L nuclei can occur during this nuclear fission event. The question explores whether the sum of the atomic numbers, mass numbers, and neutron numbers of the K and L product nuclei in any of these combinations equals that of U-235. This statement is presented in option A. All three chatbots erroneously selected option E. Since neutrons are also released during the fission of uranium, the mass number and neutron number of the K and L nuclei will inevitably change. However, the atomic number (number of protons) remains constant. Therefore, only the atomic number of the K and L product nuclei in any combination will always equal that of U-235.

In the thirteenth question, a graph depicting the change in kinetic energy of electrons ejected from a metal surface as a function of the incident light frequency is presented. The question seeks to determine which values on the graph are sufficient to ascertain the metal's threshold energy without requiring any constants beyond those provided. According to the graph, point L, where the linear extension of the data intersects the frequency axis, corresponds to the threshold energy of the metal. Therefore, knowledge of this value alone is sufficient to determine

the threshold energy. The correct answer is B. ChatGPT and Gemini both selected option C, while Copilot chose option E.

In the fourteenth question, a graph illustrating the variation in resistance of a material with temperature is provided. A closed electrical circuit is constructed using this material to create a sliding rheostat. The rheostat's operation is tested at different temperatures, and the corresponding brightness of a lamp within the circuit is observed. Three Statements are presented, and the task is to identify the true statements based on the experimental observations and the provided graph. Statement I: At temperatures exceeding T_c , the bulb's brightness increases when the rheostat slide is moved from position 1 to position 2. Statement II: At temperatures above T_c , the battery in the circuit becomes unnecessary for the bulb to illuminate. Statement III: At temperatures below T_c , the bulb's brightness remains unchanged when the rheostat slide is moved from position 1 to position 2. The graph indicates that the material exhibits superconductivity at temperatures below T_c , maintaining a constant resistance. Conversely, at temperatures above T_c , the material's resistance increases. Based on these observations, Statement II is deemed false, while Statements I and III are true. The correct answer is given in option C. All three chatbots provided responses that were not among the listed options. ChatGPT asserted that only Statement III is true, Gemini claimed that Statements I and II are true, and Copilot stated that Statements I and III are true while also erroneously indicating that Statement II and IV are false. These explanations, however, lacked direct relevance to the question. Consequently, all three chatbot responses were categorized as "N".

Comparison of answers to AYT 2023 physics questions

ChatGPT demonstrated a superior performance, correctly answering 71.42% of the 2023 AYT Physics questions, while Gemini achieved 28.57% and Copilot 14.28%. A comparative analysis of the answers provided by these AI models to each question is presented below. (Note: The answers provided by the bots to some questions are included in the appendix.)

In the first question, a vector-based scenario involves a dog escaping from a garden hut. The dog initially travels 100 meters northeast (NE) and then 60 meters west on the horizontal plane. Ahmet, the dog's owner, runs 60 meters west from the hut to a cherry tree upon observing the dog's escape. The question requires the determination of the shortest distance and direction Ahmet must travel from the cherry tree to reach his dog. By graphically representing the movements as vectors, it is determined that Ahmet needs to travel 100 meters in the northeast direction from the tree. This solution is presented in option D. ChatGPT initially selected option C when the question was presented as an image but provided the correct answer when presented in text format. Gemini consistently selected option C for both image and text versions. Copilot, while recognizing the vector nature of the problem, incorrectly interpreted the scenario as involving an ice skater, leading to the selection of option A.

In the second question, a tray with a mass of 0.8 kg and a juice box with a mass of 0.4 kg are positioned on a horizontal, frictionless table. Ali exerts a constant, horizontal force on the tray, causing both objects to move together. Given that the juice box accelerates at 5 m/s^2 , the question asks for the magnitude of the force applied by Ali to the tray. Employing Newton's Second Law ($F=ma$), the magnitude of the force is calculated to be 8 N. The correct answer is C. All three AI models successfully arrived at the correct answer due to the straightforward application of this fundamental physics principle.

In the third question, the speed-time graphs of two automobiles, initially at rest, are provided. The question presents three statements regarding their motion: Statement I: Automobile K initially accelerates and then decelerates to a stop. Statement II: Automobile K returns to its starting position at the 30-second mark.

Statement III: At the 30-second mark, automobile L is positioned ahead of automobile K. An analysis of the graph reveals that Statement I is true, while Statements II and III are false. Consequently, the correct answer is option A. ChatGPT incorrectly asserted the veracity of all three statements. Gemini, after analyzing the question, inconsistently concluded that only Statement II is true, selecting option B. Copilot provided an inconclusive answer, demonstrating an incorrect processing of the question.

In the fourth question, a 1 kg block of play dough is utilized in an inelastic collision experiment. Identical 0.1 kg iron balls are horizontally thrown at 3 m/s towards the block. Upon impact, the balls adhere to the block, causing it to move at 2 m/s on a frictionless surface. The question seeks to determine the number of iron balls that become embedded in the block. By applying the principle of conservation of momentum, it can be determined that a total of 20 balls become embedded in the block. This solution is presented in option D. ChatGPT and Gemini both arrived at the correct answer, while Copilot provided an incorrect solution.

In the fifth question, Ayşe and Ali enter a revolving door within a store. The door comprises four identical wings (K, L, M, and P) that rotate around the central axis (O). Handles L and M are located 50 cm from the axis (O), while handles K and P are positioned 100 cm from the axis. Three statements are presented, and the question asks which scenarios would result in the rotation of the door around the axis O when forces are applied perpendicular to the door's surface: Statement I: Ayşe applies a 10 N force pushing at handle L and a 10 N force pulling at handle M. Statement II: Ayşe applies a 20 N force pulling at handle L and a 10 N force pulling at handle P. Statement III: Ayşe applies a 20 N force pushing at handle K and a 10 N force pushing at handle P.

By examining the torques (moments) generated, it can be determined that the door will rotate in scenarios I and III, while in scenario II, the net torque is zero. The correct answer is therefore I and III, which corresponds to option C. ChatGPT provided the correct answer, while Gemini provided an incorrect response. Copilot failed to provide a relevant answer, instead offering explanations unrelated to the question.

In the sixth question, an ammeter with a wire frame positioned within a uniform magnetic field rotates around an axis. The ammeter needle indicates zero when no current flows through the wire frame. When a current (i) passes through, the magnetic field exerts a force proportional to the current, causing the needle to deflect. The question inquires about the changes that would result in a greater needle deflection: I: Using a magnet with stronger pole intensities. II: Decreasing the distance between the N and S poles of the magnet. III: Increasing the distance between the N and S poles of the magnet. Statements I and II are correct, while Statement III is incorrect. This combination is presented in option D. All three AI models correctly answered this question.

In the seventh question, a camera flash system is described, comprising a battery, capacitor, switch, and a specialized bulb. When the switch is activated, the energy stored in the capacitor by the battery is released, producing a bright flash of light. The question presents three statements: Statement I: Increasing the battery's potential difference decreases the capacitor's capacitance. Statement II: Utilizing a fully charged capacitor with a larger capacitance results in a more intense flash. Statement III: During the flash, the charge stored in the capacitor decreases. Statements II and III are correct, while Statement I is incorrect. This combination is presented in option E. ChatGPT provided the correct answer, while Copilot and Gemini provided incorrect responses. Gemini inconsistently concluded that all three statements were correct and selected an option that was not available, resulting in an incorrect classification. This analysis highlights the varying performance levels of the AI models across different physics question types. While ChatGPT demonstrated superior performance overall, all three models exhibited limitations in specific areas, such as vector analysis, graph interpretation, and nuanced conceptual understanding.

The eighth question addresses a simple transformer with primary and secondary windings. It states that when a voltage is applied to the primary circuit, a voltage is induced in the secondary circuit. The question then inquires which of the following quantities in the primary circuit are typically greater than their corresponding values in the secondary circuit: I. Voltage, II. Power, III. Number of turns. In an ideal transformer, power is conserved. However, in a real-world transformer, energy losses (such as those due to resistance and core losses) occur. Therefore, the power in the secondary circuit is generally less than the power in the primary circuit. Consequently, only explanation II (power) is correct. This is presented as option B. ChatGPT provided the correct answer, while Gemini and Copilot offered incorrect responses.

The ninth question involves a series of experiments designed to determine the type of three unknown circuit elements: K, L, and M. In these experiments, an alternating voltage with constant amplitude and variable frequency is applied to each element, and the resulting change in impedance is measured. The experimental results reveal the following: I. The resistance of K increases with frequency. II. The resistance of L remains constant. III. The resistance of M decreases with frequency. Based on these observations: K exhibits the characteristics of an inductor (coil), as the impedance of an inductor increases with increasing frequency. L demonstrates the behavior of a resistor, as its resistance remains constant regardless of frequency. M exhibits the characteristics of a capacitor, as the impedance of a capacitor decreases with increasing frequency. The correct answer is option D. ChatGPT and Gemini provided correct answers, while Copilot provided an incorrect response.

In the tenth question, the motions of a glass ball undergoing uniform circular motion on a string and an iron ball undergoing simple harmonic motion on a spring are compared. The question asks which of the following statements are true: I. The velocities of these two balls are always constant. II. Their acceleration is always perpendicular to the velocity. III. The work done by the net force on the balls in one period is zero. Uniform Circular Motion: Velocity is constant in magnitude but continuously changes direction. Acceleration (centripetal acceleration) is always directed towards the center of the circle and is perpendicular to the velocity. The net force (centripetal force) acts perpendicular to the displacement over one complete cycle, resulting in zero-net-work.

Simple Harmonic Motion: Velocity varies continuously. Acceleration is always directed towards the equilibrium position and is not always perpendicular to the velocity. The net force acts against displacement, resulting in zero-net-work over one complete cycle. Therefore, only Statement III is true for both types of motion. The correct answer is option C. None of the AI models provided the correct answer. ChatGPT and Copilot selected option D, while Gemini incorrectly stated that Statements I and III are true and selected option D, which was not a valid option, resulting in its response being classified as "N." This indicates a potential gap in the AI models' ability to compare different types of motion.

In the eleventh question, Ayşe observes an acrobat walking on a tightrope while balancing with a pole. Her physics teacher explains that this balancing act can be understood in terms of the concept of moment of inertia. The question asks which of the following changes would assist the tightrope walker in maintaining balance: I. Using a pole of the same mass but greater length. II. Attaching two identical weights to the ends of the same pole. III. Using a pole of the same length but less mass. Increasing the moment of inertia around the tightrope walker's center of mass would enhance stability. This can be achieved by: I. Increasing the length of the pole: This increases the distance of the pole's mass from the axis of rotation (the tightrope walker's center of mass), thereby increasing the moment of inertia. II. Attaching weights to the ends of the pole: This also increases the distance of the mass from the axis of rotation, increasing the moment of inertia. Therefore, Statements I and II are correct. The correct answer is option C. ChatGPT provided the correct answer, while Copilot and Gemini incorrectly stated that Statements II and III were correct.

In the twelfth question, the rings of a planet consist of particles orbiting in their own paths. Identical particles K and M orbit the planet, with K located closer to the planet than M. The question asks which of the following quantities are smaller for particle K compared to particle M: Linear velocity, Orbital period, Angular velocity, Magnitude of centripetal acceleration and Gravitational force. Kepler's Laws of Planetary Motion dictate that: Closer objects to the planet have shorter orbital periods. Closer objects to the planet have higher linear velocities. Closer objects to the planet experience greater gravitational forces. Therefore, only the orbital period of particle K is smaller than that of particle M. The correct answer is option B. Only ChatGPT provided the correct answer. Gemini and Copilot provided incorrect responses, with Copilot selecting option C without providing any explanation, resulting in its response being classified as "N."

In the thirteenth question, in an environment without air friction, a point target tied to a string undergoes simple harmonic motion between points A and C. An archer fires an arrow at a constant speed of 50 m/s parallel to the ground as the target begins its motion from point A. The arrow strikes the target at point B, which is located 100 meters away and represents the equilibrium position. The question asks for the oscillation period of the target. The horizontal travel time of the arrow is $100 \text{ m} / 50 \text{ m/s} = 2$ seconds. Since the target travels from point A to point B (one-quarter of the oscillation) in 2 seconds, the full oscillation period is $2 \text{ seconds} \times 4 = 8$ seconds. The correct answer is option D. ChatGPT and Copilot selected option C, while Gemini did not specify an option, stating only that the period is less than 2 seconds. Gemini's response was therefore classified as "N."

In the fourteenth question, an interference pattern is observed in water. The question requires the comparison of the vibration amplitudes at three different points (I, II, and III) within this pattern. Points I and III correspond to regions of constructive interference (peak + peak), resulting in maximum amplitude. Point II corresponds to a region of destructive interference (peak + trough), resulting in minimal or zero amplitude (damping point). Therefore, the amplitudes at points I and III are equal and greater than the amplitude at point II. The correct answer is option C. Only ChatGPT provided the correct answer. Copilot initially provided option A when the question was presented in Turkish but later provided option C when presented in English, without offering a detailed explanation. The response provided in Turkish was accepted as correct.

Comparison of answers given to AYT 2022 physics questions

In the first question, Ahmet pushes a parcel forward, while Ali pulls it towards him simultaneously. The question explores the possible directions of motion for the parcel given the combined forces. All three AI models provided incorrect answers. The correct answer is that the parcel can move in directions II and III, as the combined forces will result in a net force that does not solely align with the direction of either individual force. This is presented in option D.

The second question describes a truck traveling at a constant speed eastward on a horizontal, frictionless road. A crate rests on the horizontal plane of the truck. The question asks which of the following statements are true for an observer at rest relative to the ground: I. The truck exerts an easterly force on the crate in the horizontal direction. II. The crate exerts a downward force on the truck in the vertical direction. III. The net force acting on the crate is

zero. All three AI models provided incorrect answers. The correct answer is that statements II and III are true, while statement I is false. This is presented in option D.

The third question presents two experiments involving identical eggs. In the first experiment, an egg dropped from a height onto a hard surface break without bouncing. In the second experiment, the egg is surrounded by soft packaging foam before being dropped from the same height. In this case, the egg stops without breaking. The question asks which of the following quantities increased during the collision in the second trial compared to the first: I. The interaction time between the egg and the ground. II. The change in momentum of the egg. III. The average force exerted by the ground on the egg. The correct answer is that in the second experiment, the interaction time between the egg and the ground increased. This is presented in option A. All three AI models provided incorrect answers.

The fourth question presents a scenario where Ayşe is given three scissors of the same length but with different blade lengths and distances from the support point to the blade tip. She is asked to determine which pair of scissors would require the least force to cut a wire when applying force vertically to the handles. The correct answer is that the force required to cut the wire is minimized when the force arm (distance from the handle to the support point) is maximized and the load arm (distance from the support point to the blade tip) is minimized. This is presented in option A. All three AI models provided incorrect answers. Copilot's answer was deemed irrelevant and classified as "N."

The fifth question describes a positively charged particle moving through two regions. In region I, the particle moves without deviation in a uniform electric field. In region II, the particle deviates clockwise in a uniform magnetic field. The question asks for the directions of the applied electric and magnetic fields that would result in this observed motion. The correct answer is that the electric field must be in the direction of the particle's movement, and the magnetic field must be directed outward from the plane of the page, as determined by the right-hand rule. This is presented in option A. Both Copilot and Gemini failed to provide any answer, resulting in their responses being classified as "N." Only ChatGPT provided and explained the correct answer.

The sixth question addresses the Compton effect, specifically inquiring about the changes in the properties of a photon after undergoing Compton scattering. The question asks which of the following quantities decrease in magnitude for the scattered photon compared to the incident photon: I. Velocity, II. Momentum, III. Wavelength. ChatGPT and Copilot selected option C, and Gemini selected option D, all of which were incorrect. The correct answer is that the momentum of the scattered photon decreases, its speed remains constant, and its wavelength increases due to a decrease in energy. This is presented in option B.

The seventh question presents a scenario involving an electrical appliance, a socket, and a transformer. The transformer has primary and secondary windings with a turn ratio of 2:1 (KN: LM). The electrical appliance operates at 110 volts, and the socket provides 220 volts. The question asks how the cables should be connected for the appliance to function correctly. All three AI models provided incorrect answers. ChatGPT and Copilot selected option C, while Gemini selected option A. The correct answer is to connect the socket ends to the high-voltage winding part of the transformer (L to 1 and M to 2) and the appliance to the low-voltage winding part (K to 3 and N to 4). This is presented in option E."

The eighth question presents three arrows that are shot and embedded into a target board that is rotating at a constant angular velocity. Arrow K is closest to the center, arrow M is furthest away, and arrow N is positioned in the middle. The question asks to compare the angular and linear velocities of these arrows. All arrows share the same angular velocity as the rotating target board. However, their linear velocities differ. The outer arrow (M) possesses the highest linear velocity, while the inner arrow (K) has the smallest linear velocity. This relationship is correctly expressed in option E. Only ChatGPT provided the correct answer. Copilot and Gemini were unable to provide a complete answer, resulting in their responses being classified as "N."

The ninth question presents the Earth's orbit around the Sun depicted, with point B representing the perihelion (closest point) and point A representing the aphelion (farthest point). The question asks for a comparison of the magnitudes of Earth's angular momentum and linear velocity at these points. The angular momentum of the Earth-Sun system remains constant due to the conservation of angular momentum. However, Earth's linear velocity is greater at perihelion (point B) than at aphelion (point A) due to Kepler's laws of planetary motion. The correct answer is given in option C. All three AI models provided incorrect answers. For example, ChatGPT incorrectly identified the closest position as the farthest, leading to an opposite conclusion.

The tenth question presents an object attached to a spring undergoes simple harmonic motion on a frictionless horizontal plane. The question asks which of the following statements are true: I. The object's acceleration is greatest when its speed is lowest. II. The spring's potential energy is lowest when the object's velocity is lowest. III. The force exerted by the spring on the object is inversely related to its velocity throughout the motion. Statement I is true. At the turning points of the motion (maximum displacement), the object's speed is zero, and its acceleration is at a maximum. Statement II is false. The spring's potential energy is maximum when the object's displacement is maximum, and its velocity is zero. Statement III is false. The force exerted by the spring is directly proportional to the displacement from the equilibrium position, not inversely proportional to the velocity. Only statement I is correct. The correct option is A. All three AI models incorrectly selected option D, which stated that both I and II are true.

The eleventh question presents the Doppler effect as a phenomenon observed in various types of waves. The question asks about the types of waves in which this effect can be observed: I. Transverse waves, II. Longitudinal waves, III. Electromagnetic waves. The Doppler effect can be observed in all three types of waves: Transverse waves: Examples include electromagnetic waves (light, radio waves) and waves on a string. Longitudinal waves: Examples include sound waves. The correct answer is option E, indicating that the Doppler effect can be observed in all three types of waves. All three AI models correctly answered this question.

The twelfth question starts with the following explanation: Higgs boson, a fundamental particle predicted and discovered by the Standard Model, interacts with other particles to give them mass. Then, the question asks which particles interact with the Higgs boson: I. Photon, II. Electron, III. Up quark. Photons, being massless, do not interact with the Higgs boson. Electrons and up quarks, however, do interact with the Higgs boson and acquire mass through this interaction. The correct answer is option D. All three AI models correctly answered this question. The thirteenth question addresses the postulates of Einstein's special theory of relativity: I. The speed of light in a vacuum is constant for all observers, regardless of their relative motion. II. The laws of physics are the same for all observers in uniform motion relative to one another. Statement III, which states that the laws of physics change according to the motion of the observer, is incorrect. The correct option is D.

In the fourteenth question a conversation between friends about medical imaging techniques is given: Zeynep discusses not keeping metal objects near the device. Ömer mentions a method using potentially harmful light. Şule mentions a device that doesn't use electromagnetic waves. The correct interpretations are: Zeynep: This likely refers to an MRI (Magnetic Resonance Imaging) scan, which uses strong magnetic fields and requires the removal of metal objects. Ömer: This likely refers to an X-ray scan, which uses X-rays, a form of electromagnetic radiation. Şule: This likely refers to an ultrasound scan, which utilizes sound waves instead of electromagnetic radiation. The correct answer is option A. Gemini provided the correct answer, while ChatGPT and Copilot provided incorrect answers.

CONCLUSION AND DISCUSSION

This study aimed to analyze and compare the performance of three AI chatbots—ChatGPT, Gemini, and Copilot—in answering questions from the Turkish Physics Entrance Examination over the past three years. The findings revealed that ChatGPT correctly answered 38.09% of the TYT physics questions, while Gemini and Copilot each achieved a success rate of 28.57%. For the AYT physics questions, ChatGPT demonstrated superior performance with a correct response rate of 45.23%, compared to Gemini's 26.18% and Copilot's 14.28%. Although ChatGPT outperformed the other chatbots overall, Copilot exhibited the lowest success rate. Notably, the correct answer rates for all chatbots remained below an acceptable threshold for both the TYT and AYT questions.

Additionally, the analysis of TYT questions labeled as "N" (indicating irrelevant answers) showed that both ChatGPT and Copilot produced three such responses (14.28%), whereas Gemini had four (19.04%). For AYT questions, ChatGPT had one "N" response (2.38%), while Gemini had 12 (28.57%) and Copilot had seven (16.66%). These results suggest that Gemini and Copilot underperformed in providing relevant answers compared to ChatGPT. Specifically, Copilot frequently struggled with questions requiring image interpretation, often failing to comprehend and respond accurately (see Appendix).

Previous research supports these findings. Gregorcic and Pendrill (2023) noted that ChatGPT's responses to physics questions were often unreliable and inconsistent, rendering it inadequate as a primary resource for students and educators. Dahlkemper et al. (2023) reported that ChatGPT performed reasonably well on complex physics questions, whereas Kortemeyer (2023) found that ChatGPT-3.5's performance on the Force Concept Inventory (FCI) was comparable to that of novice students, with a correct answer rate of approximately 50–60%. Similarly, the average correct answer rate for all three chatbots on the TYT and AYT physics questions remained below 50%, indicating suboptimal performance. In contrast, dos Santos (2023) found that ChatGPT-4 outperformed Bing and

Bard in answering physics questions, offering more accurate and detailed responses. Yeadon and Hardy (2023) observed that ChatGPT-3.5 correctly answered only 30–40% of university entrance-level physics questions. Also, Aldazharova et al. (2024) reported that GPT-4 demonstrated impressive proficiency on numerous FCI items, especially those pertaining to Newton's third law, where it achieved perfect scores on several questions. However, it faced considerable challenges with items that required the interpretation of figures and spatial reasoning. While AI holds great potential as an educational tool, it still needs substantial improvement to fully align with human problem-solving abilities. Meanwhile Tong et al. (2024) reported that in comparison to the performance of ChatGPT-3.5 and the students, ChatGPT-4 demonstrated superior capabilities in tackling physics conceptual understanding and reasoning problems.

General limitations of large language models (LLMs) as AI agents have been highlighted by researchers such as McIntosh et al. (2024), Hadi et al. (2024), and Lappin (2024). These limitations extend to AI chatbots answering physics questions (Borji, 2023; Gregorcic & Pendrill, 2023; Liang et al., 2023; Polverini & Gregorcic, 2024). Liang et al. (2023) identified three key constraints: (1) LLMs generate text by predicting speech patterns rather than applying human-like reasoning, leading to deficiencies in numerical problem-solving; (2) while mathematical variables are used symbolically, physical variables correspond to real-world phenomena, making it difficult for LLMs to correctly translate problem statements into applicable physical concepts; and (3) physics problems often require vector-based reasoning rather than straightforward numerical calculations, posing additional challenges for LLMs.

These limitations may explain the chatbots' poor performance on physics-related questions. For example, when addressing questions about magnetic fields, the chatbots often fail to apply theoretical principles correctly. Similarly, when interpreting a mass-volume graph in TYT questions, the chatbots focused solely on graphical trends, overlooking fundamental physical principles such as the stratification of fluids based on density. Borji (2023) identified 11 common error types in ChatGPT's responses, including logical, mathematical, coding, and factual errors, as well as inherent biases. The accuracy of chatbot responses varies across domains, with higher performance observed in fields such as finance, programming, law, and health education (Lo, 2023). Improving LLMs' performance on conceptual physics tasks may require deeper insight into their operational mechanics and the application of effective engineering techniques. Persistent challenges include handling complex knowledge, ambiguous statements, deep analysis, and context-dependent questions.

To enhance AI performance in physics education, improvements in training methodologies are necessary. One approach is to integrate domain-specific datasets with targeted reinforcement learning techniques, ensuring that chatbots develop a deeper understanding of physics principles. Fine-tuning LLMs using expert-reviewed educational resources, including structured physics textbooks and problem sets, may enhance their ability to process and apply physical laws accurately. Moreover, hybrid AI models combining rule-based systems with deep learning can mitigate the inconsistencies observed in generative models by enforcing logical and mathematical consistency.

The constraints limiting chatbot performance can be further understood through established cognitive theories. Bloom's Taxonomy classifies cognitive learning into six levels, from basic knowledge recall to higher-order evaluation and creation. AI models generally excel at lower-level cognitive tasks, such as recalling definitions or summarizing information, but struggle with higher-order reasoning, such as synthesizing multiple concepts or evaluating physical scenarios. Enhancing AI's ability to function at higher cognitive levels would require incorporating reasoning-based training methodologies, such as logic-driven fine-tuning and problem-decomposition strategies.

Similarly, Cognitive Load Theory (CLT) posits that complex tasks requiring high cognitive effort can overwhelm a learner's working memory, hindering comprehension and problem-solving. AI-generated responses that provide overly detailed, yet incoherent explanations may contribute to extraneous cognitive load, reducing their educational effectiveness. Training AI models to prioritize clarity, coherence, and problem-relevant explanations could improve their usability in educational settings. Additionally, adaptive AI models that assess user proficiency and tailor explanations accordingly could enhance student learning experiences by reducing cognitive overload. To ensure that Turkish physics questions were correctly interpreted by the AI chatbots, some were also posed in English. The responses remained unchanged, suggesting that the chatbots understood the language but misinterpreted the underlying meaning, leading to incorrect answers - a phenomenon also reported by Kharchenko and Babenko (2024).

In this study, TYT and AYT questions were presented to the chatbots using simple prompts, resulting in varied response styles, ranging from concise answers to detailed solutions (see Appendix for examples). Future research

could explore whether more detailed prompts influence chatbot performance. Given the probabilistic nature of LLMs, their problem-solving abilities should be assessed with caution. The variability in responses to identical questions is influenced by a parameter known as "temperature." Most chatbots operate with a default temperature setting of 0.7, allowing for response variation, whereas a temperature of zero ensures consistency by selecting the highest-probability response. Higher temperature settings increase the likelihood of deviation from optimal answers (Borovský, Hanč, & Hančová, 2024).

Furthermore, general LLMs such as ChatGPT are trained on vast internet-based datasets, which may propagate misconceptions or AI hallucinations. To mitigate these issues, AI tools should be leveraged as facilitators rather than authoritative sources in active learning environments (Borovský, Hanč, & Hančová, 2024). Students must be encouraged to critically evaluate chatbot-generated responses and cross-verify information with reliable sources. Additionally, researchers, educators, and students should recognize that AI chatbot performance can be improved through prompt optimization (Kharchenko & Babenko, 2024).

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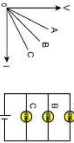
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2024 TYT 1st physics question

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5. A, B ve C lambasının anahtar kapanıncaya kadar aynı miktarda elektrik akımından geçtiği bir devre şeması aşağıda gösterilmiştir. Bu devre kapatıldıktan ve anahtar açıldıktan sonra, ampullerin ısıtma potansiyelleri sırasıyla P_A, P_B ve P_C olarak gösterilmektedir. Bu durumda, ampullerin ısıtma potansiyelleri arasındaki ilişki aşağıdaki gibidir.  A, B ve C lambasının anahtar kapanıncaya kadar aynı miktarda elektrik akımından geçtiği bir devre şeması aşağıda gösterilmiştir. Bu devre kapatıldıktan ve anahtar açıldıktan sonra, ampullerin ısıtma potansiyelleri sırasıyla P_A, P_B ve P_C olarak gösterilmektedir. Bu durumda, ampullerin ısıtma potansiyelleri arasındaki ilişki aşağıdaki gibidir. A) $V_A > V_B > V_C$ B) $V_A < V_B < V_C$ C) $V_A < V_B < V_C$ D) $V_A < V_B < V_C$ E) $V_A < V_B < V_C$ F) $P_A < P_B < P_C$ G) $P_A < P_B < P_C$ H) $P_A < P_B < P_C$ I) $P_A < P_B < P_C$	Answer given by ChatGPT (Turkish) 5. A, B ve C lambasının anahtar kapanıncaya kadar aynı miktarda elektrik akımından geçtiği bir devre şeması aşağıda gösterilmiştir. Bu devre kapatıldıktan ve anahtar açıldıktan sonra, ampullerin ısıtma potansiyelleri sırasıyla P_A, P_B ve P_C olarak gösterilmektedir. Bu durumda, ampullerin ısıtma potansiyelleri arasındaki ilişki aşağıdaki gibidir. A) $V_A > V_B > V_C$ B) $V_A < V_B < V_C$ C) $V_A < V_B < V_C$ D) $V_A < V_B < V_C$ E) $V_A < V_B < V_C$ F) $P_A < P_B < P_C$ G) $P_A < P_B < P_C$ H) $P_A < P_B < P_C$ I) $P_A < P_B < P_C$	Answer given by Copilot (Turkish) 5. A, B ve C lambasının anahtar kapanıncaya kadar aynı miktarda elektrik akımından geçtiği bir devre şeması aşağıda gösterilmiştir. Bu devre kapatıldıktan ve anahtar açıldıktan sonra, ampullerin ısıtma potansiyelleri sırasıyla P_A, P_B ve P_C olarak gösterilmektedir. Bu durumda, ampullerin ısıtma potansiyelleri arasındaki ilişki aşağıdaki gibidir. A) $V_A > V_B > V_C$ B) $V_A < V_B < V_C$ C) $V_A < V_B < V_C$ D) $V_A < V_B < V_C$ E) $V_A < V_B < V_C$ F) $P_A < P_B < P_C$ G) $P_A < P_B < P_C$ H) $P_A < P_B < P_C$ I) $P_A < P_B < P_C$	Answer given by Gemini (Turkish) 5. A, B ve C lambasının anahtar kapanıncaya kadar aynı miktarda elektrik akımından geçtiği bir devre şeması aşağıda gösterilmiştir. Bu devre kapatıldıktan ve anahtar açıldıktan sonra, ampullerin ısıtma potansiyelleri sırasıyla P_A, P_B ve P_C olarak gösterilmektedir. Bu durumda, ampullerin ısıtma potansiyelleri arasındaki ilişki aşağıdaki gibidir. A) $V_A > V_B > V_C$ B) $V_A < V_B < V_C$ C) $V_A < V_B < V_C$ D) $V_A < V_B < V_C$ E) $V_A < V_B < V_C$ F) $P_A < P_B < P_C$ G) $P_A < P_B < P_C$ H) $P_A < P_B < P_C$ I) $P_A < P_B < P_C$
Verilen Grafik ve Dört İfade: Grafikte, A, B ve C lambasının aynı voltaj (V) altında voltajı (V) ile akım (I) arasındaki ilişki gösterilmektedir. Bu grafik, aynı voltaj (V) altında, A, B ve C lambalarının akım (I) arasındaki ilişkiyi göstermektedir. Akım (I) aynı voltaj (V) altında, A, B ve C lambalarının akım (I) arasındaki ilişkiyi göstermektedir. Paralel Devredeki İki İfade: Paralel devrelerde, her bir lamba aynı potansiyel fark (V) altında çalışır. Bu durumda, $V_A = V_B = V_C$. Grafik (P) Harfleri: Elektriksel güç formülü $P = VI$ ve $V = \frac{P}{I}$ olarak verilir. Burada, V potansiyel farkı ve I akımdır. Grafik (P) Harfleri: Elektriksel güç formülü $P = VI$ ve $V = \frac{P}{I}$ olarak verilir. Burada, V potansiyel farkı ve I akımdır. Grafik (P) Harfleri: Elektriksel güç formülü $P = VI$ ve $V = \frac{P}{I}$ olarak verilir. Burada, V potansiyel farkı ve I akımdır. Grafik (P) Harfleri: Elektriksel güç formülü $P = VI$ ve $V = \frac{P}{I}$ olarak verilir. 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2022 TYT 2nd physics question	Answer given by ChatGPT (Turkish)	Answer given by Copilot (Turkish)	Answer given by Gemini (Turkish)
2. Bir öğrencinin, kütlesi 1 kg olan kitabı sırtına, yatağı bir masanın üzerine bırakarak dürtme kuvveti uygulamıştır. Bu kuvvetin büyüklüğüne ilişkin aşağıdaki ifadelerden hangisi yanlıştır? Kütla veyo masaya başqa bir kuvvet etli emmedigine göre asagidakı öğrenci ifadelerinden hangisi yuktarda verilen bilgilerden cıkartılmalaz? (Ver çekimin ivmesi $g=10 \text{ m/s}^2$ alınaz.) A) Kitabın Yuktara ye uyguladığı kuvvet 10 N'dir. B) Yuktaren kitaba uyguladığı kuvvet 10 N'dir. C) Kitabın masaya uyguladığı kuvvet 10 N'dir. D) Masanın kitaba uyguladığı kuvvet 10 N'dir. E) Yuktaren masaya uyguladığı kuvvet 10 N'dir.	 Kitabın sırtına, yatağı bir masanın üzerine bırakarak dürtme kuvveti uygulamıştır. Bu kuvvetin büyüklüğüne ilişkin aşağıdaki ifadelerden hangisi yanlıştır? Kütla veyo masaya başqa bir kuvvet etli emmedigine göre asagidakı öğrenci ifadelerinden hangisi yuktarda verilen bilgilerden cıkartılmalaz? (Ver çekimin ivmesi $g=10 \text{ m/s}^2$ alınaz.) A) Kitabın Yuktara ye uyguladığı kuvvet 10 N'dir. B) Yuktaren kitaba uyguladığı kuvvet 10 N'dir. C) Kitabın masaya uyguladığı kuvvet 10 N'dir. D) Masanın kitaba uyguladığı kuvvet 10 N'dir. E) Yuktaren masaya uyguladığı kuvvet 10 N'dir.	 Kitabın sırtına, yatağı bir masanın üzerine bırakarak dürtme kuvveti uygulamıştır. Bu kuvvetin büyüklüğüne ilişkin aşağıdaki ifadelerden hangisi yanlıştır? Kütla veyo masaya başqa bir kuvvet etli emmedigine göre asagidakı öğrenci ifadelerinden hangisi yuktarda verilen bilgilerden cıkartılmalaz? (Ver çekimin ivmesi $g=10 \text{ m/s}^2$ alınaz.) A) Kitabın Yuktara ye uyguladığı kuvvet 10 N'dir. B) Yuktaren kitaba uyguladığı kuvvet 10 N'dir. C) Kitabın masaya uyguladığı kuvvet 10 N'dir. D) Masanın kitaba uyguladığı kuvvet 10 N'dir. E) Yuktaren masaya uyguladığı kuvvet 10 N'dir.	 Kitabın sırtına, yatağı bir masanın üzerine bırakarak dürtme kuvveti uygulamıştır. Bu kuvvetin büyüklüğüne ilişkin aşağıdaki ifadelerden hangisi yanlıştır? Kütla veyo masaya başqa bir kuvvet etli emmedigine göre asagidakı öğrenci ifadelerinden hangisi yuktarda verilen bilgilerden cıkartılmalaz? (Ver çekimin ivmesi $g=10 \text{ m/s}^2$ alınaz.) A) Kitabın Yuktara ye uyguladığı kuvvet 10 N'dir. B) Yuktaren kitaba uyguladığı kuvvet 10 N'dir. C) Kitabın masaya uyguladığı kuvvet 10 N'dir. D) Masanın kitaba uyguladığı kuvvet 10 N'dir. E) Yuktaren masaya uyguladığı kuvvet 10 N'dir.

6. Bir gözlem aracıyla açık denizde dalgalar gözlemlenirken, dalgaların dalgıç yönüne doğru yaklaşırken hızları artıyor ve dalgaların dalgıç yönüne yaklaşırken boyları da azalıyor. Bu gözlemler dalgaların hangi özelliğinin değiştiğini göstermektedir? Boyları azalıyor ve hızları artıyor. Aşağıdaki ifadelerden hangileri bu gözlemlerle uyumlu değildir? I. Dalgaların hızları artıyor. II. Dalgaların boyları azalıyor. III. Dalgaların frekansları artıyor. IV. Dalgaların hızları azalıyor. A) Yalnız II B) Yalnız III C) I ve II D) I ve III E) I ve IV	Answer given by ChatGPT (Turkish) ⚙️ Aşağıdaki şekilde düşünün... Bu gözlem, dalgaların kıyıya yaklaşırken dalgıç yönüne doğru yaklaşırken hızları artıyor ve boyları da azalıyor. Bu gözlemler dalgaların hangi özelliğinin değiştiğini göstermektedir? I. Dalgıç Boyu: - Dalgıç boyu, dalgaların bir saniye boyunca aldığı mesafedir. Kıyıya yaklaşırken dalgıç boyu azalır. II. Frekans: - Frekans, bir saniye boyunca geçen dalgaların sayıdır. Kıyıya yaklaşırken dalgaların sayısı artar. III. Hız: - Hız, dalgaların bir saniye boyunca aldığı mesafedir. Kıyıya yaklaşırken hızları artar. Sonuç olarak, dalgıç boyu (I) ve frekans (II) değişir. a) Yalnız II	Answer given by Copilot (Turkish) 🌈 Siz aynı şekilde düşünün... Bu gözlem, dalgaların kıyıya yaklaşırken dalgıç yönüne doğru yaklaşırken hızları artıyor ve boyları da azalıyor. Bu gözlemler dalgaların hangi özelliğinin değiştiğini göstermektedir? I. Dalgıç Boyu: - Dalgıç boyu, dalgaların bir saniye boyunca aldığı mesafedir. Kıyıya yaklaşırken dalgıç boyu azalır. II. Frekans: - Frekans, bir saniye boyunca geçen dalgaların sayıdır. Kıyıya yaklaşırken dalgaların sayısı artar. III. Hız: - Hız, dalgaların bir saniye boyunca aldığı mesafedir. Kıyıya yaklaşırken hızları artar. Sonuç olarak, dalgıç boyu (I) ve frekans (II) değişir.	Answer given by Gemini (Turkish) 🔹 Doğru Cevap: c) I ve II Açıklama: Dalgaların kıyıya yaklaşırken dalgıç yönüne doğru yaklaşırken hızları artıyor ve boyları da azalıyor. Bu gözlemler dalgaların hangi özelliğinin değiştiğini göstermektedir? Dalgıç Boyu: - Dalgıç boyu (I), bir saniye boyunca alınan mesafedir. Kıyıya yaklaşırken dalgıç boyu azalır. - Frekans (II), bir saniye boyunca geçen dalgaların sayıdır. Kıyıya yaklaşırken dalgaların sayısı artar. Dalgaların Hızı: - Hız (III), dalgaların bir saniye boyunca aldığı mesafedir. Kıyıya yaklaşırken hızları artar. Sonuç olarak, dalgıç boyu (I) ve frekans (II) değişir. Doğru Cevap: c) I ve II
Answer given by ChatGPT (Ing. translation) ⚙️ Sure, here is the translated text: Considering the situation where wave fronts in the open sea become closer as they approach the shore: The shortening of wave fronts is generally associated with a decrease in wave speed or a reduction in wavelength. In this context: I. Wavelength: As waves approach the shore, their wavelength generally decreases. Therefore, I is correct. II. Frequency: Wave frequency is inversely related to wavelength. If the wavelength decreases, the frequency generally increases. Therefore, II is incorrect. III. Speed: The speed of waves typically decreases as they approach the shore. Therefore, III is incorrect. The correct answer is that only the wavelength decreases, which is option I. A) Only I	Answer given by Copilot (Ing. translation) This observation shows a situation where wave fronts become closer as waves approach the shore. Now let's examine the given quantities: I. Wavelength: - Wavelength is the distance a wave travels in one complete period. The wavelengths of waves approaching the shore is shorter. II. Frequency: - Frequency is the number of waves that pass a point in a unit of time. The frequency of waves approaching the shore increases. III. Speed: - Speed is the velocity of the waves. The speed of waves approaching the shore is slower. As a result, the correct answer is c) I and III.	Answer given by Gemini (Ing. translation) Correct Answer: c) I and II Explanation: As waves approach the shore, the wave fronts are observed to become closer. This causes some properties of the waves to change. Wave Properties: - Wavelength (λ): The horizontal distance between two wave crests. - Frequency (f): The number of waves that pass a point in one second. - Speed (v): The speed at which the wave travels. Changes in Waves as They Approach the Shore: - Wavelength (λ): As waves approach the shore, their wavelength decreases. - Frequency (f): As the wavelength decreases, the wave period also shortens. Therefore, the frequency increases. - Speed (v): Wave speed depends on water depth and wavelength. In deep water, wave speed is proportional to the square root of the water depth. In shallow water, wave speed is slower. Thus, as waves approach the shore, they slow down. Conclusion: As waves approach the shore, the wavelength (λ) decreases, and the frequency (f) increases. The speed (v) slows down. Therefore, the quantities (wavelength) and (frequency) are smaller near the shore, while quantity (speed) is greater. The correct answer is c) I and II.	

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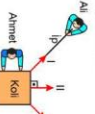
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2023 AYI 3 rd Physics question	Answer given by ChatGPT (Turkish)	Answer given by Copilot (Turkish)	Answer given by Gemini (Turkish)
3. Başlangıçta $t = 0$ anında) yönünü düzlemde hareket eden bir araba hızı zamanla değişmektedir. K ve L arabalarının hızları zamanla değişimini gösteren grafikler aşağıdaki gibidir. K ve L arabalarının hareketi ile ilgili: - K arabası önce hızlanıyor daha sonra yavaşlıyor durmaktadır. - K arabası 30. saniyede başlangıç konumuna geri dönmüştür. 30. saniyede L arabası K arabasından daha ileridedir. Yargılardan hangileri doğrudur? A) Yalnız I B) Yalnız II C) Yalnız III D) I ve II E) I ve III	Answer given by ChatGPT (Turkish) Soruyu doğru şekilde analiz etmek için hız-zaman grafiğini inceleyelim. I. K arabası önce hızlanıyor daha sonra yavaşlıyor durmaktadır. - Grafikte K arabasının hızı zamanla artarak 20 m/s'ye ulaşır (0-15 saniye) ve sonra yavaşlayarak durur (15-30 saniye). Bu ifade doğrudur. II. K arabası 30. saniyede başlangıç konumuna geri dönmüştür. - Hız-zaman grafiğinde alan, yol değişimini gösterir. K arabasının hız-zaman grafiğinin altında kalan alan pozitif ve negatif olarak eşitlenmelidir. 0-15 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. 15-30 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olduğu için K arabası 30. saniyede başlangıç konumuna geri dönmüştür. Bu ifade doğrudur. III. 30. saniyede L arabası K arabasından daha ileridedir. - L arabasının hız-zaman grafiğini inceleyelim. L arabası 0-15 saniye için hızlanıyor ve 15-30 saniye için yavaşlıyor. L arabasının hız-zaman grafiğinin altında kalan alan $\frac{1}{2} \times 15 \times 10 = 75$ m'dir. K arabasının hız-zaman grafiğinin altında kalan alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olmadığı için L arabası K arabasından daha ileridedir. Bu ifade doğrudur. Sonuç olarak, I, II ve III ifadeleri doğrudur. Doğru cevap: E) I, II ve III	Answer given by Copilot (Turkish) Soruyu doğru şekilde analiz etmek için hız-zaman grafiğini inceleyelim. I. K arabası önce hızlanıyor daha sonra yavaşlıyor durmaktadır. - Grafikte K arabasının hızı zamanla artarak 20 m/s'ye ulaşır (0-15 saniye) ve sonra yavaşlayarak durur (15-30 saniye). Bu ifade doğrudur. II. K arabası 30. saniyede başlangıç konumuna geri dönmüştür. - Hız-zaman grafiğinde alan, yol değişimini gösterir. K arabasının hız-zaman grafiğinin altında kalan alan pozitif ve negatif olarak eşitlenmelidir. 0-15 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. 15-30 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olduğu için K arabası 30. saniyede başlangıç konumuna geri dönmüştür. Bu ifade doğrudur. III. 30. saniyede L arabası K arabasından daha ileridedir. - L arabasının hız-zaman grafiğini inceleyelim. L arabası 0-15 saniye için hızlanıyor ve 15-30 saniye için yavaşlıyor. L arabasının hız-zaman grafiğinin altında kalan alan $\frac{1}{2} \times 15 \times 10 = 75$ m'dir. K arabasının hız-zaman grafiğinin altında kalan alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olmadığı için L arabası K arabasından daha ileridedir. Bu ifade doğrudur. Sonuç olarak, I, II ve III ifadeleri doğrudur. Cevap seçeneği E) I ve III doğrudur. Sonuç olarak, yargıları I, II ve III doğrudur. Cevap seçeneği E) I ve III doğrudur.	Answer given by Gemini (Turkish) Açıklama: Soruda verilen ifade ve grafikler aşağıdaki gibidir: I. Yargı: "K arabası önce hızlanıyor daha sonra yavaşlıyor durmaktadır." - Yargı doğru değildir. Arabanın hızı zamanla artarak 20 m/s'ye ulaşır (0-15 saniye) ve sonra yavaşlayarak durur (15-30 saniye). Bu ifade doğrudur. II. Yargı: "K arabası 30. saniyede başlangıç konumuna geri dönmüştür." - Yargı doğru değildir. Arabanın hız-zaman grafiğinin altında kalan alan pozitif ve negatif olarak eşitlenmelidir. 0-15 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. 15-30 saniye için alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olduğu için K arabası 30. saniyede başlangıç konumuna geri dönmüştür. Bu ifade doğrudur. III. Yargı: "30. saniyede L arabası K arabasından daha ileridedir." - Yargı doğru değildir. Arabanın hız-zaman grafiğinin altında kalan alan pozitif ve negatif olarak eşitlenmelidir. 0-15 saniye için alan $\frac{1}{2} \times 15 \times 10 = 75$ m'dir. K arabasının hız-zaman grafiğinin altında kalan alan $\frac{1}{2} \times 15 \times 20 = 150$ m'dir. Bu alanlar eşit olmadığı için L arabası K arabasından daha ileridedir. Bu ifade doğrudur. Sonuç olarak, yargıları I, II ve III doğrudur. Cevap seçeneği E) I ve III doğrudur. Sonuç olarak, yargıları I, II ve III doğrudur. Cevap seçeneği E) I ve III doğrudur.
Solution: Let's analyze the given information based on the velocity-time graph. I. The car K initially accelerates, then decelerates and stops. • From the graph, it is observed that car K accelerates to a velocity of 20 m/s between 0 and 15 seconds and then decelerates to a stop between 15 and 30 seconds. This statement is correct. II. The car K has returned to the starting position at the 30th second. • The area under the velocity-time graph represents the distance traveled. Car K moved forward during the acceleration phase and then moved backward during the deceleration phase, covering the same distance in the opposite direction. Hence, at the 30th second, car K returns to its starting position. This statement is correct. III. At the 30th second, car L is further ahead than car K. • Car L's velocity-time graph shows a continuously positive velocity, indicating that it is always moving forward. In contrast, car K returns to the starting position by the 30th second after moving forward and then backward. Therefore, at the 30th second, car L is further ahead than car K. This statement is also correct. Conclusion: All three statements are correct. The correct answer is E) I, II, and III.	Answer given by ChatGPT (Ing. translation) Let's analyze the given information based on the velocity-time graph. I. The car K initially accelerates, then decelerates and stops. • From the graph, it is observed that car K accelerates to a velocity of 20 m/s between 0 and 15 seconds and then decelerates to a stop between 15 and 30 seconds. This statement is correct. II. The car K has returned to the starting position at the 30th second. • The area under the velocity-time graph represents the distance traveled. Car K moved forward during the acceleration phase and then moved backward during the deceleration phase, covering the same distance in the opposite direction. Hence, at the 30th second, car K returns to its starting position. This statement is correct. III. At the 30th second, car L is further ahead than car K. • Car L's velocity-time graph shows a continuously positive velocity, indicating that it is always moving forward. In contrast, car K returns to the starting position by the 30th second after moving forward and then backward. Therefore, at the 30th second, car L is further ahead than car K. This statement is also correct. Conclusion: All three statements are correct. The correct answer is E) I, II, and III.	Answer given by Copilot (Ing. translation) Let's analyze the given information based on the velocity-time graph. I. The car K initially accelerates, then decelerates and stops. • From the graph, it is observed that car K accelerates to a velocity of 20 m/s between 0 and 15 seconds and then decelerates to a stop between 15 and 30 seconds. This statement is correct. II. The car K has returned to the starting position at the 30th second. • The area under the velocity-time graph represents the distance traveled. Car K moved forward during the acceleration phase and then moved backward during the deceleration phase, covering the same distance in the opposite direction. Hence, at the 30th second, car K returns to its starting position. This statement is correct. III. At the 30th second, car L is further ahead than car K. • Car L's velocity-time graph shows a continuously positive velocity, indicating that it is always moving forward. In contrast, car K returns to the starting position by the 30th second after moving forward and then backward. Therefore, at the 30th second, car L is further ahead than car K. This statement is also correct. Conclusion: All three statements are correct. The correct answer is E) I, II, and III.	Answer given by Gemini (Ing. translation) Explanation: Let's examine each statement based on the given description and the image: 1. Statement I: "Car K accelerated first and then slowed down and stopped." - This statement is true. As seen in the image, Car K's speed increases initially, then decreases, and reaches zero at the 30-second mark. 2. Statement II: "Car K returned to the starting position at 30 seconds." - This statement is false. As seen in the image, Car K's position is below zero at the 30-second mark. 3. Statement III: "At 30 seconds, Car L is further ahead than Car K." - This statement is true. As shown in the image, Car L's position is greater than Car K's position. 4. Statement IV: "This indicates that Car L is further ahead than Car K at 30 seconds." - This indicates that Car L is further ahead than Car K at 30 seconds. Conclusion: Only Statement II is correct. Therefore, the correct answer is b) Only II.

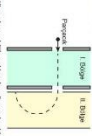
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2023 AYI 7 th Physics question	Answer given by ChatGPT (Turkish)	Answer given by Copilot (Turkish)	Answer given by Gemini (Turkish)
7. Fiziksel maddelerde elektrik akımının oluşması için gerekli olan etkenler aşağıdakilerden hangileridir? A) Yalnız I B) Yalnız II C) I ve II D) I ve III E) II ve III Buna göre, I. Elektriksel alanın potansiyel farkı artması II. Akımın süresi artması III. Akımın potansiyel farkı artması Yargılardan hangileri doğrudur?	Answer given by ChatGPT (Turkish) 7. Fiziksel maddelerde elektrik akımının oluşması için gerekli olan etkenler aşağıdakilerden hangileridir? A) Yalnız I B) Yalnız II C) I ve II D) I ve III E) II ve III Buna göre, I. Elektriksel alanın potansiyel farkı artması II. Akımın süresi artması III. Akımın potansiyel farkı artması Yargılardan hangileri doğrudur? Doğru cevap: c) I ve III Answer given by ChatGPT (Ing. translation) In this question, we need to understand how a flash system works and the effect of the components in this system. Let's examine the statements given in the question one by one. I. If the potential difference of the battery in the flash system is increased, the capacitance of the capacitor decreases. Increasing the potential difference of a battery does not affect the capacitance of a capacitor. The capacitance of a capacitor depends on its physical properties (plate area, distance between plates, and dielectric material), not on the potential difference. Therefore, this statement is incorrect. II. If a capacitor with a larger capacitance is used in the flash system, a more intense light is produced in the bulb. A capacitor with a larger capacitance can store more energy. The energy stored in a capacitor is calculated as: $E = \frac{1}{2} CV^2$ where E is the energy, C is the capacitance, and V is the potential difference. A larger capacitor can store more energy, and if this energy is discharged quickly by the flash bulb, it will produce a more intense light. This statement is correct. III. When the flash of light, the charge stored in the capacitor begins to decrease. When the flash occurs, the energy stored in the capacitor is used, and thus the charge is rapidly discharged through the bulb. This means the charge in the capacitor decreases. This statement is correct. In conclusion, the correct statements are II and III. The correct answer is c) II and III.	Answer given by Copilot (Turkish) 7. Fiziksel maddelerde elektrik akımının oluşması için gerekli olan etkenler aşağıdakilerden hangileridir? A) Yalnız I B) Yalnız II C) I ve II D) I ve III E) II ve III Buna göre, I. Elektriksel alanın potansiyel farkı artması II. Akımın süresi artması III. Akımın potansiyel farkı artması Yargılardan hangileri doğrudur? Doğru cevap: c) I ve III Answer given by Copilot (Ing. translation) Answers are being generated for you. The flash system is used in cameras to produce sufficient light intensity. Here are the correct statements for this question: I. If the potential difference of the battery in the flash system is increased, the capacitance of the capacitor decreases. This is correct because a higher potential difference leads to more energy being stored. II. If a fully charged capacitor with a larger capacitance is used in the flash system, a more intense light is produced in the bulb. This is correct because a larger capacitor stores more energy. III. When the flash of light, the charge stored in the capacitor begins to decrease. This is correct because when the flash occurs, the stored energy is depleted. Therefore, the correct statements are C) I and II.	Answer given by Gemini (Turkish) 7. Fiziksel maddelerde elektrik akımının oluşması için gerekli olan etkenler aşağıdakilerden hangileridir? A) Yalnız I B) Yalnız II C) I ve II D) I ve III E) II ve III Buna göre, I. Elektriksel alanın potansiyel farkı artması II. Akımın süresi artması III. Akımın potansiyel farkı artması Yargılardan hangileri doğrudur? Doğru cevap: c) I ve III Answer given by Gemini (Ing. translation) Correct Answer: (I) and III. Explanation: I. Statement: If the potential difference of the battery in the flash system is increased, the capacitance of the capacitor decreases. This is correct. The capacitance of a capacitor is proportional to the amount of charge it can store. As the potential difference of the battery increases, the amount of charge stored in the capacitor decreases. Therefore, as the potential difference of the battery increases, the capacitance of the capacitor decreases. II. Statement: If a capacitor with a larger capacitance is used in the flash system, the light produced in the bulb will be more intense. This is correct. The intensity of the light produced in the bulb is proportional to the current flowing through the capacitor. If the capacitance of the capacitor is larger, it can store more charge when fully charged. More charge means more current. Therefore, if a capacitor with a larger capacitance is used, the light produced in the bulb will be more intense. III. Statement: When the flash light burns, the charge stored in the capacitor begins to decrease. This is correct. When the flash light burns, the charge stored in the capacitor is discharged through the bulb, converting the energy into light. During this process, the stored charge in the capacitor decreases. Therefore, when the flash light burns, the charge stored in the capacitor begins to decrease. (Conclusion: Statements I and III are correct, and Statement II is also correct. Therefore, the correct answer is C) I and III.)

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2022 AYI 1 ^{ci} Physics question	Answer given by ChatGPT (Turkish)	Answer given by Copilot (Turkish)	Answer given by Gemini (Turkish)
1. Süratlenen önemsenmediği ve uatın potansiyel şiddetli gilo olan yalıy bir zeminden atılan bir kolye Ahmet elineyle ileri doğru iterken Ali de bir ip yardımıyla kolyeyi geri çekmektedir.  Ahmet ve Ali aynı anda kuvvet uygulamayı bırakarsa kolye; şiddetli I, II ve III yönlerinden hangilerine doğru hareket eder? A) Yalnız I B) Yalnız II C) ve III D) II ve III E) I, II ve III	Answer given by ChatGPT (Turkish) 1. Soru: Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında kolye hangi yöne hareket eder? Ahmet kolyeyi sağa doğru itiyor (I yönü) ve Ali kolyeyi sola doğru çekiyor (II yönü). Kolye başlangıçta sağa doğru hareket ediyordu (v). Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında, kolye sadece Ali'nin çektiği kuvvetin (II yönü) etkisi altında kalacaktır. Bu nedenle kolye sola doğru hareket eder. Doğru cevap: B) Yalnız II	Answer given by Copilot (Ing. translation) 1. Soru: Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında kolye hangi yöne hareket eder? Ahmet kolyeyi sağa doğru itiyor (I yönü) ve Ali kolyeyi sola doğru çekiyor (II yönü). Kolye başlangıçta sağa doğru hareket ediyordu (v). Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında, kolye sadece Ali'nin çektiği kuvvetin (II yönü) etkisi altında kalacaktır. Bu nedenle kolye sola doğru hareket eder. Doğru cevap: B) Yalnız II	Answer given by Gemini (Ing. translation) 1. Soru: Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında kolye hangi yöne hareket eder? Ahmet kolyeyi sağa doğru itiyor (I yönü) ve Ali kolyeyi sola doğru çekiyor (II yönü). Kolye başlangıçta sağa doğru hareket ediyordu (v). Ahmet ve Ali aynı anda kuvvet uygulamayı bıraktığında, kolye sadece Ali'nin çektiği kuvvetin (II yönü) etkisi altında kalacaktır. Bu nedenle kolye sola doğru hareket eder. Doğru cevap: B) Yalnız II

[illegible]

2022 AYI 5th Physics question 8. Bir parçacığın bir manyetik alan içerisinde hareket etmesiyle ilgili aşağıdaki ifadelerden hangisi yanlıştır? (Yanlış olanı seçiniz.) A) Parçacığın hızı değişmez. B) Parçacığın hızı değişir. C) Parçacığın hızı değişir. D) Parçacığın hızı değişir. E) Parçacığın hızı değişir.  Bir parçacığın bir manyetik alan içerisinde hareket etmesiyle ilgili aşağıdaki ifadelerden hangisi yanlıştır? (Yanlış olanı seçiniz.) A) Parçacığın hızı değişmez. B) Parçacığın hızı değişir. C) Parçacığın hızı değişir. D) Parçacığın hızı değişir. E) Parçacığın hızı değişir.	Answer given by ChatGPT (Turkish) Bir parçacığın bir manyetik alan içerisinde hareket etmesiyle ilgili aşağıdaki ifadelerden hangisi yanlıştır? (Yanlış olanı seçiniz.) A) Parçacığın hızı değişmez. B) Parçacığın hızı değişir. C) Parçacığın hızı değişir. D) Parçacığın hızı değişir. E) Parçacığın hızı değişir.	Answer given by Copilot (Turkish) Bir parçacığın bir manyetik alan içerisinde hareket etmesiyle ilgili aşağıdaki ifadelerden hangisi yanlıştır? (Yanlış olanı seçiniz.) A) Parçacığın hızı değişmez. B) Parçacığın hızı değişir. C) Parçacığın hızı değişir. D) Parçacığın hızı değişir. E) Parçacığın hızı değişir.	Answer given by Gemini (Turkish) Bir parçacığın bir manyetik alan içerisinde hareket etmesiyle ilgili aşağıdaki ifadelerden hangisi yanlıştır? (Yanlış olanı seçiniz.) A) Parçacığın hızı değişmez. B) Parçacığın hızı değişir. C) Parçacığın hızı değişir. D) Parçacığın hızı değişir. E) Parçacığın hızı değişir.
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