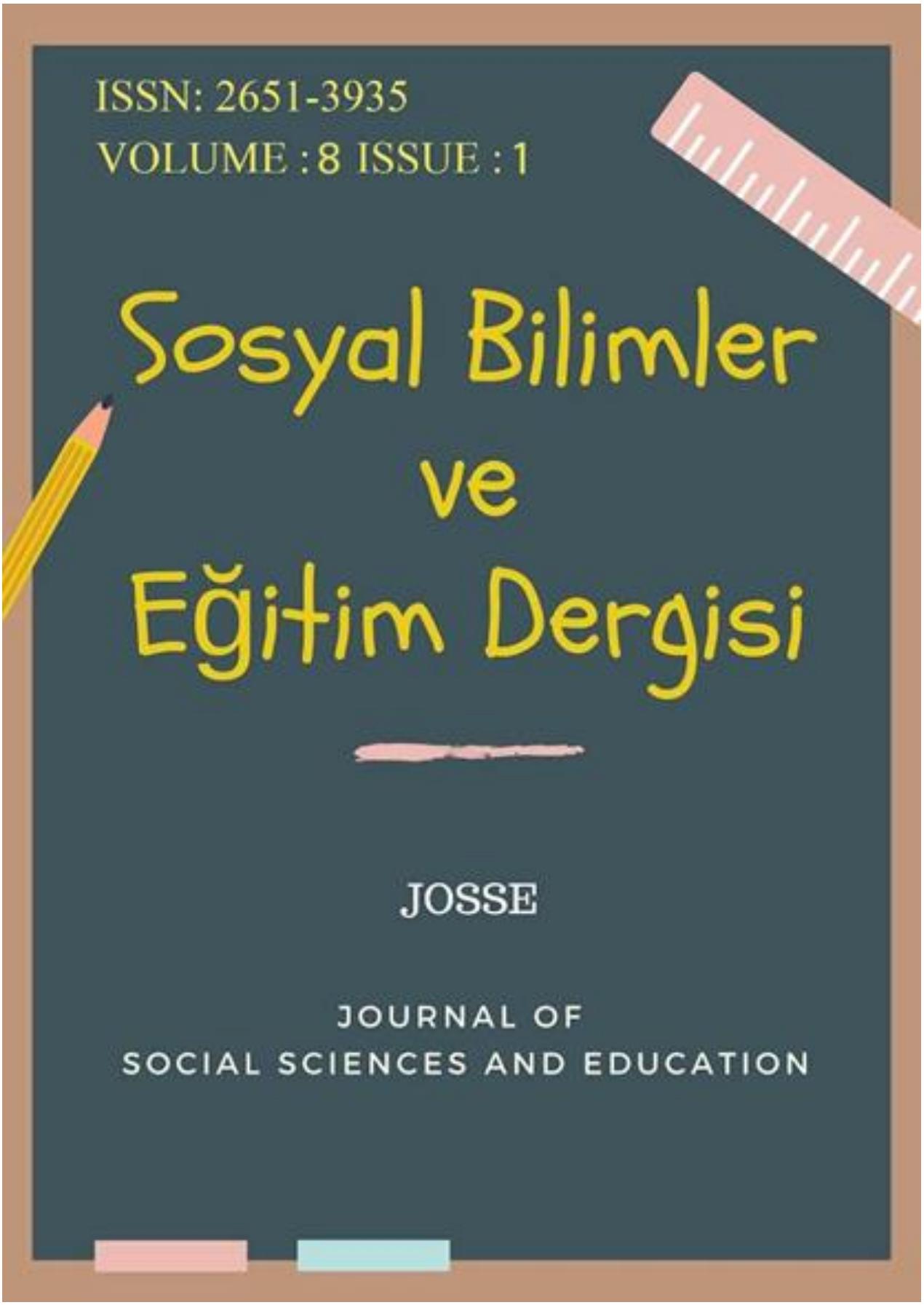

ISSN: 2651-3935
VOLUME : 8 ISSUE : 1
Sosyal Bilimler
ve
Eğitim Dergisi
JOSSE
JOURNAL OF
SOCIAL SCIENCES AND EDUCATION

Journal of Social Sciences and Education (JOSSE), 8(1),1-133.

ISSN 2651-3935

https://dergipark.org.tr/josse

josseducation@gmail.com

Journal of Social Sciences and Education (JOSSE)

Publising Date: May, 2025

2025, Volume 8, Issue 1

JOSSE is published biannually (May- October)

https://dergipark.org.tr/tr/pub/josse

Publisher

Bilgiçağı Education Consultancy and Publishing Industry Trade Limited Company

Language

English

Editorial Board

Spelling and Language Editors

Field Editors

Reviewers for May 2025, 8(1), 1-133

Degree	Name Surname	Institution	Communication
Assoc. Prof. Dr.	Enes Abanoz	Ondokuz Mayıs University	enes.abanoz@omu.edu.tr
Assoc. Prof. Dr.	Sefer Kalaman	Ankara Yildirim Beyazit University	seferkalaman@aybu.edu.tr
Assoc. Prof. Dr.	Tevfik Palaz	Gazi University	tevfikpalaz@gmail.com
Dr.	Orhan Ünal	Ondokuz Mayis University	orhanunal07@hotmail.com
Assoc. Prof. Dr.	Önder Şanlı	Adıyaman University	ondersanli44@hotmail.com
Assoc. Prof. Dr.	Celalettin Korkmaz	Fırat University	celalettinkorkmaz@gmail.com
Prof. Dr.	Osman Çepni	Karabük University	ocepni@karabuk.edu.tr
Assoc. Prof. Dr.	Hatice Türe	Anadolu University	haticeture@anadolu.edu.tr
Asst. Prof. Dr.	Şule Gençoğlu	Malatya Turgut Özal University	sulegencoglu2309@gmail.com
Asst. Prof. Dr.	Canan Tiftik	İstanbul Gelişim University	tiftikcanan0@gmail.com

Contents
Volume 8, Issue 1, May 2025

Indexing Information
Volume 8, Issue 1, May 2025

H. W. Wilson Databases

https://www.ebsco.com/m/ee/Marketing/titleLists/eft-coverage.htm

MLA

https://www.mla.org/search?query=Journal+of+Social+Sciences+And+Education

EBSCO HOST

https://www.ebsco.com/m/ee/Marketing/titleLists/mla-fulltext.htm

Tei

http://www.turkegitimindeksi.com/Journals.aspx?ID=5080

DRJI

http://olddrji.lbp.world/Publisher/PublisherHome.aspx?uname=2651-3935

CİteFactor

https://www.citefactor.org/journal/index/25686#.YSIjDI4zbcd

ASOS indeks

https://asosindex.com.tr/index.jsp?modul=journal-page&journal-id=403

İdeal Online

https://www.idealonline.com.tr/IdealOnline/lookAtPublications/journalDetail.xhtml?uId=718

Google Scholar

https://scholar.google.com.tr/scholar?hl=tr&as_sdt=0%2C5&q=%22Sosyal+Bilimler+ve+E%C4%9Fitim+Dergisi%22&btnG=

BASE

https://www.base-search.net/Search/Results?type=all&lookfor=sosyal+bilimler+ve+e%C4%9Fitim+dergisi+&ling=1&oaboost=1&name=&thes=&refid=dcresen&newsearch=1

I2OR

http://www.i2or.com/9.html

Academic Resource Index

https://journalseeker.researchbib.com/view/issn/2651-3935

IAD

http://openaccess.izmirakademi.org/journal/josse/1124

Contact

Yildiz Technical University, Department of Social Education Davutpasa

Campus34220 Esenler / Istanbul, TURKEY

Yıldız Teknik Üniversitesi Davutpaşa Kampüsü Eğitim Fakültesi Sosyal

BilgilerEğitimi Bölümü, B-215, Esenler/İstanbul, TÜRKİYE

Publisher: *Bilgiçağı Eğitim Danışmanlık ve Yayıncılık Sanayi Ticaret Limited Şirketi*

Journal Administrator & Assistant Editor: *Sibel ÇAĞIR*

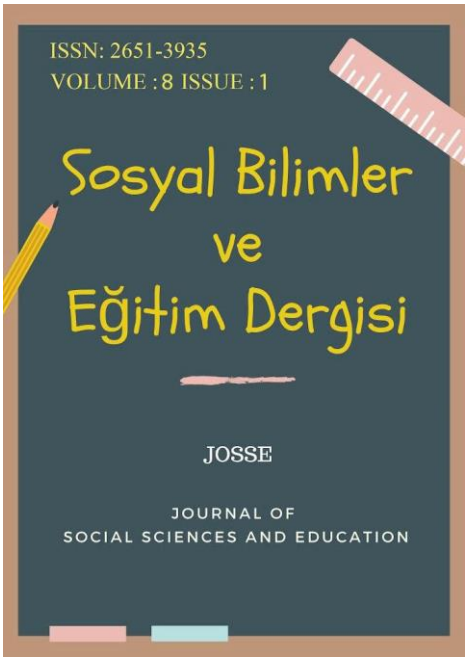
Phone: *0531 404 17 57*

e-mail: josseducation2018@gmail.com

cagirsibel@gmail.com

web: https://dergipark.org.tr/josse

JOURNAL OF SOCIAL SCIENCES AND EDUCATION (JOSSE)



https://dergipark.org.tr/tr/pub/josse

Design of an iOS Mobile Application for the Automated Evaluation of Open-Ended Exams via Artificial Intelligence and Image Processing

** This study was produced from the paper presented at the International Symposium on Measurement, Selection and Placement held on October 04-06, 2024.*

Nazmi Ekin VURAL[1]
Yozgat Bozok University, Faculty of Communication, New Media and Communication, Asst. Prof.
ekin.vural@bozok.edu.tr
Orcid ID: 0000-0003-4198-0407

Article Type: Research Article
Received: 04.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Citation: Vural, N. E. (2025). Design of an ios mobile application for the automated evaluation of open-ended exams via artificial intelligence and image processing. *Journal of Social Sciences and Education*, *8*(1), 1-35.

Design of an iOS Mobile Application for the Automated Evaluation of Open-Ended Exams via Artificial Intelligence and Image Processing*

Nazmi Ekin VURAL[1]

Yozgat Bozok University, Faculty of Communication, New Media and Communication

Abstract

Evaluating open-ended exams presents significant challenges in terms of time management and consistency in educational processes. This study aims to develop an iOS-based mobile application, *"Exam Reader"* to streamline the evaluation of handwritten open-ended exam responses by integrating visual recognition and language analysis tools, enabling educators to deliver timely and fair assessments. Developed using the Swift programming language, the application relies on two core technologies. First, handwritten student responses are converted into digital text using Optical Character Recognition (OCR) via the Google Cloud Vision API. These texts are then analyzed for clarity and coherence using the OpenAI API and GPT-4o model, ensuring that students' ideas are presented in a structured, accessible format for evaluation. Finally, the evaluation results and related data are provided to users in PDF format. Designed with a user-friendly interface, the application allows educators to quickly interpret responses and align them with expected learning outcomes through integrated language and image analysis tools. This system offers an innovative model for digitizing, standardizing, and automating open-ended exam evaluations, contributing to the systematic improvement of educational assessment processes. However, the application has limitations. Variations in handwriting and low-quality scans may reduce OCR accuracy, and AI-supported content analysis risks missing contextual nuances. Additionally, the system requires a stable internet connection, limiting offline functionality. Future enhancements, including advanced OCR models, multilingual support, and an offline mode, are planned to address these issues. The application developed in this direction is expected to make a significant contribution to the digitalization of educational assessment and to adapt to next-generation technologies.

Research Article

Received: 04.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Keywords: Image processing, Handwriting recognition, AI, Cloud Vision API, OpenAI API, iOS.

* This study was produced from the paper presented at the International Symposium on Measurement, Selection and Placement held on October 04-06, 2024.

[1] Corresponding author:
Asst. Prof.
ekin.vural@bozok.edu.tr
Orcid ID: 0000-0003-4198-0407

Introduction

Open-ended exams are an essential educational tool that provides a detailed measure of students' knowledge, analytical thinking skills, and depth of understanding of topics. However, manual scoring of these exams is time-consuming and can lead to inconsistencies and errors due to the subjective judgment of human raters (Wiser et al., 2016, pp. 841-844). In the process of digitizing handwritten exam answers, the application of user-centered design principles plays a critical role in reducing the risk of errors and increasing process efficiency. According to Norman (2013, p. 72), principles such as discoverability, pointers, feedback, and conceptual models enable users to understand the system's functions and evaluate its interactions. For example, in an Optical Character Recognition (OCR) system, visual markers highlighting the area to be scanned (e.g., blinking frames) and immediate feedback (e.g., preview screens showing scanning accuracy) allow users to avoid erroneous data entry and speed up the process. Feedforward mechanisms guide users to correct actions through beacons and mappings, while feedback facilitates error correction by clearly communicating the results of actions. When these principles are designed to suit user needs in the digitization process, both accuracy and efficiency are increased. Traditional manual scoring methods pose substantial challenges due to their high labor and cost requirements, especially in large-scale exams.

As a solution to these problems, the development of automated scoring systems has accelerated since the 1990s. The first generation of automated scoring systems achieved limited success with rule-based approaches, but advances in machine learning techniques have brought notable innovations to this field (Shermis et al., 2013, p. 2). Modern machine learning systems, especially with supervised learning methods, can evaluate student responses with notable accuracy in terms of contextual accuracy, grammar, and conceptual integrity (Wiser et al., 2016, p. 842). For example, systems such as e-rater® and IntelliMetric™ support the digitization and automatic scoring of handwritten text with machine learning algorithms, while user-centered interfaces enable educators and students to use these systems with minimal learning curves (Burstein et al., 2013, p. 55; Schultz, 2013, p. 89). This integrated approach increases the accessibility and effectiveness of technology in educational settings, enabling users with different skill levels to interact with the system with confidence.

The digitization and evaluation of handwritten open-ended responses are facilitated by advanced technologies such as Tesseract OCR and Multidimensional Recurrent Neural Networks (MDRNN) (Smith, 2007, p. 629; Graves & Schmidhuber, 2009, p. 546). Tesseract OCR supports digitization by recognizing text through text line detection and connected

component analysis, while MDRNN offers high accuracy in language-independent transcription by recognizing different writing styles without dependency on specific languages or alphabets. User-centered design, with markers and feedback (Norman, 2013, p. 72), allows educators and students to learn the process quickly, while integration with automated essay evaluation (AEE) systems increases assessment accuracy (Shermis & Burstein, 2013, p. 2).

Transformer-based Large Language Models (LLMs), based on attentional mechanisms, evaluate open-ended responses quickly and consistently (Vaswani et al., 2017, p. 5999). These models provide individualized feedback in instruction by analyzing the grammar, fluency, and content of responses, thus identifying students' strengths and weaknesses. However, these technologies can carry ethical risks, such as generative AI tools enabling plagiarism or cheating, and biases in data sets leading to unfair assessments (Tanberkan et al., 2024, p. 144). These risks can be mitigated by adopting a participatory approach in which educators, students, and other stakeholders are actively involved in shaping the development and implementation of the system. Promoting AI literacy and fostering awareness of ethical use further empowers educational communities to engage with these technologies responsibly and reflectively.

In this study, we discuss a process that involves automatically scanning open-ended exam responses using an iOS-based mobile application, digitizing the handwritten content, and interpreting it with a large language model. The application recognizes students' handwritten answers through OCR technology, evaluates them using an AI-assisted scoring system, and generates the results in PDF format. This approach aims to offer an innovative contribution to assessment and evaluation practices within the educational technology literature.

1. Artificial Intelligence and Image Processing Based Automation Approaches in the Evaluation of Open-Ended Exams

1.1. Conceptual Framework and General Approach

This chapter systematically reviews recent technological advances in the field of automated assessment of open-ended exams. Innovative solutions such as machine learning, OCR, handwriting recognition, and large language models are employed to digitize, analyze, and score handwritten student responses. In this context, the approach offers multidimensional benefits, including time savings in assessment processes, reduced human error, and faster pedagogical feedback. Each subsection in this part offers a concrete illustration of how digital enhancement is shaping education, through an in-depth examination of technical components and practical implementation examples.

1.2. Automation Studies

Open-ended exams effectively assess students' conceptual understanding and analytical thinking, but scoring these exams by human assessors is time- and labor-intensive. For instance, one study reported that it takes a human evaluator an average of four minutes to evaluate a single answer for nine different ideas, equating to approximately ten hours to evaluate five questions for a class of 30 students (Wiser et al., 2016, p. 841). To address these challenges, machine learning-based automated assessment systems have been developed. However, these systems have not yet fully matched the performance of human evaluators. In a competition on machine scoring of short-form constructed responses, the average squared weighted kappa value for human raters was 0.90, while the best machine algorithm achieved 0.76, indicating higher reliability among human raters (Shermis, 2015, p. 60).

Natural Language Processing (NLP) model developed for identifying research questions in Hebrew scientific reports demonstrated high accuracy in detecting their presence or absence (Ariely, Nazaretsky, & Alexandron, 2020, p. 565). This finding underscores the potential of NLP-based systems to accurately identify specific components of open-ended responses in automated assessment processes. However, the effectiveness of automated writing evaluation (AWE) systems in improving student writing is significantly influenced by pedagogical practices, with more favorable outcomes observed when AWE is integrated with human feedback during the drafting and revising process (Chen & Cheng, 2008, p. 107). Without sufficient teacher facilitation, reliance on AWE can lead to student frustration and limited improvement in writing quality, particularly in areas like coherence and content development.

Tools such as EvoGrader, which uses supervised machine learning to analyze open-ended student responses in biology education, assess concepts like natural selection with accuracy rates exceeding 90% (Wiser et al., 2016, pp. 841–847). While EvoGrader is effective for formative assessments, caution is advised when using it for high-stakes grading due to potential limitations in capturing nuanced responses. Similarly, e-rater® V.2, developed by Educational Testing Service (ETS), plays a significant role in the automated assessment of open-ended written texts. It conducts structural, grammatical, and content-based analyses using a single scoring model applicable to all prompts of an assessment (Attali & Burstein, 2006, pp. 2, 7–12). Key criteria, such as the organization and development of discourse elements and the proportion of grammatical, usage, and spelling errors, enhance the system’s validity. However, e-rater® V.2 has limitations, including vulnerability to irrelevant content (Attali & Burstein, 2006, p. 4), making it more suitable for standardized tests and classroom assessments when paired with human oversight.

In contrast, c-rater, also developed by ETS, focuses on short-answer structured responses and has achieved high reliability in specific contexts, with unweighted kappa values ranging from 0.55 to 0.94 for reading and math questions (Shermis, 2015, p. 49). Despite this, inconsistencies between machine scoring and human raters persist, particularly due to challenges like conceptual diversity and linguistic variations (Shermis, 2015, pp. 49, 62). Recent efforts to improve reliability involve hybrid models combining rule-based and machine learning approaches (Ramesh & Sanampudi, 2022, p. 2499). The rise of distance education during the COVID-19 pandemic further accelerated the need for automated evaluation of open-ended responses. Studies have shown that NLP techniques, combined with similarity measures like soft cosine similarity and machine learning algorithms such as Support Vector Machine (SVM), Random Forest, and Multinomial Naïve Bayes, can successfully evaluate descriptive responses, with Multinomial Naïve Bayes achieving 92% accuracy (Ahmed, Hina, & Asif, 2021, pp. 4887–4891).

Automated Essay Scoring (AES) systems offer the potential to increase consistency in assessment processes and provide faster feedback by reducing the workload of human raters (Ke & Ng, 2019, p. 6300). However, these systems are primarily developed with English-oriented datasets, limiting their applicability to morphologically rich languages (MRLs) (Ke & Ng, 2019, p. 6303). To address this, a study demonstrated that Hebrew biology open-ended questions can be successfully evaluated using machine learning and NLP techniques (Ariely, Nazaretsky, & Alexandron, 2020, p. 565). The AdaBoost.M1 algorithm demonstrated superior performance in automatically scoring open-ended physics questions in Turkish, achieving accuracy rates ranging from 0.65 to 0.99 across four university-level questions with varying complexity (Çınar et al., 2020, p. 3834). This study highlights the potential of machine learning to address the challenges of automated short-answer grading in morphologically rich languages, where linguistic complexity poses significant obstacles to traditional scoring systems. To enhance the practical applicability of AES systems, models must account for language and cultural differences and undergo continuous validation tailored to specific educational contexts (Attali & Burstein, 2006; Shermis, 2015; Ke & Ng, 2019, p. 6306).

The accurate digitization of handwritten student responses is a critical step in the automated evaluation of open-ended exam responses. Two key technologies, OCR and Handwriting Recognition, have seen substantial advancements in recent years, driven by deep learning techniques and mobile application developments.

1.3. Optical Character Recognition (OCR) Technologies

OCR systems aim to detect characters in printed or written documents and convert them into digital text. Tesseract, one of the open-source OCR engines, was developed by Hewlett-Packard between 1984 and 1994 and released as open source in 2005. Tesseract's innovative structure is based on features such as detecting lines of text through connected component analysis and easily detecting both black-and-white and inverted (black on white) text. Architecturally, it involves a two-stage recognition process (initial recognition and adaptive classification) with the identification of connected components (blobs), line and word alignment. A second pass improves accuracy by re-evaluating words recognized with low accuracy. This approach provides high performance on documents that contain scanning artifacts or different fonts (Smith, 2007, pp. 629, 633). The main stages in OCR processes include thresholding, edge detection, segmentation and morphological operations. These stages are especially critical for separating and clarifying the text from the background. Histogram equalization, grayscale and binary imaging techniques are also important steps that improve OCR performance (Gonzalez & Woods, 2008, pp. 197- 223).

Nowadays, OCR technologies play an effective role in the educational application of optical mark recognition (OMR) systems for mobile devices. High accuracy rates (90%-95%) are achieved by reading optical forms with mobile device cameras, supported by image processing techniques such as grayscale, noise reduction and edge detection (Turhan et al., 2023, pp. 177-178, 183). These systems demonstrate the successful integration of Optical Form Recognition and OMR applications on mobile platforms (Turhan, Bozkurt, & Şahin, 2023, p. 170). Thanks to cross-platform support, these applications, which work on Android, iOS and web browsers, contribute to digitalization and time saving in education.

1.4. Handwriting Recognition Technologies

Handwriting recognition, unlike OCR, aims to digitize text written in free form rather than in print. In particular, offline handwriting recognition requires processing only image data, which makes the process more complex.

One of the most important advances in this field is the integration of MDRNN and Connectionist Temporal Classification (CTC) techniques. It has been shown that the MDRNN structure can simultaneously model horizontal and vertical contexts in the image, thus providing robustness against local distortions. MDRNN utilizes the contextual information around each pixel to create a flexible representation against local variations from different angles. In particular, Multidimensional LSTM (MDLSTM) cells effectively model long-distance

dependencies and have been successful with irregular and continuously varying data such as handwriting (Graves & Schmidhuber, 2009, pp. 545-550).

Furthermore, in modern systems for handwriting recognition, image processing steps include segmentation and normalization before character detection (Shah & Yousaf, 2007, pp. 1-2). Especially for low-resolution image recognition, these preprocessing techniques support system performance by providing consistent data input. These methods have made it possible to perform recognition directly at the full line or paragraph level without prior letter or word segmentation. Indeed, MDRNN-CTC-based systems have outperformed traditional systems in Arabic handwriting recognition competitions with over 91% accuracy rates (Graves & Schmidhuber, 2009, pp. 545-551).

1.5. OCR and Handwriting Recognition on Mobile Platforms

The migration of image processing techniques to mobile devices has substantially increased the accessibility of automated test assessment applications in education. Optical reader systems developed for mobile platforms can provide fast feedback to the user by processing optical forms received through the camera in real time (Turhan et al., 2023, p. 171).

Artificial intelligence plays an important role in digital image processing, especially in mobile platforms, in steps such as segmentation and edge detection. Machine learning-based methods are increasingly used in applications such as healthcare and real-time image analysis on mobile devices. Also, artificial intelligence gains analytical capabilities as machine learning and deep learning methods process and interpret complex data patterns (Çeliker & Gürsoy, 2025, p. 113; Lepakshi, 2022, p. 402). For example, deep learning techniques provide high accuracy in areas such as cancer diagnosis in medical imaging, and these technologies are being integrated into mobile platforms (Hidayat et al., 2025, pp. 1-8). In addition, applications of artificial intelligence in the field of education can be indirectly supported by mobile technologies by providing solutions for individual needs through personalized learning systems (Keser Ateş et al., 2025, p. 19). AI-driven image processing techniques, such as filtering and edge detection, enhance image quality by reducing noise and extracting meaningful features, enabling accurate OCR for mobile-based educational assessment systems (Hussain et al., 2020, p. 245). Tools like OpenCV provide robust support for these processes, facilitating real-time analysis of handwritten student responses on mobile platforms.

The integration of artificial intelligence techniques in mobile image processing systems has made it possible to use advanced features such as automatic target recognition, document classification, and fault tolerance (Azizi et al., 2024, p. 133). These developments contribute to

the more accurate and faster operation of mobile-based open-ended exam assessment applications in educational technologies.

1.6. Use of Artificial Intelligence and Large Language Models in Education

The rapid development of artificial intelligence technologies in recent years has led to major shifts in the field of education. In particular, new generation artificial intelligence applications such as LLMs are reshaping many processes in education such as assessment, evaluation, content production and individualized learning. Computational language tools now allow learning processes to be more attuned to individual student needs, helping educators identify strengths and areas for improvement. Early automated writing evaluation systems demonstrated the potential to save teachers' time and encourage student revision, though their effectiveness was limited by superficial revisions without pedagogical support (Warschauer & Grimes, 2008, p. 33). These findings underscore the importance of integrating modern large language models with effective teaching strategies to enhance assessment and learning outcomes in education. In particular, LLMs such as ChatGPT reduce the workload of educators in automatic scoring of open-ended exams and intelligent assessment processes, provide objective results, and improve student test scores by 30% and reduce self-reported anxiety levels by 20% (Tanberkan et al., 2024, pp. 140-142; Wang et al., 2024, p. 1). However, the capacity of these models to produce high-quality text increases ethical risks such as plagiarism and cheating, threatening the fairness of the assessment processes. Furthermore, issues such as algorithm biases and personal data privacy complicate the use of LLMs in education. To mitigate these risks, authentic exam designs, plagiarism detection tools and ethical use trainings are recommended; at the same time, it is emphasized that theoretical frameworks such as flow theory should be used to develop AI-supported learning environments (Karadağ, 2023, pp. 829-831; Wang et al., 2024, p. 15).

The transformer architecture lies at the heart of the success of large language models. Vaswani et al. (2017: pp. 5999-6015) showed in their study *"Attention Is All You Need",* that this architecture based on the attention mechanism brings notable changes in language modeling and significantly increases learning speed and model performance by parallel processing on data. Thanks to the Transformer structure, much longer textual relations could be learned compared to previous models and there were noticeable differences in language processing tasks.

OpenAI's GPT-2 model, which was developed based on this architecture, achieved notable success in multi-task learning and demonstrated human-like performance in NLP tasks

by exhibiting capabilities such as zero-shot learning (Radford et al., 2019). Radford et al. showed that the model can be effective on different tasks such as question answering, summarization, and translation, simply by training it on large datasets.

The BERT (Bidirectional Encoder Representations from Transformers) model stands out as an innovation in NLP. Transformer-based models have been reported to provide notable progress in individualized assessment processes in education. Devlin et al. (2018, pp. 1-6) stated that BERT generates contextual representations of texts more efficiently thanks to its bidirectional attention mechanism and outperforms previous methods in many language processing tasks. BERT's success offers the potential for wide application, especially in areas such as semantic analysis of open-ended responses in education, content assessment, and individualized review of student work. Furthermore, Cui and Liang (2024, pp. 8-15) demonstrated that BERT supports educational processes by producing fast, reliable and objective results in complex tasks such as translation quality assessment. This shows that BERT offers both scalable and in-depth analysis in education.

Another development that supports the use of artificial intelligence and large language models in education is deep learning methods. LeCun, Bengio, and Hinton (2015, p. 436) emphasize that deep learning innovates tasks such as natural language understanding and content generation through its ability to extract high-level features from complex data and learning abstract representations. These methods have enabled LLMs to learn abstract conceptual knowledge with multi-layered structures. However, the use of LLMs in education brings some risks. Tanberkan et al. (2024, pp. 143-144) draw attention to ethical violations, data bias, accuracy problems and the risk of artificial intelligence systems producing hallucinatory (misleading) content. Therefore, it is emphasized that AI applications in education should be designed within the framework of transparency, fairness and reliability principles.

As a result, artificial intelligence and large language models have the potential to enhance teaching, assessment, and evaluation processes in education. Applications such as automatic item generation, automatic assessment and personalized feedback can make educational processes more efficient and individualized (Karadağ, 2023, p. 828). In particular, the *"hallucinatory snowball effect",* where LLMs generate additional false assertions to support false answers, can lead to reliability issues in education (Zhang et al., 2023, pp. 1-2). To mitigate these risks, increasing users' AI literacy and developing pedagogical strategies will support the ethical and efficient integration of technology in educational settings (Karadağ, 2023, p. 833).

1.7. Problem Definition

In traditional assessment processes, manual evaluation of open-ended examinations incurs high time and labor costs, as well as problems such as inconsistencies and risks of error due to subjective interpretations of the assessors. Especially in educational settings with large class sizes, detailed review of written responses is often not possible, which reduces the quality of feedback and delays learning processes. Automated assessment of open-ended exams is a critical need in the field of assessment and evaluation. Such solutions require not only accurate recognition of the written text, but also reliable analysis of the contextual and conceptual correctness of the answers. In particular, the digitization of handwritten responses necessitates the coordinated use of OCR and artificial intelligence-based text analysis techniques.

1.8. Purpose and Scope of the Study

The main objective of this study is to ensure that handwritten open-ended exam answers are automatically scanned, digitized and evaluated based on content using an artificial intelligence-supported model in a fast, accurate and reliable manner through a mobile-based system. To this end, an OCR process supported by image processing techniques and an automatic scoring mechanism using LLMs were designed.

The scope of the study is based on three main technical components:

First, students' handwritten responses are scanned using a mobile device camera and converted into digital text using open-source solutions such as the Tesseract OCR engine. Second, the resulting digital text is analyzed for spelling and phrasing corrections using large language models and is then given a meaningful structure. Finally, a success score for the student's answer is generated through a comparative analysis with the correct answers and evaluation criteria and presented to the evaluator as a PDF.

The study was limited to open-ended questions of a specific structure. Answers containing complex graphs, figures or tables were excluded from the scope of this system. Furthermore, the evaluation process will be based on content integrity and conceptual accuracy; stylistic or aesthetic aspects (e.g. spelling, page layout) will not be taken into account. By improving the reliability of handwriting recognition, this study aims to reduce human error in measurement and evaluation processes, ease the workload of instructors in educational settings, and increase the capacity to provide faster feedback to students.

Method

The mobile application *"Exam Reader"* developed in this study integrates a range of modern technologies for the automatic evaluation of open-ended exam answers (Table 1). The application process consists of scanning the exam papers, digitizing them with OCR, content analysis supported by artificial intelligence, and automatic scoring.

1. Application Development Process and General Structure

The iOS-based mobile application developed in this study combines the processes of automatically digitizing handwritten answers of open-ended exams, evaluating them with artificial intelligence-supported content analysis and presenting the results to the user in a holistic structure. The application was coded in Swift programming language using Apple's official development environment Xcode. The code block, consisting of 1,028 lines in total, is structured with a modular architecture approach.

1.1 Core Technologies Used

Table 1

The Main Technologies Employed in the Application

Component	Description
Swift	The programming language used for development
VisionKit	Document scanning and image acquisition
CoreImage	Image filtering and preprocessing
Google Cloud Vision API	OCR (handwriting recognition) processes
OpenAI GPT-4o	Text correction and content scoring
PDFKit & QuickLook	PDF generation and display
UIKit & SwiftUI	Building user interfaces

The mobile application developed in this study was designed to deliver both technical functionality and a user-friendly experience. Built using the Swift programming language in the Xcode environment, it is fully compatible with iOS versions 17.5.3 and 18.2.

The primary development objectives of the application were defined as follows:

Accuracy: High-precision digitization of handwritten exam responses.

Consistency: Objective and standardized scoring based on predefined criteria.

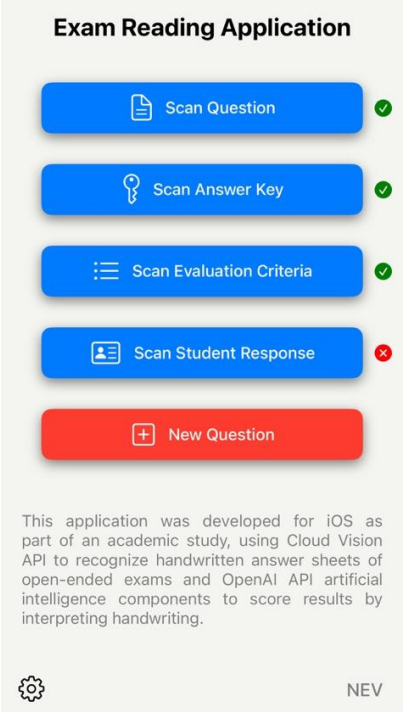
Usability: Intuitive step-by-step guidance for users without technical expertise.
Accessibility: A flexible interface adaptable to various device sizes and user needs.

The app integrates Apple's VisionKit and CoreImage for image processing, Google Cloud Vision API for OCR, and OpenAI's GPT-4o model for text editing and content analysis. PDF outputs are generated using PDFKit for transparent evaluation results. The user interface combines UIKit and SwiftUI, with button-based navigation and consistent visual/textual feedback to enhance user experience. Error handling and API communication prioritize secure data flow and clear error messages.

1.2. Interface Design and Button Workflow

Picture 1

User Interface



The application's user interface is designed to simplify the exam evaluation process for users, such as educators, by providing a clear and intuitive workflow. Four main buttons guide users through the process: "Scan Question", "Scan Answer Key", "Scan Evaluation Criteria", "Scan Student Response" and "New Question" (Picture 1). Each button triggers a specific action, such as capturing a question or student answer using the device's camera. Visual feedback—a green checkmark (✔) for successful scans or a red cross (✕) for errors—ensures users can track their progress. The interface dynamically updates button availability based on

the current step, preventing errors and enhancing usability. For example, the "Scan Student Response" button is only enabled after the question-and-answer key are scanned. This design minimizes the learning curve, making the application accessible to users without technical expertise.[1]

1.3. Workflow Management and Resetting State

The application manages the evaluation process through a structured workflow that ensures seamless transitions between steps, such as scanning questions, answer keys, evaluation criteria, and student responses. After completing an evaluation or starting a new one, the system resets all data and interface components to their initial state, allowing users to begin a fresh cycle without errors ("New Question" button Picture 1). This reset process clears stored information, such as scanned texts and button statuses, and prepares the interface for the next evaluation. For example, an educator can evaluate one student's exam and automatically begin a new session for another without manual input. This streamlined approach enhances efficiency and reduces the risk of data overlap, making the application practical for repeated use in educational settings.[2]

2. Image Processing and OCR Process

The application processes scanned exam papers to convert handwritten responses into digital text, enabling automated evaluation. This process begins with image processing, where the captured images—such as questions, answer keys, evaluation criteria, or student responses—are enhanced for clarity. Adjustments like brightness correction and noise reduction ensure the text is legible, improving the accuracy of subsequent steps. Following this, OCR technology, powered by Google Cloud Vision API, transforms the handwritten text into machine-readable digital text. The OCR process is optimized for the Turkish language by setting a language hint to "Turkish," which enhances recognition accuracy for Turkish handwriting. Once the text is digitized, it is ready for further analysis and evaluation. This seamless integration of image processing and OCR allows the application to handle handwritten exams efficiently, saving time for users like educators while maintaining high accuracy in text recognition.[3]

[1] For technical details on the interface implementation, see Appendix 1.
[2] For technical details on the reset process, see Appendix 2.
[3] For technical details on the image processing and OCR implementation, see Appendix 3.

2.1. Image Acquisition

The application begins the evaluation process by capturing images of exam papers, such as questions, answer keys, evaluation criteria, or student responses, using the device's camera. This image acquisition step ensures that handwritten content is accurately recorded for further processing. Once captured, the images undergo preprocessing to enhance their quality and improve text recognition accuracy. This involves adjustments like increasing brightness, enhancing contrast, and reducing noise, which make the handwritten text clearer and easier to digitize. For instance, a faintly written student response can be made more legible through these enhancements, ensuring reliable results in the subsequent OCR step. This process allows the application to handle a variety of handwriting styles and paper conditions, making it practical for real-world educational settings.[4]

2.2. Use of OCR Technology

The application uses OCR technology to convert handwritten exam responses into digital text, enabling automated evaluation. This step relies on Google Cloud Vision API, a powerful tool that accurately recognizes text in images, including handwritten content. After the exam papers are scanned and preprocessed, the API analyzes the images and extracts the text, such as student answers or evaluation criteria. To ensure high accuracy for Turkish handwriting, the OCR process is configured with a language hint set to "Turkish," which helps the API better interpret Turkish characters and grammar. Once the text is digitized, it is ready for further analysis, such as comparison with the answer key or evaluation by system. This OCR process ensures that handwritten responses are reliably converted into a format suitable for automated scoring, saving time and reducing manual effort for users like educators.[5]

2.3 Handwriting Recognition and Text Editing Process

The student responses transferred into digital format through the OCR process generally contain various spelling and grammatical errors and thus must be edited before becoming meaningful and suitable for evaluation. In this context, the raw texts obtained from handwriting were linguistically and structurally improved using OpenAI's GPT-4o model within the application. This process ensures grammatical integrity and also increases the accuracy of AI-supported scoring.

[4] For technical details on image acquisition, see Appendix 4.
[5] For technical details on the OCR implementation, see Appendix 5.

2.3.1 Handwriting Recognition Technologies

The application leverages handwriting recognition technologies to accurately interpret and digitize handwritten exam responses, a critical step in automating the evaluation process. Building on the OCR process, this step uses advanced algorithms to specifically handle the variability of handwriting styles, such as different letter shapes or writing clarity. The Google Cloud Vision API, which powers the OCR, includes handwriting recognition capabilities that are fine-tuned for diverse scripts, including Turkish. This ensures that even challenging handwritten texts—such as those with cursive writing or faint ink—are correctly converted into digital text. The digitized text is then prepared for further analysis, such as comparison with the answer key or AI-based scoring. This technology enables the application to process a wide range of handwritten responses efficiently, reducing the manual workload for users like educators and ensuring consistent evaluation results.[6]

2.3.2 Post-OCR Text Editing

After the OCR process converts handwritten exam responses into digital text, the application performs post-OCR text editing to ensure the extracted text is accurate and suitable for evaluation. This step addresses common OCR errors, such as misrecognized characters or formatting issues, which can occur due to handwriting variations or image quality. The application uses OpenAI's GPT-4o model to intelligently refine the text by correcting errors, standardizing formatting, and ensuring the text aligns with the expected context (e.g., a student's response to a specific question). For example, if the OCR misinterprets a handwritten "5" as an "S," GPT-4o can correct this based on the context of the question. To provide transparency, the application calculates the percentage of changes made to the original OCR output using the Levenshtein distance method, which measures the number of edits needed to transform the original text into the refined version. This percentage is reported in the final PDF (e.g., "Text edited by AI by X%"), allowing users to understand the extent of modifications. This ensures the digitized text is reliable for automated scoring, enhancing the accuracy of the evaluation for users like educators.[7]

2.4 Content Analysis, Evaluation, and PDF Result Generation

This section outlines the integrated process of analyzing, evaluating, and presenting student responses in a comprehensive and transparent manner. The application performs content

[6] For technical details on the handwriting recognition implementation, see Appendix 6.
[7] For technical details on the post-OCR text editing implementation, see Appendix 7.

analysis, scores responses based on predefined evaluation criteria, and compiles results into a visually accessible PDF report, ensuring accuracy, consistency, and usability for educators and students.

2.4.1 Scanning and Defining Evaluation Criteria

The application enables users, such as educators, to scan and define evaluation criteria, which form the foundation for automated scoring. Users scan a document, such as a rubric or scoring guide, outlining expected answers and corresponding points. Using OCR, the application extracts these criteria into digital text, ensuring the system understands specific scoring requirements, such as key concepts or phrases. For example, a history exam question might require mentioning "the Industrial Revolution" and "its economic impact" for full points. This process aligns student responses with learning goals, promoting consistency while allowing nuanced interpretation. By simplifying the assessment process, it contributes to fairer and more transparent grading. [8]

2.4.2 AI-Based Analysis of Student Responses

Once student responses are digitized and refined through OCR and post-OCR text editing, the OpenAI GPT-4o model analyzes them against the predefined evaluation criteria. The system compares each response to key learning goals, suggesting a score based on conceptual understanding, accuracy, and completeness. For instance, if a history question requires "the Industrial Revolution" and "its economic impact," GPT-4o identifies these elements and assigns points accordingly. The system also provides a confidence estimate for each evaluation, offering transparency to educators. This AI-based analysis ensures objective, efficient, and consistent grading, reducing educator workload while maintaining fairness. [9]

2.4.3 Scoring, Feedback, and PDF Report Generation

At the final stage, the application compiles evaluation results into a comprehensive PDF report using the PDFKit library, presenting scores, feedback, and transparent insights in a professional, archivable format. Each response is scored based on how well it meets the evaluation criteria, with supportive indicators such as the degree of text editing (e.g., 15% for OCR corrections) and evaluation confidence (e.g., 95%). For example, a report might show a score of 8/10 for a response, noting the inclusion of "the Industrial Revolution" but missing "its

[8] For technical details on scanning and defining evaluation criteria, see Appendix 8.
[9] For technical details on the AI-based analysis implementation, see Appendix 9.

economic impact." The report includes feedback for educators, highlighting student strengths and areas for improvement, and for students, offering constructive comments like, "Consider adding economic effects for a complete answer." Generated with AI support, this feedback ensures consistency with scoring criteria and supports tailored instruction and student learning. The PDF format ensures readability, shareability, and archivability, allowing educators to distribute or store results efficiently. This integrated process enhances evaluation efficiency, transparency, and actionable outcomes. [10]

In conclusion, the developed mobile application enhances the efficiency of open-ended exam evaluation by reducing processing time and improving assessment consistency. It offers a new model for assessment and evaluation that emphasizes speed, accuracy, and transparency.

Results and Recommendations

The iOS-based mobile application developed within the scope of this study adopts an integrated approach to automatically scanning, digitizing, correcting, and evaluating students' handwritten answers in open-ended exams through content analysis. Considering the increasing need for digitalization of assessment and evaluation processes in education, it is evident that such applications offer notable advantages such as speed, consistency and objectivity.

The application offers a key advantage by reducing the time required for manual assessment processes. Reliable handwriting recognition using the Google Cloud Vision API, followed by editing and evaluation using the OpenAI GPT-4o model, increased both the speed and accuracy of the evaluation process. The high accuracy rates offered by LLMs for content analysis made it possible to obtain consistent results even when compared to human raters. In addition, a simple and user-friendly interface design was adopted in the development of the application, and wide compatibility with mobile devices was ensured so that different user groups could easily use the application. The creation of PDF-based results reports provided educators with the opportunity for long-term data storage and transparent communication with students.

However, some limitations of the system were also identified. Differences in the legibility of handwriting, especially during the OCR process, could lead to fluctuations in recognition performance. Individual differences in handwriting and low-quality scans sometimes reduced the accuracy of text recognition, which could affect the results of the

[10] For technical details on scoring and result generation, the PDF report generation implementation and the feedback generation implementation see Appendix 10.

automatic assessment. It was also considered that AI-assisted content analysis runs the risk of not fully understanding the context. As emphasized in the literature, artificial intelligence models can sometimes make incomplete or misleading assessments based on superficial clues. Another limitation of the system is that it requires an uninterrupted internet connection for full performance. The lack of offline modes limits the usability of the application, especially in rural or low bandwidth areas, as access to the Google Cloud Vision API and OpenAI API can be difficult.

In terms of future development, supporting the application with more advanced OCR models is an important goal. In particular, integration with advanced handwriting recognition systems such as MDRNN can be achieved to improve recognition accuracy. In addition, providing multilingual support will enable students from different language groups to be included in the system. In this context, the integration of multilingual models should be planned so that educational institutions can effectively use the application in different language environments. The development of an offline mode of use has also been identified as an important area of future work. In particular, developing a hybrid structure where local OCR and evaluation engines can be run on the device will increase the independence and accessibility of the application.

In conclusion, the mobile application developed in this study presented an innovative approach in the field of automatic assessment of open-ended exams. It has made a substantial contribution in terms of providing speed, objectivity and transparency in measurement and evaluation processes in education and has strongly served the goals of supporting student learning and reducing educator workload. This model, created with the combination of artificial intelligence and mobile technologies, has laid a solid foundation for future studies in the field of educational technologies and paved the way for new development opportunities.

References

Ahmed, F., Hina, R., & Asif, M. (2021). Evaluation of descriptive answers of open-ended questions using NLP techniques. *Turkish Journal of Computer and Mathematics Education, 12*(10), 4887–4896. https://doi.org/10.1109/ICCIS54243.2021.9676405

Ariely, N., Nazaretsky, T., & Alexandron, G. (2021). Machine learning and Hebrew NLP for automated assessment of open-ended questions in biology. https://doi.org/10.1007/s40593-021-00283-x

Ariely, M., Nazaretsky, T., & Alexandron, G. (2020). First steps towards NLP-based formative feedback to improve scientific writing in Hebrew. In A. N. Rafferty, J. Whitehill, V. Cavalli-Sforza, & C. Romero (Eds.), *Proceedings of the 13th International Conference on Educational Data Mining (EDM 2020)* (pp. 565–568). Retrieved from https://osf.io/preprints/edarxiv/pe5ky

Attali, Y., & Burstein, J. (2006). Automated Essay Scoring With e-rater® V.2. The Journal of Technology, Learning and Assessment, 4(3). Retrieved from https://ejournals.bc.edu/index.php/jtla/article/view/1650

Azizi, S., Mahmoudi, F., Alizadehsani, R., & Nahavandi, S. (2024). Image processing and artificial intelligence for apple detection and localization: A comprehensive review. *Artificial Intelligence Review, 57*(2), 123–150. https://doi.org/10.1016/j.cosrev.2024.100690

Burstein, J., Tetreault, J., & Madnani, N. (2013). The E-rater® automated essay scoring system. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 55–67). Routledge. Retrieved from https://psycnet.apa.org/record/2013-15323-004

Chen, C. F. E., & Cheng, W. Y. E. (2008). Beyond the design of automated writing evaluation: Pedagogical practices and perceived learning effectiveness in EFL writing classes. *Language Learning & Technology, 12*(2), 94–112. Retrieved from https://www.lltjournal.org/item/10125-44145/

Cui, Y., & Liang, M. (2024). Automated scoring of translations with BERT models: Chinese and English language case study. *Applied Sciences, 14*(5), 1925. https://doi.org/10.3390/app14051925

Çeliker, N., & Gürsoy, S. (2025). Artificial intelligence in human resource management: A bibliometric analysis on trends, prospects and future research agenda. *The Journal of Business Science, 13*(1), 97-120. https://doi.org/10.22139/jobs.1594699

Çınar, A., Kara, A., Koç, H., & Kılıç, S. (2020). Machine learning algorithm for grading open-ended physics questions in Turkish. *Education and Information Technologies, 25*(5), 3821–3844. http://doi.org/10.1007/s10639-020-10128-0

Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2018). BERT: Pre-training of deep bidirectional transformers for language understanding. *arXiv preprint* arXiv:1810.04805. https://arxiv.org/abs/1810.04805

Gonzalez, R. C., & Woods, R. E. (2008). *Digital image processing* (3rd ed.). Pearson Prentice Hall. Retrieved from https://sde.uoc.ac.in/sites/default/files/sde_videos/Digital%20Image%20Processing%203rd%20ed.%20-%20R.%20Gonzalez,%20R.%20Woods-ilovepdf-compressed.pdf

Graves, A., & Schmidhuber, J. (2009). Offline handwriting recognition with multidimensional recurrent neural networks. *Advances in Neural Information Processing Systems, 21*, 545–552. Retrieved from https://www.cs.toronto.edu/~graves/nips_2008.pdf

Hidayat, E. Y., Hastuti, K., & Muda, A. K. (2025). Artificial intelligence in digital image processing: A bibliometric analysis. *Intelligent Systems with Applications, 25*, 200466. https://doi.org/10.1016/j.iswa.2024.200466

Hussain, S., Dixit, P., & Hussain, M. S. (2020). Image processing in artificial intelligence. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 6*(5), 244–249. https://doi.org/10.32628/CSEIT206542

Karadağ, N. (2023). The impact of artificial intelligence on online assessment: A preliminary review. *Journal of Educational Technology & Online Learning*, 6(4), 822-837. https://doi.org/10.31681/jetol.1351548

Ke, Z., & Ng, V. (2019). Automated essay scoring: A survey of the state of the art. In *Proceedings of the Twenty-Eighth International Joint Conference on Artificial Intelligence (IJCAI-19)* (pp. 6300–6308). International Joint Conferences on Artificial Intelligence. https://doi.org/10.24963/ijcai.2019/879

Keser Ateş, S., Kaleci, F., & Erdoğan, A. (2025). Artificial intelligence in education: A bibliometric analysis. *Ahmet Keleşoğlu Faculty of Education Journal (AKEF), 7*(1), 14–36. https://doi.org/10.38151/akef.2025.147

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature, 521*(7553), 436–444. https://doi.org/10.1038/nature14539

Lepakshi, V. A. (2022). Machine learning and deep learning based AI tools for development of diagnostic tools. In A. Parihar, R. Khan, A. Kumar, A. K. Kaushik, & H. Gohel (Eds.),

Computational approaches for novel therapeutic and diagnostic designing to mitigate SARS-CoV-2 infection (pp. 399–420). Academic Press. https://doi.org/10.1016/B978-0-323-91172-6.00011-X

Norman, D. A. (2013). *The design of everyday things* (Rev. & expanded ed.). Basic Books. https://jnd.org/books/the-design-of-everyday-things-revised-and-expanded-edition/

Radford, A., Wu, J., Child, R., Luan, D., Amodei, D., & Sutskever, I. (2019). Language models are unsupervised multitask learners. *OpenAI.* Retrieved from https://openai.com/research/language-unsupervised

Ramesh, D., & Sanampudi, S. K. (2022). An automated essay scoring systems: A systematic literature review. *Artificial Intelligence Review, 55*, 2495-2527. https://doi.org/10.1007/s10462-021-10068-2

Shermis, M. D. (2015). Contrasting state-of-the-art in the machine scoring of short-form constructed responses. *Educational Assessment, 20*(1), 46–65. https://doi.org/10.1080/10627197.2015.997617

Shermis, M. D., Burstein, J., & Apel Bursky, S. (2013). Introduction to automated essay evaluation (AES) NLP. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 1–15). Routledge. https://doi.org/10.4324/9780203122761

Schultz, M. T. (2013). The IntelliMetric™ automated essay scoring engine – A review and an application to Chinese essay scoring. In M. D. Shermis & J. Burstein (Eds.), *Handbook of automated essay evaluation: Current applications and new directions* (pp. 89–98). Routledge. https://doi.org/10.4324/9780203122761

Shah, F. T., & Yousaf, K. (2007). Handwritten digit recognition using image processing and neural networks. *Proceedings of the World Congress on Engineering 2007, Vol I (WCE 2007).* Retrieved from https://www.iaeng.org/publication/WCE2007/WCE2007_pp648-651.pdf

Smith, R. (2007). An overview of the Tesseract OCR engine. *Proceedings of the Ninth International Conference on Document Analysis and Recognition*, 629–633. https://doi.org/10.1109/ICDAR.2007.4376991

Tanberkan, H., Özer, M., & Gelbal, S. (2024). Impact of artificial intelligence on assessment and evaluation approaches in education. *International Journal of Educational Studies and Policy, 5*(2), 139–152. Retrieved from https://dergipark.org.tr/en/pub/ijesp/issue/90802/1659826

Turhan, S., Bozkurt, M., & Şahin, D. Ö. (2023). Development of mobile application based optical mark reader system using image processing techniques. *KMÜ Mühendislik ve Doğa Bilimleri Dergisi, 5*(2), 169–190. https://doi.org/10.55213/kmujens.1386520

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser L. & Polosukhin, I. (2017). Attention is all you need. *Advances in Neural Information Processing Systems, 30*, 5998–6008. https://arxiv.org/abs/1706.03762

Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications, 252*, 124167. https://doi.org/10.1016/j.eswa.2024.124167

Warschauer, M., & Grimes, D. (2008). Automated writing assessment in the classroom. *Pedagogies: An International Journal, 3*(1), 22–36. https://doi.org/10.1080/15544800701771580

Wiser, M. J., Anderson, C. W., & Sadler, T. D. (2016). Comparing human and automated evaluation of open-ended student responses to questions of evolution. *Research in Science Education, 46*(6), 841–867. https://doi.org/10.1162/978-0-262-33936-0-ch025

Zhang, M., Press, O., Merrill, W., Liu, A., & Smith, N. A. (2023). How language model hallucinations can snowball. https://arxiv.org/abs/2305.13534

Appendixes

Appendix 1

Technical Implementation of User Interface

This appendix provides the technical details of the user interface implementation described in Section 2.1.2. The user interface is built using Swift and UIKit, with buttons created and managed as follows:

The user interface is implemented using Swift and UIKit. Buttons are created with the following code:

```
scanQuestionButton = createStyledButton(title: "Scan Question", icon:
UIImage(systemName: "doc.text"), action: #selector(scanQuestion))
scanAnswerButton = createStyledButton(title: "Scan Answer Key", icon:
UIImage(systemName: "key"), action: #selector(scanAnswer))
```

Button states are managed using a custom enumeration:

```
enum ButtonState {
    case notEnabled
    case enabled
    case clicked
}
```

The updateButtonStates() function dynamically adjusts button states:

```
func updateButtonStates() {
    setButtonState(button: scanQuestionButton, state: questionText.isEmpty ?
.enabled : .clicked)
    ...
}
```

-Button Creation: The createStyledButton function generates buttons with specific titles, icons (e.g., document and key symbols), and actions (e.g., triggering the scanQuestion or scanAnswer methods).

-State Management: The ButtonState enumeration defines three states (notEnabled, enabled, clicked) to control button availability and visual feedback during the workflow.

-Dynamic Updates: The updateButtonStates() function ensures buttons reflect the current step of the process, such as enabling the next button only after a successful scan.

Appendix 2

Technical Implementation of Workflow Management and Resetting State

This appendix provides the technical details of the reset functionality described in Section 2.1.3. The code below illustrates how the application resets data and interface components to their initial state, ensuring a seamless transition between evaluation cycles.

The startNewQuestion() function is used to reset all relevant data and user interface components at the end of an evaluation process or when starting a new one:

```
@objc func startNewQuestion() {
    questionText = ""
    answerText = ""
    ...
    updateButtonStates()
    resetCheckIndicators()
}
```

-Data Reset: The variables questionText and answerText are cleared to ensure no residual data from the previous evaluation remains.

-Interface Update: The updateButtonStates() function adjusts the state of the buttons (e.g., enabling/disabling them based on the workflow stage).

-Visual Feedback Reset: The resetCheckIndicators() function clears visual feedback indicators (e.g., green checkmarks or red crosses) to prepare the interface for the next cycle.

Appendix 3

Technical Implementation of Image Processing and OCR Process

This appendix provides the technical details of the image processing and OCR functionality described in Section 2.2. The following code and configurations illustrate how the application enhances captured images and converts handwritten text into digital text using Google Cloud Vision API.

Image Preprocessing

Before OCR, the application preprocesses captured images to improve text recognition accuracy. The preprocessImage function adjusts image properties such as brightness and noise levels:

```
func preprocessImage(_ image: UIImage) -> UIImage {
    guard let ciImage = CIImage(image: image) else { return image }
    let filter = CIFilter(name: "CIColorControls")!
    filter.setValue(ciImage, forKey: kCIInputImageKey)
    filter.setValue(1.1, forKey: kCIInputBrightnessKey) // Increase brightness
    filter.setValue(0.5, forKey: kCIInputContrastKey)   // Adjust contrast
    let outputImage = filter.outputImage!
    let context = CIContext()
    let cgImage = context.createCGImage(outputImage, from: outputImage.extent)!
    return UIImage(cgImage: cgImage)
}
```

-Brightness and Contrast Adjustment: The CIColorControls filter increases brightness and adjusts contrast to enhance text visibility.

-Noise Reduction: Implicit noise reduction is achieved through these adjustments, improving OCR accuracy.

OCR with Google Cloud Vision API

The OCR process converts handwritten text into digital text using Google Cloud Vision API. The API request is configured with a language hint to optimize for Turkish handwriting:

```
func performOCR(image: UIImage, completion: @escaping (String?) -> Void) {
```

```
    guard let base64String = image.jpegData(compressionQuality:
0.8)?.base64EncodedString() else {
        completion(nil)
        return
    }

    let parameters: [String: Any] = [
        "requests": [
            [
                "image": ["content": base64String],
                "features": [["type": "DOCUMENT_TEXT_DETECTION"]],
                "imageContext": ["languageHints": ["tr"]]
            ]
        ]
    ]

    // API call implementation (omitted for brevity)
    // On success, the extracted text is returned via the completion handler
}
```

-Image Encoding: The image is converted to a Base64 string to be sent to the API.

-Language Hint: The "languageHints": ["tr"] parameter ensures the API prioritizes Turkish language recognition, improving accuracy for Turkish handwriting.

-Feature Type: The "type": "DOCUMENT_TEXT_DETECTION" setting instructs the API to focus on extracting text from document-like images.

Appendix 4

Technical Implementation of Image Acquisition

This appendix provides the technical details of the image acquisition functionality described in Section 2.2.1. The following code illustrates how the application captures images using the device's camera and preprocesses them to improve text recognition accuracy.

Image Acquisition

The application uses the iOS VNDocumentCameraViewController to capture images of exam papers, providing a user-friendly scanning interface:

```
func startDocumentScan() {
    let scanner = VNDocumentCameraViewController()
    scanner.delegate = self
    present(scanner, animated: true, completion: nil)
}

func documentCameraViewController(_ controller: VNDocumentCameraViewController,
didFinishWith scan: VNDocumentCameraScan) {
    guard scan.pageCount > 0 else {
        dismiss(animated: true, completion: nil)
        return
    }
    let image = scan.imageOfPage(at: 0)
    dismiss(animated: true) {
        self.processImage(image)
    }
}
```

-Camera Interface: The VNDocumentCameraViewController provides an intuitive interface for users to scan documents, automatically detecting page edges and capturing high-quality images.

-Image Retrieval: The didFinishWith delegate method retrieves the scanned image for further processing.

Appendix 5

Technical Implementation of OCR Using Google Cloud Vision API

This appendix provides the technical details of the OCR implementation using Google Cloud Vision API, as described in Section 2.2.2. The following code illustrates how the application converts preprocessed images into digital text.

OCR Implementation

The performOCR function sends the preprocessed image to Google Cloud Vision API and retrieves the extracted text:

```
func performOCR(image: UIImage, completion: @escaping (String?) -> Void) {
    guard let base64String = image.jpegData(compressionQuality:
0.8)?.base64EncodedString() else {
        completion(nil)
        return
    }

    let parameters: [String: Any] = [
        "requests": [
            [
                "image": ["content": base64String],
                "features": [["type": "DOCUMENT_TEXT_DETECTION"]],
                "imageContext": ["languageHints": ["tr"]]
            ]
        ]
    ]

    // API call implementation (omitted for brevity)
    // On success, the extracted text is returned via the completion handler
}
```

-Image Encoding: The image is converted to a Base64 string using jpegData with a compression quality of 0.8, preparing it for the API request.

-Language Hint: The "languageHints": ["tr"] parameter optimizes the API for Turkish handwriting, improving recognition accuracy for Turkish characters and grammar.

-Feature Type: The "type": "DOCUMENT_TEXT_DETECTION" setting instructs the API to focus on extracting text from document-like images, such as exam papers.

-Completion Handler: The completion closure returns the extracted text (or nil if the process fails), which is then used for further analysis in the evaluation pipeline.

Appendix 6

Technical Implementation of Handwriting Recognition Technologies

This appendix provides the technical details of the handwriting recognition implementation described in Section 2.3.1. The following code and configurations illustrate how the application uses Google Cloud Vision API to recognize and digitize handwritten text, building on the OCR process.

Handwriting Recognition with Google Cloud Vision API

The performOCR function, previously introduced for OCR, is utilized here with specific configurations to optimize for handwriting recognition:

```
func performOCR(image: UIImage, completion: @escaping (String?) -> Void) {
    guard let base64String = image.jpegData(compressionQuality:
0.8)?.base64EncodedString() else {
        completion(nil)
        return
    }

    let parameters: [String: Any] = [
        "requests": [
            [
                "image": ["content": base64String],
                "features": [["type": "DOCUMENT_TEXT_DETECTION"]],
                "imageContext": ["languageHints": ["tr"]]
            ]
        ]
    ]

    // API call implementation (omitted for brevity)
    // On success, the extracted text is returned via the completion handler
}
```

-Handwriting Optimization: The "type": "DOCUMENT_TEXT_DETECTION" feature of Google Cloud Vision API includes built-in capabilities for handwriting recognition, adept at handling variability in handwriting styles such as cursive or faint text.

-Language Hint for Turkish: The "languageHints": ["tr"] parameter ensures the API is optimized for Turkish handwriting, improving recognition accuracy for Turkish-specific characters and grammar.

-Image Encoding: The image is converted to a Base64 string with a compression quality of 0.8, ensuring efficient transmission to the API while maintaining quality for text recognition.

-Completion Handler: The completion closure returns the digitized text (or nil if the process fails), which is then used for further analysis in the evaluation pipeline.

Appendix 7

Technical Implementation of Post-OCR Text Editing

This appendix provides the technical details of the post-OCR text editing implementation described in Section 2.3.2. The following code and configurations illustrate how the application uses OpenAI's GPT-4o model to refine OCR-extracted text and calculate the percentage of changes made during the editing process.

Text Editing with GPT-4o

The editOCRText function sends the OCR-extracted text to GPT-4o for refinement, correcting errors and standardizing the output:

```
func editOCRText(_ ocrText: String, completion: @escaping (String?) -> Void) {
    let parameters: [String: Any] = [
        "model": "gpt-4o",
        "prompt": "Correct and standardize the following OCR-extracted text for
clarity and context: \(ocrText)",
        "max_tokens": 500,
        "temperature": 0.3
    ]

    // API call implementation (omitted for brevity)
    // On success, the refined text is returned via the completion handler
}
```

-Model Selection: The "model": "gpt-4o" parameter specifies the use of OpenAI's GPT-4o, which is adept at understanding context and correcting text errors.

-Prompt Design: The "prompt" instructs GPT-4o to correct and standardize the OCR text, ensuring the output aligns with the expected context (e.g., a student response).

-Control Parameters: The "max_tokens": 500 limits the response length, and "temperature": 0.3 ensures a more deterministic and precise correction process.

-Completion Handler: The completion closure returns the refined text (or nil if the process fails), which is then used for evaluation.

Change Percentage Calculation

The calculateChangePercentage function computes the percentage of changes made to the original OCR text, which is reported in the final PDF for transparency:

```
func calculateChangePercentage(original: String, processed: String) -> Int {
    let distance = levenshteinDistance(a: original, b: processed)
    return Int(round((Double(distance) / Double(original.count)) * 100))
}
```

-Levenshtein Distance: The levenshteinDistance function calculates the edit distance between the original OCR text (original) and the refined text (processed), measuring the number of changes made.

-Percentage Calculation: The change percentage is computed as the ratio of edits to the original text length, rounded to the nearest integer, and reported in the final PDF (e.g., "Text edited by AI by X%").

Appendix 8

Technical Implementation of Scanning and Defining Evaluation Criteria

This appendix provides the technical details of the scanning and defining evaluation criteria implementation described in Section 2.4.1. The following code illustrates how the application captures the evaluation criteria document, processes it using OCR, and prepares the criteria for automated scoring.

Scanning the Evaluation Criteria Document

The application uses the iOS VNDocumentCameraViewController to capture the evaluation criteria document, similar to the image acquisition process for other components:

```
func scanEvaluationCriteria() {
    let scanner = VNDocumentCameraViewController()
    scanner.delegate = self
    present(scanner, animated: true, completion: nil)
}

func documentCameraViewController(_ controller: VNDocumentCameraViewController,
didFinishWith scan: VNDocumentCameraScan) {
    guard scan.pageCount > 0 else {
        dismiss(animated: true, completion: nil)
        return
    }
    let image = scan.imageOfPage(at: 0)
    dismiss(animated: true) {
        self.processCriteriaImage(image)
    }
}
```

-Camera Interface: The VNDocumentCameraViewController provides an intuitive interface for users to scan the evaluation criteria document, automatically detecting page edges and capturing a high-quality image.

-Image Retrieval: The didFinishWith delegate method retrieves the scanned image, which is then passed to the processCriteriaImage function for further processing.

Extracting Evaluation Criteria Using OCR

The scanned image is processed using the previously defined performOCR function to extract the evaluation criteria as digital text:

```
func processCriteriaImage(_ image: UIImage) {
    let preprocessedImage = preprocessImage(image) // Apply preprocessing
    performOCR(image: preprocessedImage) { extractedText in
        guard let text = extractedText else {
            // Handle error (e.g., display red cross visual feedback)
            return
        }
        self.evaluationCriteria = text
        // Further processing to parse criteria into a structured format (if
needed)
    }
}
```

-Preprocessing: The preprocessImage function (detailed in Appendix 4) enhances the image quality by adjusting brightness and contrast, ensuring better OCR accuracy.

-OCR Processing: The performOCR function (detailed in Appendix 5) uses Google Cloud Vision API to extract the text from the scanned image, with a language hint set to “Turkish” for optimal recognition.

-Criteria Storage: The extracted text is stored in the evaluationCriteria variable, ready for use in the AI-based evaluation process. Additional parsing may be applied to structure the criteria (e.g., into key phrases and associated points).

Appendix 9

Technical Implementation of AI-Based Analysis of Student Responses

This appendix provides the technical details of the AI-based analysis implementation described in Section 2.4.2. The following code and configurations illustrate how the application uses OpenAI’s GPT-4o model to evaluate student responses and assign scores based on defined evaluation criteria.

AI-Based Evaluation with GPT-4o

The evaluateStudentResponse function sends the digitized student response and evaluation criteria to GPT-4o for scoring:

```
func evaluateStudentResponse(_ response: String, criteria: String, completion:
@escaping (Int, Double) -> Void) {
    let parameters: [String: Any] = [
        "model": "gpt-4o",
        "prompt": """
            Evaluate the following student response based on the given criteria.
Assign a score out of 10 and provide a confidence score (0 to 1) for your
evaluation.
            Criteria: \(criteria)
            Response: \(response)
            Return the score and confidence in the format: 'Score: X, Confidence:
Y'.
        """,
        "max_tokens": 150,
        "temperature": 0.5
    ]

    // API call implementation (omitted for brevity)
    // Example response parsing:
    // let result = "Score: 8, Confidence: 0.95"
    // Parse result to extract score (8) and confidence (0.95)
    completion(8, 0.95) // Placeholder values for illustration
}
```

-Model Selection: The "model": "gpt-4o" parameter specifies the use of OpenAI’s GPT-4o, which is capable of understanding and evaluating complex text based on given criteria.

-Prompt Design: The "prompt" instructs GPT-4o to evaluate the student response against the criteria, assign a score out of 10, and provide a confidence score between 0 and 1.

-Control Parameters: The "max_tokens": 150 limits the response length, and "temperature": 0.5 balances creativity and precision in the evaluation process.

-Completion Handler: The completion closure returns the assigned score (e.g., 8) and confidence score (e.g., 0.95), which are used in the final report.

Example Evaluation

For a history question with the criteria "Mention the Industrial Revolution and its economic impact (10 points total: 5 for each element)," and a student response "The Industrial Revolution led to increased factory production and economic growth," GPT-4o might evaluate as follows:

-Identifies "Industrial Revolution" (5 points).

-Identifies "economic growth" as the economic impact (5 points).

-Returns: Score: 10, Confidence: 0.95.

Appendix 10

Technical Implementation of Scoring, Feedback, and PDF Report Generation

This appendix provides the technical details of the scoring and result generation implementation described in Section 2.4.3. The following code illustrates how the application compiles scores, evaluation metrics, and feedback into a PDF report.

Compiling Scores and Metrics

The generateEvaluationResult function aggregates the scores, confidence levels, and text editing percentage for inclusion in the final report:

```
func generateEvaluationResult(response: String, score: Int, confidence: Double,
editPercentage: Int) -> String {
    let resultSummary = """
        Student Response: \(response)
        Score: \(score)/10
        Confidence: \(confidence * 100)%
        Text Edited by AI: \(editPercentage)%
    """
    // Additional feedback can be generated by GPT-4o if needed (omitted for
brevity)
    return resultSummary
}
```

-Result Summary: The function formats the evaluation results into a string, including the student's response, assigned score (e.g., 8/10), confidence level (e.g., 95%), and the percentage of text edits made during post-OCR processing (e.g., 15%).

-Extensibility: Additional AI-generated feedback could be appended to the summary, such as suggestions for improvement, if required.

PDF Report Generation

The createPDFReport function generates a PDF document containing the evaluation results:

```
func createPDFReport(resultSummary: String) -> URL? {
    let pdfRenderer = UIGraphicsPDFRenderer(bounds: CGRect(x: 0, y: 0, width: 595,
height: 842)) // A4 size
    let data = pdfRenderer.pdfData { context in
        context.beginPage()
        let attributes: [NSAttributedString.Key: Any] = [
            .font: UIFont.systemFont(ofSize: 12),
            .foregroundColor: UIColor.black
        ]
        let text = NSAttributedString(string: resultSummary, attributes: attributes)
        text.draw(in: CGRect(x: 20, y: 20, width: 555, height: 802))
    }

    let                                    fileURL                                    =
FileManager.default.temporaryDirectory.appendingPathComponent("EvaluationReport.pdf
")
    try? data.write(to: fileURL)
    return fileURL
}
```

-PDF Rendering: The UIGraphicsPDFRenderer creates an A4-sized PDF document, rendering the resultSummarytext with specified formatting (e.g., font size, color).

-File Storage: The PDF data is saved to a temporary file (EvaluationReport.pdf), and the file URL is returned for sharing or storage.

-Formatting: The text is drawn within a defined rectangle to ensure proper layout on the page.

Compiling the Report Data

The generateEvaluationResult function aggregates the evaluation data into a formatted string for inclusion in the PDF report:

```
func generateEvaluationResult(response: String, score: Int, confidence: Double,
editPercentage: Int) -> String {
    let resultSummary = """
        Student Response: \(response)
        Score: \(score)/10
        Confidence: \(confidence * 100)%
        Text Edited by AI: \(editPercentage)%
    """
    // Additional feedback can be generated by GPT-4o if needed (omitted for
brevity)
    return resultSummary
}
```

-Result Summary: The function formats the evaluation results into a string, including the student's response, assigned score (e.g., 8/10), confidence level (e.g., 95%), and the percentage of text edits made during post-OCR processing (e.g., 15%).

-Extensibility: Additional AI-generated feedback, such as suggestions for improvement, could be appended to the summary if required.

Feedback Generation with GPT-4o

The generateFeedback function uses GPT-4o to create tailored feedback based on the student's response and evaluation criteria:

```
func generateFeedback(response: String, criteria: String, score: Int, completion:
@escaping (String, String) -> Void) {
    let parameters: [String: Any] = [
        "model": "gpt-4o",
        "prompt": """
            Provide feedback for an educator and a student based on the following:
            Evaluation Criteria: \(criteria)
            Student Response: \(response)
            Score: \(score)/10
            For the educator: Highlight areas of strength and weakness in the
response, and suggest teaching focus.
            For the student: Provide constructive feedback to improve their answer.
            Return the feedback in the format: 'Educator Feedback: ... | Student
Feedback: ...'
        """,
        "max_tokens": 200,
        "temperature": 0.7
    ]

    // API call implementation (omitted for brevity)
    // Example response parsing:
    // let result = "Educator Feedback: The student correctly identified the
Industrial Revolution but missed its economic impact. Consider focusing on this in
future lessons. | Student Feedback: You did well mentioning the Industrial
Revolution, but try to include its economic effects for a complete answer."
    // Parse result to extract educatorFeedback and studentFeedback
    completion("The student correctly identified the Industrial Revolution but
missed its economic impact. Consider focusing on this in future lessons.", "You did
well mentioning the Industrial Revolution, but try to include its economic effects
for a complete answer.") // Placeholder values for illustration
}
```

-Model Selection: The "model": "gpt-4o" parameter specifies the use of OpenAI's GPT-4o, which is capable of generating context-aware feedback.

-Prompt Design: The "prompt" instructs GPT-4o to generate feedback for both the educator and student, focusing on strengths, weaknesses, and actionable suggestions based on the response, criteria, and score.

-Control Parameters: The "max_tokens": 200 limits the response length, and "temperature": 0.7 allows for a balanced level of creativity in feedback generation.

-Completion Handler: The completion closure returns two feedback strings: one for the educator and one for the student, which are then included in the PDF report.

Integration into the PDF Report

The feedback is appended to the result summary before PDF generation, as part of the generateEvaluationResult function:

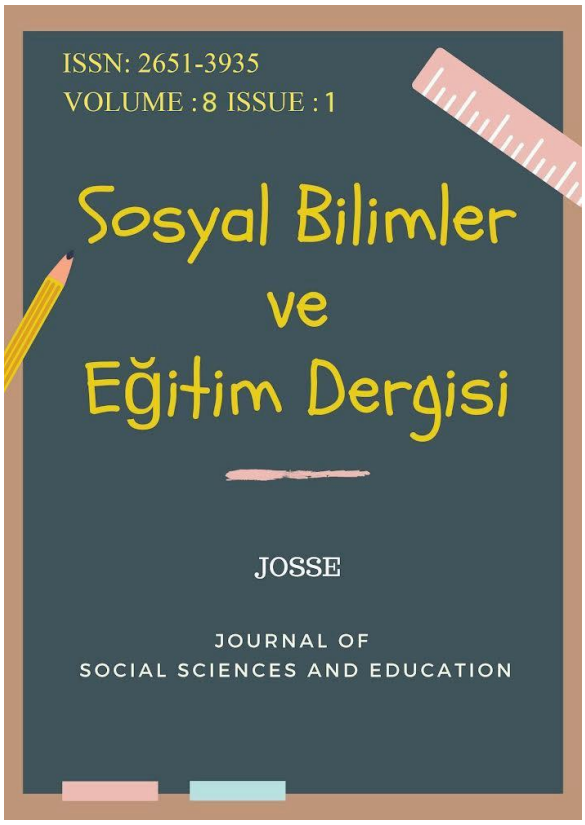
```
func generateEvaluationResult(response: String, score: Int, confidence: Double,
editPercentage: Int, educatorFeedback: String, studentFeedback: String) -> String {
    let resultSummary = """
```

```
        Student Response: \(response)
        Score: \(score)/10
        Confidence: \(confidence * 100)%
        Text Edited by AI: \(editPercentage)%
        Educator Feedback: \(educatorFeedback)
        Student Feedback: \(studentFeedback)
    """
    return resultSummary
}
```

-Feedback Inclusion: The educatorFeedback and studentFeedback strings are added to the resultSummary, which is then used by the createPDFReport function to generate the final PDF.

-Formatting: The feedback is presented clearly in the PDF report, ensuring both educators and students can easily access and understand the insights.

JOURNAL OF SOCIAL SCIENCES AND EDUCATION (JOSSE)



https://dergipark.org.tr/tr/pub/josse

Investigation of Social Studies Teachers' Naturel Disaster Literacy Levels in Terms of Various Variables (The Case of Ankara Province)

** This study was produced from the master's thesis titled "Investigation of Social Studies Teachers' Naturel Disaster Literacy Levels in Terms of Various Variables (The Case of Ankara Province)" conducted by the first author under the supervision of the second author.*

Adem KARACA[1]
Ministry of National Education
Social Studies Teacher
ademkaraca_66@hotmail.com
Orcid ID: 0009-0005-6248-9125

Tevfik PALAZ[2]
Gazi University, Gazi Faculty of Education,
Department of Social Studies Education
Associate Professor Doctor
tevfikpalaz@gazi.edu.tr
Orcid ID: 0000-0002-1631-531X

Article Type: Research Article
Received: 18.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Citation: Karaca, A., & Palaz, T. (2025). Investigation of social studies teachers' naturel disaster literacy levels in terms of various variables (the case of Ankara province). *Journal of Social Sciences and Education*, 8(1), 36-64.

Investigation of Social Studies Teachers' Naturel Disaster Literacy Levels in Terms of Various Variables (The Case of Ankara Province)*

Adem KARACA [1]

Ministry of National Education

Tevfik PALAZ[2]

Gazi University, Gazi Faculty of Education, Department of Social Studies Education

Abstract

The aim of this study is to examine the natural disaster literacy of social studies teachers from various perspectives. The study is designed using a quantitative research method and a survey model. The sample consists of 306 social studies teachers from in the central districts of Ankara. The data collection tool used in the research is the "Natural Disaster Literacy Questionnaire." The obtained data were statistically analyzed using the SPSS 22.00 software package. As a result of the study, it was found that social studies teachers' behaviors regarding natural disaster literacy and their affective tendencies are at a "Medium" level, while their achievement levels are at a "Very High" level. Additionally, those who are aware of their school's disaster plan, those who have participated in training related to natural disasters, and those who chose "Fire drill" among the activities they wish to participate in regarding natural disasters have higher levels of natural disaster literacy behavior. It was also determined that social studies teachers who are aware of their school's disaster plan have higher levels of affective tendencies regarding natural disaster literacy, and those who selected "Search and rescue" among the desired activities related to natural disasters have high achievement levels in natural disaster literacy. Emphasizing practical application in natural disaster training is important for increasing the levels of behavior and affective tendencies. Furthermore, it is essential for schools to assist social studies teachers in areas such as participating in disaster drills and being aware of their school's disaster plan, as this is necessary for creating awareness of disaster literacy.

Keywords: Social studies, social studies teachers, natural disaster, literacy.

Research Article

Received: 18.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

* *This study was produced from the master's thesis titled "Investigation of Social Studies Teachers' Naturel Disaster Literacy Levels in Terms of Various Variables (The Case of Ankara Province)" conducted by the first author under the supervision of the second author.*

Corresponding author:
[1] *Social Studies Teacher*
ademkaraca_66@hotmail.com
Orcid ID: 0009-0005-6248-9125

[2] *Associate Professor Doctor*
tevfikpalaz@gazi.edu.tr
Orcid ID: 0000-0002-1631-531X

Introduction

Disaster can be defined as a natural event such as earthquake, tsunami, flood with a great potential for material and moral loss (Lathifa & Putra, 2022, p.1). All events that harm living things and their habitats are called disasters. If these events are caused by nature, they are called natural disasters (Dikmenli & Gafa, 2017, p.21). As in many countries, natural disasters such as earthquakes, floods, avalanches, droughts, landslides occur in Turkey. Especially with global warming, natural disasters have increased in recent years. As a result of these disasters, many living things are damaged.

The ability of a society to be protected from all kinds of disasters and to minimise the negative effects of disasters depends on the importance given by all segments of the society to have disaster awareness. Individuals forming the society feel ready and safe about disasters and this is realised by having disaster awareness. Therefore, in order to minimise the damages of disasters, disaster awareness must be created in the individuals forming the society and this can only be achieved through education. This awareness, which is very important for the development of disaster resilience, should be instilled from primary school children to all age levels of the society (Torlak, 2021, p.3). Considering that disaster awareness can be placed more firmly especially at young ages, the importance of disaster education for primary school students emerges. It is of great importance that teachers who will provide disaster education and raise disaster awareness among students have high disaster literacy levels. Teachers with high levels of disaster literacy will make significant contributions to the society in terms of raising disaster awareness in the society.

When the literature is examined, there are various studies on determining natural disaster literacy (NDL). Sözcü (2019) examined the NDL levels of prospective teachers, Demirdelen (2020) examined the NDL levels of primary/secondary school teachers working in Osmaniye city centre, Türker and Sözcü (2021) examined the NDL levels of prospective geography teachers, Uygun Seven (2022) examined the NDL levels of prospective science teachers, Üstündağ (2022) examined the NDL levels of special education teachers working in Bitlis province, Lathifa and Putra (2022) examined the NDL levels of Indonesian students, Vu et al. (2023) examined the NDL levels of Vietnamese high school students, and Logayah et al. (2023) examined the NDL levels of secondary school students. When the related literature was examined, no research was found to determine the natural disaster literacy status of social studies teachers. Social studies course is very important in terms of creating disaster awareness at a young age. In order to create disaster awareness, social studies teachers play a key role in

terms of transferring these subjects to students efficiently and establishing them as behaviours as well as including the relevant subjects in the textbooks. In this context, in order to fill this gap in the literature and to contribute to the related literature, this study focuses on determining the natural disaster literacy levels of social studies teachers. With this research, the NDL levels of social studies teachers working in schools were analysed in terms of various variables.

The main purpose of the research is to examine the current natural disaster literacy levels of social studies teachers in the central districts of Ankara province in terms of various variables. For this purpose, answers to the following questions were sought.

1. Is there a significant difference between social studies teachers' NDL behaviour levels and marital status, total years of employment, experiencing a disaster, receiving disaster education at university, knowing the school disaster plan, participating in a disaster-related activity, knowing the emergency gathering place, and the desired disaster-related activity?

2. Is there a significant difference between social studies teachers' NDL affective disposition levels and marital status, total working years, experiencing a disaster, receiving disaster education at university, knowing the school disaster plan, participating in a disaster-related activity, knowing the place of emergency gathering, and the desired disaster-related activity?

3. Is there a significant difference between social studies teachers' NDL achievement levels and marital status, total working years, experiencing a disaster, receiving disaster education at university, knowing the school disaster plan, participating in a disaster-related activity, knowing the emergency gathering place, and the desired disaster-related activity?

Method

Model

In this study, the natural disaster literacy levels of social studies teachers were examined according to various variables. The study was designed in quantitative research method and survey model. Quantitative research is a systematic method in which numerical data are collected by scientific methods and these data are subjected to statistical analyses and numerical data are produced (Tekindal, 2021, p. 175). The approach that tries to define a past or present situation as it is is called a survey model (Karaca, 2018, p. 111).

Sample and Population

The population of the study consists of 1357 social studies teachers working in secondary schools and imam hatip secondary schools in the central districts of Ankara province. The process used to determine the sample is as follows (Yalçın, 2016, p. 65):

N: amount of individuals in the aggregate

n: amount of individuals in the sample

z: standard normal distribution table value for the desired level of reliability

d: sensitivity

p: proportion of individuals in the aggregate with the desired characteristic (p+q=1)z2

Application of the formula:

n: sample size

$$n = \frac{N.z^2.p.q}{N.d^2+z^2.p.q} \qquad n = \frac{1357.(1,96)^2.(0,5).(0,5))}{1357.(0,05)^2+(1,96)^2.(0,5).(0,5)} = 299$$

As a result of the sampling formula applied, it was found that 299 social studies teachers should be reached as the sample number representing the population. Ankara has 25 districts, 9 of which are central districts (Sincan, Çankaya, Etimesgut, Altındağ, Pursaklar, Keçiören, Gölbaşı, Mamak, Yenimahalle). A total of 306 social studies teachers working in secondary schools and imam hatip secondary schools in the central districts of Ankara were reached and all questionnaires were valid and included in the evaluation.

Data Collection Tool

The questionnaire titled "Determination of Natural Disaster Literacy Levels of Prospective Teachers" developed by Sözcü (2019) was used as a data collection instrument in the study. The questionnaire consists of four parts. The first part includes a personal information form consisting of 9 questions (Table 3). In the second part of the questionnaire, there is "Natural disaster literacy behaviour scale" (three factors; geographical questioning, personal protection measure and physical and intellectual approach) which consists of 23 questions and measures the behaviours of the participants against natural disasters. According to the reliability analysis results of this scale, "reliability score is 0.88". In the third part of the questionnaire, there is the "Natural disaster literacy affective disposition scale" (three factors; sensitivity, awareness, individual and social preparedness) which consists of 25 questions and measures the attitudes of the participants towards natural disasters. According to the reliability analysis

results of this scale, "reliability score is 0,87". The scales in the second and third parts of the questionnaire are in the form of five-point Likert (1: completely agree, 2: agree, 3: undecided, 4: disagree, 5: strongly disagree). In the last part of the questionnaire, there is 'Natural disaster literacy achievement test' consisting of 24 questions. In the achievement test, empty and wrong questions were scored as '0' points and correct answers were scored as '1' point. The minimum score that can be obtained from the test is '0' and the maximum score is '24'. The interpretation of the test is 'Low Score' between 0-6 points, 'Medium Score' between 7-18 points, and 'High Score' between 19-24 points. According to the reliability analysis results of this achievement test, 'Cronbach Alpha' value is 0,81. The 'Cronbach Alpha' value of the measurement tool used was calculated as 0,89. In scale reliability, Cronbach Alpha value of 700 and above is accepted as a sufficient value (Seçer, 2015, p. 219). This shows that the scale reliability is high.

Table 1

Scale Reliability

Cronbach's Alfa	Number of Questions
0,89	72

Collection of Data and Analysis

Necessary permissions were obtained from Ankara Provincial Directorate of National Education for the implementation of the questionnaires. In the study, 306 questionnaires were distributed and collected by personally visiting secondary schools in the central districts of Ankara. In order to reach social studies teachers, the seminar period was preferred for the implementation of the questionnaires and the data were collected within a week.

The data obtained from the questionnaires were transferred to the computer environment and subjected to statistical analyses using SPSS 22.0 package programme. Kolmogrov-Simirnov and Shapiro-Wilk normality tests were applied to determine whether the research data were normally distributed. Independent Sample t test was performed with paired groups showing normal distribution and One-Way ANOVA analyses were performed with multiple groups, and percentage frequency, mean, standard deviation scores were calculated to find descriptive statistics. Scheffe test from Post-Hoc Analysis was applied to determine the direction of significance of the emerging significant groups. In all statistical procedures, significance was accepted as $p<0.05$.

Table 2

Normality Test Results

	Skewness	**Kurtosis**
NDL Behaviour Scale	0,329	0,260
NDL Affective Tendencies Scale	0,953	1,301
NDL Achievement Test	0,804	1,291

According to the normality test results, the skewness value of NDL behaviour scale was calculated as 0.329 and kurtosis value as 0.260, the skewness value of NDL affective tendencies scale was calculated as 0.953 and kurtosis value as 1.301, and the skewness value of NDL achievement test was calculated as 0.804 and kurtosis value as 1.291. Skewness and Kurtosis values between -1.5 and +1.5 indicate that the data are normally distributed (Tabachnick & Fidell, 2013, p.68).

Ethical Committee Approval

The necessary permissions were obtained from the researcher who developed the measurement tool for the data collection tool (Survey) used in this study. It is also stated by reference in the method section of the study.

Findings

Findings Related to Demographic Characteristics of Participants

The data on the demographic characteristics of the participants obtained from the first part of the questionnaire form are presented in Table 3 as follows.

Table 3

Information on Demographic Characteristics of Social Studies Teachers

Features		**f**	**%**	**Stacked %**
Gender	Female	152	49,7	49,7
	Male	154	50,3	100
Marital status	Married	226	73,9	73,9
	Single	80	26,1	100
Total working years	1-5 years	49	16,0	16,0
	6-10 years	51	16,7	32,7
	11-15 years	63	20,6	53,3
	16 years and over	143	46,7	100
Have you experienced a disaster before?	Yes	204	66,7	66,7
	No	102	33,3	100

Did you take a course on natural disasters during your university education?	Yes	164	53,6	53,6
	No	142	46,4	100
Do you know the disaster plan of the school where you work?	Yes	194	63,4	63,4
	No	112	36,6	100
Have you participated in activities related to natural disasters?	Yes	216	70,6	70,6
	No	90	29,4	100
Do you know the emergency assembly area of the school where you work?	Yes	259	84,6	84,6
	No	47	15,4	100
Which activities related to natural disasters would you like to participate in?	Seminar-Conference	41	13,4	13,4
	Earthquake drill	45	14,7	28,1
	Fire drill	4	1,3	29,4
	First aid training	101	33,0	62,4
	Aid campaign	20	6,5	69,0
	Search and rescue	80	26,1	95,1
	None	15	4,9	100
	Total	306	100	

Table 3 shows that 152 female (49.7%) and 154 male (50.3%) social studies teachers participated in the study. The marital status of the participants was 226 (73,9%) married and 80 (26,1%) single. In terms of total years of experience, 49 (16%) of the participants have been working for 1-5 years, 51 (16,7%) for 6-10 years, 63 (20,6%) for 10-15 years, and 143 (46,7%) for 16 years or more. This shows that the participants are mostly experienced teachers. 204 (66.7%) of the teachers stated that they had experienced a disaster before, while 102 (33.3%) stated that they had not experienced a disaster before. To the question 'Did you take a course on natural disasters in your university education?' 164 (53,6%) of the teachers who participated in the research answered yes and 142 (46,4%) answered no. While 194 (63,4%) of the teachers knew the disaster plan of the school where they worked, 112 (36,6%) did not. Again, 216 (70,6%) of the teachers participated in a disaster-related activity, while 90 (29,4%) of them did not participate in a disaster-related activity. While 259 (84,6%) of the teachers were aware of the emergency assembly area of the school where they worked, only 47 (15,4%) were not aware of the emergency assembly area. When the teachers were asked which activity they would like to participate in related to natural disasters, 101 of them (33%) answered that they would like to participate in first aid training, 80 (26,1%) in search and rescue, 45 (14,7%) in earthquake drills, 41 (13,4%) in seminars-conferences, 20 (6,5%) in aid campaigns, 4 (1,3%) in fire drills and 15 (4,9%) in none of them.

Evaluation of NDL Behaviour Scale Data

The scores of the social studies teachers' NDL behaviour levels were determined and scored with a five-point Likert analysis method as "Always (5 points), Mostly (4 points), Sometimes

(3 points), Occasionally (2 points), Never (1 point)". Questions 17, 18, 19, 20, 21, 22 and 23 in the scale were reverse coded because they were negative.

Table 4

NDL Behaviour Level Score Scale

Score Value	Level
1-2.33	Low
2.34-3.67	Medium
3.68-5.00	High

In order to determine the general score of the social studies teachers, the scores of their responses to the questionnaire statements were summed and their arithmetic averages were taken. In this context, the scores obtained were interpreted as follows; the DOA behaviour levels of social studies teachers decrease as they approach 1 and increase as they approach 5. As seen in Table 4, those with a score value of 1-2.33 have 'Low', those with a score value of 2.34-3.67 have 'Medium', and those with a score value of 3.68-5.00 have 'High' literacy level.

Table 5

NDL Behaviour Level Score Scale

NDL Behaviour Level Score Averages	n	MEAN.±S.DEVIATION
	306	3.41±0.580

The overall mean of the NDL behaviour level scores of social studies teachers was calculated as 3.41 with a standard deviation of 0.58, and the mean value obtained shows that the natural disaster literacy behaviour of social studies teachers is at a moderate level.

Table 6

The t-Test of the Difference between the Marital Status of Social Studies Teachers and their NDL Behaviour Levels

Dimension	Marital Status	n	X	SS	SD	t	P
NDL Behaviour Level	Married	226	3,440	0,587	145,183	0,241	*,231**
	Single	80	3,350	0,558			

*p<0,05

When the natural disaster literacy behaviour levels of social studies teachers according to marital status are compared in Table 6, it is seen that the highest mean (X =3,440) belongs to the group whose marital status is married.

In order to test whether there is a significant difference between the NDL behaviour levels of social studies teachers and their marital status, t-test, which is a parametric test among statistical tests, was applied, but no significant difference was found.

Table 7

ANOVA Test of the Difference Between Social Studies Teachers' Total Years of Working Experience and NDL Behaviour Levels

Dimension	**Total Years of Working**	**n**	**X**	**SS**	**t**	**P**
NDL Behaviour Level	1-5 years	49	3,358	0,593	2,376	*,070**
	6-10 years	51	3,284	0,678		
	11-15 years	63	3,365	0,476		
	16 years and over	143	3,506	0,572		
	Source of Variance	*KT*	*SD*	*KO*		
	Between Groups	2,372	3	,775		
	In Group	100,506	302	,334		
	Total	102,877	305			

*p<0,05

As Table 7 shows, when the total working years of social studies teachers and their NDL behaviour levels are compared, it is seen that the highest mean (X=3,506) belongs to teachers with a total working year of 16 years or more. This is followed by 11-15 years (X=3,365), 1-5 years (X=3,358) and the lowest average belongs to teachers with 6-10 years (X=3,284) working years.

As a result of One-Way ANOVA test, which is one of the parametric tests among the statistical tests conducted to test whether there is a significant difference between social studies teachers' NDL behaviour levels and their total working years, no significant difference was found.

Table 8

The t-Test of the Difference Between Social Studies Teachers' Experiences of Natural Disasters and NDL Behaviour Levels

Dimension	**Disaster Experience**	**n**	**X**	**SS**	**SD**	**t**	**P**

NDL Behaviour Level	Yes	204	3,407	0,581	201,998	0,113	*,677**
	No	102	3,436	0,581			

*p<0,05

Table 8 shows that the highest mean (X=3,436) belongs to those who have never experienced a natural disaster, while the mean (X=3,407) of those who have experienced a natural disaster is low.

In order to test whether there is a significant difference between the NDL behaviour levels of social studies teachers and their disaster experience, t-test, one of the parametric tests, was applied, but no significant difference was found.

Table 9

The t-Test of the Difference Between Social Studies Teachers' Receiving Disaster Education at University and NDL Behaviour Levels

Dimension	**Receiving Disaster Education at University**	**n**	**X**	**SS**	**SD**	**t**	**P**
NDL Behaviour Level	Yes	164	3,450	0,583	298,611	0,413	*,278**
	No	142	3,378	0,577			

*p<0,05

Table 9 shows that the highest mean (X=3,450) belongs to those who took a course on natural disasters at university and the lowest mean (X=3,378) belongs to those who did not take a course on natural disasters at university.

In order to test whether there is a significant difference between social studies teachers' NDL behaviour levels and their taking courses on natural disasters at university, t-test, one of the parametric tests, was applied, but no significant difference was found.

Table 10

The t-Test of the Difference between Social Studies Teachers' Knowledge of the Disaster Plan of the School where They Work and Their NDL Behaviour Levels

Dimension	**Knowing School Disaster Plan**	**n**	**X**	**SS**	**SD**	**t**	**P**
NDL Behaviour Level	Yes	194	3,467	0,563	219,393	0,054	*,044**
	No	112	3,328	0,602			

*p<0,05

When the NDL behaviour levels of social studies teachers are compared according to their knowledge of the disaster plan of the school where they work, it is seen that the mean of those who know the disaster plan of the school where they work (X=3,467) is higher than those who do not (X=3,328).

The t-test was applied to test whether there was a significant difference between social studies teachers' NDL behaviour levels and their knowledge of the disaster plan of the school where they work. As a result of the t-test, it was seen that there was a significant relationship between social studies teachers' natural disaster literacy behaviour levels and their knowledge of the disaster plan of the school they work in (p=,044, p<0.05). In this case, it was determined that the NDL behaviour levels of those who knew the disaster plan of the school where they worked were higher than those who did not.

Table 11

The t-Test of the Difference Between Social Studies Teachers' Participation in Activities Related to Natural Disasters and NDL Behaviour Levels

Dimension	Participation in Natural Disaster Related Activities	n	X	SS	SD	t	P
NDL Behaviour Level	Yes	216	3,462	0,578	167,545	0,070	*,035**
	No	90	3,308	0,575			

*p<0,05

In Table 11, when the NDL behaviour levels of social studies teachers according to their participation in activities related to natural disasters are compared, it is seen that the mean of those who participate in activities related to natural disasters (X=3,462) is higher than those who do not (X=3,308).

In order to test whether there is a significant difference between social studies teachers' NDL behaviour levels and their participation in activities related to natural disasters, t-test was applied. As a result of the t-test, it was seen that there was a significant relationship between social studies teachers' NDL behaviour levels and their participation in activities related to natural disasters (p=,035, p<0,05). Thus, it was revealed that the NDL behaviour levels of social studies teachers who participated in natural disaster activities were higher than those who did not participate.

Table 12

The t-Test of the Difference Between Social Studies Teachers' Knowledge of Emergency Assembly Area and NNL Behaviour Levels

Dimension	Knowing the Emergency Assembly Area	n	X	SS	SD	t	P
NDL Behaviour Level	Yes	259	3,431	0,558	57,349	0,847	*,316**
	No	47	3,338	0,692			

*p<0,05

Table 12 shows that the highest mean (X=3,431) belongs to those who know the emergency assembly area of the school where they work, while the mean of those who do not know the emergency assembly area (X=3,338) is low when social studies teachers' knowledge of the emergency assembly area of the school where they work is compared with their NDL behaviour levels.

In order to test whether there is a significant difference between social studies teachers' NDL behaviour levels and their knowledge of the emergency assembly area of the school where they work, t-test, which is a parametric test among statistical tests, was applied, but no significant difference was found.

Table 13

ANOVA Test of the Difference Between the Activities Social Studies Teachers Wanted to Participate in Related to Disaster and their NDL Behaviour Levels

Dimension	Disaster Related Activity Wanted to Participate	n	X	SS	t	P
NDL Behaviour Level	Seminar-Conference	41	3,619	0,673	2,247	*,039**
	Earthquake drill	45	3,434	0,564		
	Fire drill	4	3,978	0,739		
	First aid training	101	3,325	0,557		
	Aid campaign	20	3,350	0,476		
	Search and rescue	80	3,376	0,548		
	None	15	3,582	0,627		
	Source of Variance	*KT*	*SD*	*KO*		
	Between Groups	4,438	6	,740		
	In Group	98,439	299	,329		
	Total	102,877	305			

*p<0,05

When Table 13 is examined, when the activities that social studies teachers want to participate in related to natural disasters and NDL behavior levels are compared, it is seen that

the highest average (X=3.978) is Fire Drill. This is followed by Seminar-Conference (X=3.619), None (X=3.582), Earthquake Drill (X=3.434), Search-Rescue (X=3.376), Aid Campaign (X=3.350) and the lowest average belongs to teachers who want to participate in First Aid Training (X=3.325).

One-way ANOVA test was applied to test whether there is a significant difference between the NDL behavior levels of social studies teachers and the disaster-related activities they want to participate in. As a result of the application, it was seen that there is a significant difference between the NDL behavior levels of social studies teachers and the disaster-themed activities they want to participate in ($p=.039$, $p<0.05$). Post-Hoc analysis and Scheffe test were applied to determine the direction of the difference and the direction of the difference; Fire Drill - Seminar/Conference - None - Earthquake Drill - Search/Rescue - Aid Campaign - First Aid. The NDL behavior level of those who want to participate in the Fire Drill activity is higher than those who choose other activities.

Evaluation of NDL Affective Dispositions Scale Data

The NDL affective dispositions levels scores of the social studies teachers who participated in the study were determined and scored by five-point Likert analysis method as 'I completely agree (5 points), I agree (4 points), I am undecided (3 points), I disagree (2 points), I strongly disagree (1 point)'. Questions 16, 17, 18, 19, 20, 21, 22, 23 and 24 in the scale were reverse coded because they were negative.

Table 14

NDL Affective Dispositions Level Score Scale

Score Value	Level
1-2.33	Low
2.34-3.67	Medium
3.68-5.00	High

In order to determine the general score of the social studies teachers, the scores of their responses to the questionnaire statements were summed and their arithmetic mean were taken. In this context, the scores obtained were interpreted as follows; social studies teachers' NDL affective dispositions levels decrease as they approach 1 and increase as they approach 5. As seen in Table 14, those with a score value of 1-2.33 have 'Low', those with a score value of 2.34-3.67 have 'Medium', and those with a score value of 3.68-5.00 have 'High' literacy level.

Table 15

NDL Affective Dispositions Level Score Scale

NDL Affective Dispositions Level Score Averages	n	MEAN.±S.DEVIATION
	306	3.61±0.475

The overall average of social studies teachers' NDL affective dispositions level scores was calculated as 3.61 with a standard deviation of 0.47, and this mean value indicated that social studies teachers' NDL affective dispositions level was 'Medium'.

Table 16

The t-Test of the Difference Between the Marital Status of Social Studies Teachers and the Level of NDL Affective Dispositions

Dimension	Marital Status	n	X	SS	SD	t	P
NDL Affective Dispositions Level	Married	226	3,631	0,492	159,032	0,713	*,464**
	Single	80	3,586	0,425			

*p<0,05

Table 16 shows that the highest mean (X = 3,631) belongs to the group whose marital status is married when the NDL affective dispositions level of social studies teachers is compared according to their marital status.

In order to test whether there is a significant difference between the NDL affective dispositions level of social studies teachers and their marital status, t-test, which is a parametric test among statistical tests, was applied, but it was found that there was no significant difference.

Table 17

ANOVA Test of the Difference Between the Level of NDL Affective Dispositions According to Social Studies Teachers' Total Years of Employment

Dimension	Total Years of Working	n	X	SS	t	P
NDL Affective Dispositions Level	1-5 years	49	3,591	0,443	0,620	*,603**
	6-10 years	51	3,548	0,531		
	11-15 years	63	3,641	0,494		
	16 years and over	143	3,645	0,458		
	Source of Variance	*KT*	*SD*	*KO*		
	Between Groups	,422	3	,141		
	In Group	68,500	302	,227		
	Total	68,922	305			

*p<0,05

Table 17 shows that the highest mean (X=3,645) belongs to teachers with a total working year of 16 years or more, followed by teachers with a total working year of 11-15 years (X=3,641), 1-5 years (X=3,591) and the lowest mean belongs to teachers with a total working year of 6-10 years (X=3,548). This is followed by 11-15 years (X=3,641), 1-5 years (X=3,591) and the lowest mean belongs to teachers with 6-10 years (X=3,548).

As a result of One-Way ANOVA test, which is a parametric test among the statistical tests performed to test whether there is a significant difference between social studies teachers' NDL affective dispositions level and total working years, no significant difference was found.

Table 18

The t-Test of the Difference Between the Level of NDL Affective Dispositions of Social Studies Teachers According to Their Experience of Natural Disasters

Dimension	Disaster Experience	n	X	SS	SD	t	P
NDL Affective Dispositions Level	Yes	204	3,622	0,457	183,678	0,274	*,889**
	No	102	3,614	0,510			

*p<0,05

Table 18 shows that the highest mean (X=3,622) belongs to those who have experienced a natural disaster, while the mean (X=3,614) of those who have not experienced a natural disaster is low.

In order to test whether there is a significant difference between the level of NDL affective dispositions of social studies teachers and their disaster experience, t-test, which is a parametric test among statistical tests, was applied, but no significant difference was found.

Table 19

The t-test of the Difference Between the Level of NDL Affective Dispositions According to the Social Studies Teachers' Receiving Disaster Education at the University

Dimension	Receiving Disaster Education at University	n	X	SS	SD	t	P
NDL Affective Dispositions Level	Yes	164	3,611	0,477	298,430	0,054	*,745**
	No	142	3,629	0,474			

*p<0,05

Table 19 shows that the highest mean (X=3,629) belongs to those who did not take a course on natural disasters at university, while the mean (X=3,611) of those who took a course on natural disasters at universities is low.

In order to test whether there is a significant difference between social studies teachers' NDL affective dispositions level and their taking courses on natural disasters at university, t-test, which is a parametric test, was applied, but no significant difference was found.

Table 20

The t-test of the Difference Between the Level of NDL Affective Dispositions of Social Studies Teachers According to Their Knowledge of the Disaster Plan of the School Where They Work

Dimension	Knowing School Disaster Plan	n	X	SS	SD	t	P
NDL Affective Dispositions Level	Yes	194	3,671	0,481	243,253	0,160	*,011**
	No	112	3,529	0,453			

*p<0,05

In Table 20, when the NDL affective dispositions level of social studies teachers is compared according to their knowledge of the disaster plan of the school they work in, it is seen that the mean of those who know the disaster plan of the school they work in (X=3,671) is higher than those who do not (X=3,529).

A t-test was applied to test whether there was a significant difference between social studies teachers' level of NDL affective dispositions and their knowledge of the disaster plan of the school where they work. As a result of the t-test, it was seen that there was a significant relationship between social studies teachers' level of NDL affective dispositions and their knowledge of the disaster plan of the school where they work (p=.011, p<0.05). In this case, it was determined that social studies teachers who knew the disaster plan of the school where they worked had higher levels of NDL affective dispositions than those who did not.

Table 21

The t-Test of the Difference Between the Level of NDL Affective Dispositions of Social Studies Teachers According to Their Participation in Activities Related to Natural Disasters

Dimension	Participation in Natural Disaster Related Activities	n	X	SS	SD	t	P
	Yes	216	3,636	0,477	168,532	0,022	*,338**

NDL Affective Dispositions Level	No	90	3,579	0,471			

*p<0,05

In Table 21, when the level of NDL affective dispositions of social studies teachers according to their participation in activities related to natural disasters is compared, it is seen that the mean of those who participate in activities related to natural disasters (X=3,636) is higher than those who do not (X=3,579).

In order to test whether there is a significant difference between social studies teachers' level of NDL affective dispositions and their participation in activities related to natural disasters, t-test was applied. As a result of the t-test, it was observed that there was no significant relationship between social studies teachers' level of NDL affective dispositions and their participation in activities related to natural disasters.

Table 22

The t-test of the Difference Between the Level of NDL Affective Dispositions of Social Studies Teachers According to Their Knowledge of the Emergency Assembly Area

Dimension	**Knowing the Emergency Assembly Area**	**n**	**X**	**SS**	**SD**	**t**	**P**
NDL Affective Dispositions Level	Yes	259	3,618	0,472	61,894	0,780	*,946**
	No	47	3,623	0,498			

*p<0,05

Table 22 shows that the highest mean (X=3,623) belongs to those who do not know the emergency assembly area of the school where they work and the mean of those who know the emergency assembly area (X=3,618) is low. In order to test whether there is a significant difference between social studies teachers' NDL affective dispositions level and their knowledge of the emergency meeting place of the school where they work, t-test, which is a parametric test among statistical tests, was applied, but no significant relationship was found.

Table 23

ANOVA Test of the Difference Between Social Studies Teachers' NDL Affective Dispositions Level According to the Activities They Wanted to Participate in Related to Disaster

Dimension	**Disaster Related Activity Wanted to Participate**	**n**	**X**	**SS**	**t**	**P**
	Seminar-Conference	*41*	*3,821*	*0,565*	*1,614*	*,143**

NDL Affective Dispositions Level	Earthquake drill	45	3,616	0,475
	Fire drill	4	3,450	0,389
	First aid training	101	3,577	0,461
	Aid campaign	20	3,530	0,405
	Search and rescue	80	3,598	0,430
	None	15	3,634	0,565
	Source of Variance	*KT*	*SD*	*KO*
	Between Groups	2,162	6	,360
	In Group	66,760	299	,223
	Total	68,922	305	

*p<0,05

When Table 23 is analysed, it is seen that the highest mean (X=3,821) is Seminar-Conference, followed by None (X=3,634), Earthquake Drill (X=3,634), Search and Rescue (X=3,616), Search and Rescue (X=3,598), First Aid (X=3,577). This is followed by None (X=3,634), Earthquake Drill (X=3,616), Search and Rescue (X=3,598), First Aid (X=3,577), Aid Campaign (X=3,530) and the lowest mean is Fire Drill (X=3,450).

One-Way ANOVA test was applied to test whether there was a significant difference between the level of social studies teachers' NDL affective dispositions and the activity they wanted to participate in related to disaster. As a result of the ANOVA test, it was seen that there was no significant difference between the level of social studies teachers' NDL affective dispositions and the disaster-related activities they wanted to participate in.

Evaluation of NDL Achievement Test Data

Tablo 24

NDL Achievement Test Score Range

	n	**%**	**Stacked %**
Low Score (0-6 Score)	2	0,7	0,7
Medium Score (7-18 Score)	46	15,0	15,7
High Score (19-24 Score)	258	84,3	100,0
Total	306	100,0	

According to the results of the achievement test of 306 social studies teachers who answered the questionnaire; 2 teachers were in the low score range between 0-6 points, 46 teachers were in the medium score range between 7-18 points and 258 teachers were in the high score range between 19-24 points.

A 24-question multiple-choice test was applied to measure the achievement levels of the social studies teachers participating in the study. The test was evaluated and subjected to statistical analysis.

Table 25

NDL Achievement Level Score Scale

Score Value	Level
0-20	Very low
21-40	Low
41-60	Medium
61-80	High
81-100	Very high

The achievement level achievement scores of social studies teachers were organised into five groups. Those who scored between 0-20 are in the 'Very Low' group, those who scored between 21-40 are in the 'Low' group, those who scored between 41-60 are in the 'Medium' group, those who scored between 61-80 are in the 'High' group, and those who scored between 81-100 are in the 'Very High' group.

Table 26

NDL Achievement Level Score Means

NDL Achievement Level Score Means	n	MEAN.±S.DEVIATION
	306	86.61±0.134

The overall mean of social studies teachers' NDL achievement level scores was calculated as 86.61 with a standard deviation of 0.134, and this mean value reveals that social studies teachers' natural disaster literacy achievement level is 'Very High'.

Table 27

The t-Test of the Difference Between the Marital Status of Social Studies Teachers and NNL Achievement Level

Dimension	Marital Status	n	X	SS	SD	t	P
NDL Achievement Level	Married	226	86,358	14,781	174,165	0,983	*,597**
	Single	80	87,325	11,663			

*p<0,05

Table 27 shows that when the marital status of social studies teachers and NDL achievement level are compared, the highest mean (X = 87,325) belongs to the group whose marital status is single.

In order to test whether there is a significant difference between the NST achievement level of social studies teachers and their marital status, t-test, which is a parametric test among statistical tests, was applied and no significant difference was found.

Table 28

ANOVA Test of the Difference Between Social Studies Teachers' Total Years of Employment and NDL Achievement Levels

Dimension	**Total Years of Working**	**n**	**X**	**SS**	**t**	**P**
NDL Achievement Level	1-5 years	49	86,940	9,364	0,286	*,835**
	6-10 years	51	86,480	16,331		
	11-15 years	63	85,222	13,304		
	16 years and over	143	87,153	14,883		
	Source of Variance	*KT*	*SD*	*KO*		
	Between Groups	2,365	2	1,183		
	In Group	3424,253	303	11,301		
	Total	3426,618	305			

*p<0,05

When the total working years of social studies teachers and NDL achievement are compared in Table 28, it is seen that the highest mean (X=87,153) belongs to teachers with 16 years or more of total working years. This is followed by 1-5 years (X=86,940), 6-10 years (X=86,480) and the lowest average belongs to teachers with 11-15 years (X=85,522).

As a result of One-Way ANOVA test, which is a parametric test among the statistical tests performed to test whether there is a significant difference between the NDL achievement level of social studies teachers and their total working years, no significant difference was found.

Table 29

The t-Test of the Difference between the NDL Achievement Level of Social Studies Teachers According to Their Experience of Natural Disasters

Dimension	**Disaster Experience**	**n**	**X**	**SS**	**SD**	**t**	**P**
NDL Achievement Level	Yes	204	86,970	14,090	204,066	0,000	*,527**
	No	102	85,892	13,923			

*p<0,05

Table 29 shows that the highest mean (X=86,970) belongs to those who have experienced natural disasters, while the mean (X=85,892) of those who have not experienced natural disasters is lower.

In order to test whether there is a significant difference between the NDL achievement levels of social studies teachers and their disaster experience, t-test, which is a parametric test among statistical tests, was applied, but no significant difference was found.

Table 30

The t-test of the Difference between the NDL Achievement Level of Social Studies Teachers According to their Disaster Education at the University

Dimension	Receiving Disaster Education at University	n	X	SS	SD	t	P
NDL Achievement Level	Yes	164	87,408	12,714	274,354	0,955	*,286**
	No	142	85,690	15,388			

*p<0,05

Table 30 shows that the highest mean (X=87,408) belongs to those who took a course on natural disasters at the university and the lowest mean (X=85,690) belongs to those who did not take a course on natural disasters at the university.

In order to test whether there is a significant difference between the NDL achievement level of social studies teachers and their taking courses on natural disasters at university, t-test, which is a parametric test, was applied, but no significant difference was found.

Table 31

The t-Test of the Difference Between the NDL Achievement Level of Social Studies Teachers According to Their Knowledge of the Disaster Plan of the School Where They Work

Dimension	Knowing School Disaster Plan	n	X	SS	SD	t	P
NDL Achievement Level	Yes	194	86,288	14,693	257,508	0,870	*,597**
	No	112	87,169	12,819			

*p<0,05

According to Table 31, when the NDL achievement level of social studies teachers is compared according to their knowledge of the disaster plan of the school where they work, it is

seen that the mean of those who do not know the disaster plan of the school where they work (X=87,169) is higher than those who do (X=86,288).

In order to test whether there is a significant difference between social studies teachers' level of achievement in NDL and their knowledge of the disaster plan of the school where they work, t-test was applied. As a result of the t-test, it was observed that there was no significant relationship between the NDL achievement level of social studies teachers and their knowledge of the disaster plan of the school where they work.

Table 32

The t-test of the Difference Between Social Studies Teachers' NDL Achievement Level According to Their Participation in Activities Related to Natural Disasters

Dimension	Participation in Natural Disaster Related Activities	n	X	SS	SD	t	P
NDL Achievement Level	Yes	216	86,740	14,199	172,136	0,096	*,803**
	No	90	86,300	13,659			

*p<0,05

In Table 32, when the NDL achievement level of social studies teachers is compared according to their participation in activities related to natural disasters, it is seen that the mean of those who participate in activities related to natural disasters (X=86,740) is higher than those who do not (X=86,300).

In order to test whether there is a significant difference between the NDL achievement level of social studies teachers and their participation in activities related to natural disasters, t-test was applied. As a result of the t-test, it was observed that there was no significant relationship between social studies teachers' achievement level in NDL and their participation in activities related to natural disasters.

Table 33

The t-test of the Difference between the NDL Achievement Level of Social Studies Teachers According to Their Knowledge of Emergency Assembly Area

Dimension	Knowing the Emergency Assembly Area	n	X	SS	SD	t	P
NDL	Yes	259	86,907	14,309	70,389	0,061	*,387**
	No	47	84,978	12,326			

Achievement Level						

*p<0,05

Table 33 shows that the highest mean (X=86,907) belongs to those who know the emergency assembly area of the school where they work, while the mean of those who know the emergency assembly area is low (X=84,978).

In order to test whether there is a significant difference between social studies teachers' level of achievement in NDL and their knowledge of the emergency assembly area of the school where they work, t-test, which is a parametric test among statistical tests, was applied, but no significant difference was found.

Table 34

ANOVA Test of the Difference Between Social Studies Teachers' NDL Achievement Level According to the Activities They Wanted to Participate in Related to Disaster

Dimension	**Disaster Related Activity Wanted to Participate**	**n**	**X**	**SS**	**t**	**P**
NDL Achievement Level	Seminar-Conference	41	83,048	16,755	2,310	*,034**
	Earthquake drill	45	85,488	17,635		
	Fire drill	4	85,200	13,881		
	First aid training	101	85,990	13,813		
	Aid campaign	20	87,050	8,720		
	Search and rescue	80	90,937	9,516		
	None	15	80,666	17,178		
	Source of Variance	*KT*	*SD*	*KO*		
	Between Groups	139,239	3	46,413		
	In Group	3287,378	302	10,885		
	Total	3426,618	305			

*p<0,05

Table 34 shows that the highest mean (X=90,937) was Search and Rescue (X=90,937), followed by Relief Campaign (X=87,050), First Aid (X=85,990), Earthquake Drill (X=85,488), Fire Drill (X=85,488). This is followed by Aid Campaign (X=87,050), First Aid (X=85,990), Earthquake Drill (X=85,488), Fire Drill (X=85,200), Seminar-Conference (X=83,048) and the lowest average is None (X=80,666).

One-way ANOVA test was applied to test whether there is a significant difference between the level of achievement of social studies teachers in NDL and the activity they wanted to participate in related to disaster. As a result of the ANOVA test, it was seen that there was a significant difference between the NST achievement level of social studies teachers and the disaster-related activities they wanted to participate in (p=,034, p<0,05). Post-Hoc analysis,

Scheffe test was applied to determine the direction of the difference and the direction of the difference was as follows: Search and Rescue - Aid Campaign - First Aid - Earthquake Drill - Fire Drill - Seminar/Conference - None. The NDL achievement level of those who want to participate in Search and Rescue activities is higher than those who choose other activities.

Results and Discussion

In this study, the NDL levels of social studies teachers were tried to be determined in terms of various variables. According to the findings of the study, social studies teachers' natural disaster literacy achievement levels are high, while their behavioural and affective dispositions levels are close to medium low. When the related literature is analysed, it is seen that almost all of the studies have the same situation. This shows us that social studies teachers who have knowledge about natural disasters cannot transform this knowledge into behaviour. In parallel with our study, Türker and Sözcü (2021), in their study on geography teachers, found that the participants' natural disaster literacy levels were high, but the behavioural dimension of NDL was at a medium level. Torlak (2021), in his study on pre-service social studies teachers, stated that the participants' level of transforming their knowledge about disasters into behaviour was low. In addition, Ajar (2023) concluded in his study on geography teachers that the natural disaster achievement levels of the participants were good, but it was necessary to match this with the ability to cope with disaster.

According to the findings obtained as a result of statistical analysis of the data obtained from social studies teachers, there was no significant difference between the natural disaster behaviour levels of social studies teachers and marital status, total years of employment, experiencing a disaster, receiving training on disaster at university, and knowing the emergency assembly area of the school. On the other hand, the natural disaster literacy behaviour levels of those who know the disaster plan of the school where they work, those who have participated in training on natural disasters, and those who choose ‘Fire Drill’ among the activities they want to participate in related to natural disasters are high. Similarly, Demirdelen (2020) concluded in his study on primary/secondary school teachers that the NDL levels of teachers who wanted to participate in fire drills were high.

It was observed that there was no significant difference between the level of natural disaster affective dispositions of social studies teachers and their marital status, total working years, experiencing a disaster, receiving training on disaster at university, participating in activities related to natural disasters, knowing the emergency assembly area of the school where

they work, and the activities they wanted to participate in related to natural disasters. However, only the social studies teachers who knew the disaster plan of the school where they were working had high levels of NDL affective dispositions. In a study conducted by Genç, Yıldız, Kaya & Bilgili (2022) on participants aged 18-60, it was concluded that more than half of the participants had insufficient/medium level of disaster literacy. Similarly, Lathifa & Putra (2022), in their study on Indonesian students, stated that the disaster literacy levels of the students were at a medium level with a tendency to be low.

There is no significant difference between the natural disaster achievement levels of social studies teachers and their marital status, total working years, experiencing a disaster, receiving disaster education at university, knowing the disaster plan of the school where they work, participating in activities related to natural disasters, and knowing the emergency gathering place of the school where they work. Similarly, Vu et al. (2023), in a study conducted on high school students, stated that NDL knowledge, perception and skills are above average and the highest average belongs to knowledge. Logayah et al. (2023), in their study on secondary school students, stated that students' NDL achievement dimension was high, behaviour dimension was medium and skill dimension was low. Unlike our study, Zengin (2021), in his study on pre-service social studies teachers, stated that the participants had negative views on the education they received about natural disasters, the inclusion of the concept of disaster in the curriculum and the creation of disaster awareness in individuals. Uzunyol (2013), in his research on secondary school students, stated that students who had experienced disasters before had higher natural disaster knowledge levels than those who had not experienced disasters. Sucu (2021), in his study on 11th grade students, revealed that students do not have sufficient knowledge about the distribution of natural disasters on earth. It is seen that those who choose ‘Search and Rescue’ in the activities they want to participate in related to natural disasters have high natural disaster literacy achievement levels.

Recommendations

Although the achievement level of social studies teachers in NDL is “Very High”, the level of NDL behavioral and affective dispositions is close to “Medium”. It is essential for teachers, who will instill natural disaster awareness in students, not only to have theoretical knowledge about natural disasters, but also to transform their knowledge about the subject into behavior and to transfer knowledge to their students in this way in order to create this awareness in the society. In addition, in order to transform the level of natural disaster literacy knowledge

into behavior, applied and project-based teaching should be adopted while teaching courses on natural disasters in schools.

Social studies teachers who know the disaster plan of the school where they work have high natural disaster literacy levels. Therefore, teachers should be informed about the natural disaster plan. In addition, social studies teachers who participate in activities related to natural disasters have high natural disaster literacy levels. In this context, it is necessary to ensure that teachers participate in activities organized related to natural disasters in order to increase the level of natural disaster literacy.

The study was conducted to measure the natural disaster literacy levels of social studies teachers working in secondary schools and imam hatip secondary schools in the central districts of Ankara province. It is thought that it would be useful to conduct similar studies in other provinces. The study was applied to social studies teachers working in public schools, but it can also be conducted on social studies teachers working in private education institutions. In the study, a questionnaire was used as a data collection tool. The study can also be conducted using different techniques such as observation and interviews. It is also possible to focus on the applicability of research on NDL in educational institutions in other countries in our country.

Ethical Committee Approval

The necessary permissions were obtained from the researcher who developed the measurement tool for the data collection tool (Survey) used in this study. It is also stated by reference in the method section of the study.

In the meeting of Gazi University, Ethics Committee dated 13/02/2024 and numbered 03, it was decided that the study titled ‘Investigation of Social Studies Teachers’ Natural Disaster Literacy Levels in Terms of Various Variables (The Case of Ankara Province)’ was ethically appropriate. The ethics commission research code of the related research is 2024-259.

References

Ajar, S.B. (2023). Identification of geography teacher competency in the disaster literacy. IOP Conf. Series: Earth and Environmental Science, Vol. 1190, 1-7. 25.07.2024 tarihinde https://iopscience.iop.org/article/10.1088/1755-1315/1190/1/012048 sayfasından erişilmiştir.

Demirdelen, S. (2020). *Osmaniye ili merkez ilçesinde görev yapan ilkokul/ortaokul öğretmenlerinin doğal afet okuryazarlık düzeylerinin belirlenmesi*. Yayınlanmamış Yüksek Lisans Tezi, Gümüşhane Üniversitesi Sosyal Bilimler Enstitüsü.

Dikmenli, Y. & Gafa, İ. (2017). Farklı Eğitim Kademelerine Göre Afet Kavramı. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi,* 44, 21-36. 08.08.2023 tarihinde https://www.researchgate.net/publication/321976233_Farkli_Egitim_Kademelerine_Gore_Afet_Kavrami#fullTextFileContent sayfasından erişilmiştir.

Genç, F.Z., Yıldız, S., Kaya, E. & Bilgili, N. (2022). Disaster literacy levels of individuals aged 18–60 years and factors affecting these levels: A web-based cross-sectional study. *International Journal of Disaster Risk Reduction*, 76, 1-9.

Karaca, H. (2018). *Örgütlerde personel güçlendirme ve milli eğitim örgütünde personel güçlendirme yaklaşımının belirlenmesine yönelik bir uygulama*. Yayınlanmamış Yüksek Lisans Tezi, Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü.

Lathifa, E. & Putra, R. D. (2022). Disaster Literacy Level of Indonesian College Students in Izmir, Turkiye. *Social Science Research Network,*1-14. https://ssrn.com/abstract=4211467 veya http://dx.doi.org/10.2139/ssrn.4211467.

Logayah, D.S., Maryani, E., Ruhimat, M. & Wiyanarti, E. (2023). Investigating natural disaster literacy levels. *Earth And Environmental Science*, 1314, 1-10. 12.07.2024 tarihinde https://iopscience.iop.org/article/10.1088/1755-1315/1314/1/012008 sayfasından alınmıştır.

Seçer, İ. (2015). *SPSS ve LISREL ile pratik veri analizi*, 2. Baskı, Anı Yayıncılık, Ankara.

Sözcü, U. (2019). *Öğretmen adaylarının doğal afet okuryazarlık düzeylerinin belirlenmesi.* Yayınlanmamış Doktora Tezi, Kastamonu Üniversitesi Sosyal Bilimler Enstitüsü.

Sucu, H. (2021). *11. sınıf öğrencilerinin doğal afetlere yönelik bilişsel yapılarının kelime ilişkilendirme testi yoluyla incelenmesi.* Yayınlanmamış Yüksek Lisans Tezi, Necmettin Erbakan Üniversitesi, Eğitim Bilimleri Enstitüsü.

Tabachnick B.G. & Fidell, L.S. (2013). *Using multivariate statistics*. Pearson.

Tekindal, S. (2021). *Nicel, nitel, karma yöntem araştırma desenleri ve istatistik.* Nobel Akademik yayıncılık.

Torlak, V. (2021). *Sosyal bilgiler öğretmen adaylarının afetlere yönelik farkındalıklarının incelenmesi.* Yayınlanmamış Yüksek Lisans Tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü.

Türker, A. & Sözcü, U. (2021). Examining natural disaster literacy levels of pre-service geography teachers. Journal of Pedagogical Research, 5(2), 207-221.

Uygun Seven, B. (2022). *Fen bilgisi öğretmen adaylarının doğal afet okuryazarlığı ile afet bilinci algı düzeylerinin çeşitli değişkenlere göre incelenmesi.* Yüksek Lisans Tezi, Kahramanmaraş Sütçü İmam Üniversitesi Fen Bilimleri Enstitüsü..

Uzunyol, B. (2013). *8. sınıf öğrencilerinin doğal afetler hakkındaki bilgi düzeylerinin çeşitli değişkenlere göre incelenmesi.* Yayınlanmamış Yüksek Lisans Tezi, Niğde Üniversitesi, Eğitim Bilimleri Enstitüsü.

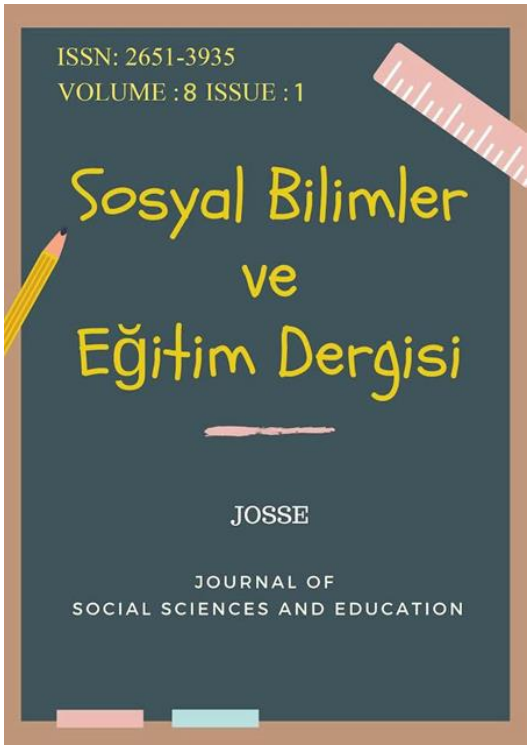
Üstündağ, Y. (2022). *Bitlis ilinde görev yapan özel eğitim okul öğretmenlerinin doğal afet okuryazarlık düzeylerinin belirlenmesi.* Yüksek Lisans Tezi, Bitlis Eren Üniversitesi Lisansüstü Eğitim Enstitüsü.

Vu, B.D., Nguyen, H.T., Dinh, H.V.T., Nguyen, Q.A.N. & Ha, X.V. (2023). Natural disaster prevention literacy education among vietnamese high school students. *Education Sciences,* 13(262), 1-17.

Yalçın, E. (2016*). Ofis çalışanlarının işletmelerin uyguladıkları sosyal sorumluluğa ilişkin algı düzeylerinin belirlenmesi*. Yüksek Lisans Tezi, Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü.

Zengin, S. (2021). Sosyal bilgiler *öğretmen adaylarının doğal afetlere yönelik görüşlerinin incelenmesi: Amasya Üniversitesi örneği.* Yüksek Lisans Tezi, Amasya Üniversitesi Sosyal Bilimler Enstitüsü.

JOURNAL OF SOCIAL SCIENCES AND EDUCATION (JOSSE)



https://dergipark.org.tr/tr/pub/josse

**This article is derived from the thesis with the same title.*

Social Studies Teachers' Views on the Contribution of Academic Research to Their Professional Development

Melih YILDIRIM [1]
Yıldız Technical University, Social Studies Education Department
Master's Degree Student
melih.yildirim0061565@gmail.com
Orcid ID: 0009-0007-9831-8496

Şahin ORUÇ [2]
Yıldız Technical University, Faculty of Educatıon, Department of Turkısh and Socıal Scıences Educatıon
Prof. Dr.
sahinoruc44@hotmail.com
Orcid ID: 0000-0001-8666-3654

Article Type: Research Article
Received: 0.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Citation: Yıldırım, M., & Oruç, Ş. & Surname, N. (2025). Social studies teachers' views on the contribution of academic research to their professional development. *Journal of Social Sciences and Education*, 8(1), 65-80.

Social Studies Teachers' Views on the Contribution of Academic Research to Their Professional Development*

Melih YILDIRIM [1]

Yıldız Technical University, Faculty of Education, Social Studies Education Department

Şahin ORUÇ [2]

Yıldız Technical University, Faculty of Educatıon, Department of Turkısh and Socıal Scıences Education

Abstract

The views and thoughts of Social Studies Teachers on the contribution of academic research, especially master's and doctoral theses, to their professional development were examined within the scope of the study. Within the scope of the research, face-to-face interviews were conducted with 20 Social Studies Teachers working in Yozgat province by asking interview questions prepared by the researcher. The answers obtained were analyzed with the content analysis method. Striking results as a result of the data analysis are that Social Studies Teachers do not conduct academic research, and when they want to conduct any scientific research, whether related to their field or outside of it, the first source they turn to is the internet. Yıldırım, İlhan, Şekerci and Sözbilir (2013) emphasized the importance of teachers following academic research for their professional development. Can (2004) stated that an idealistic teacher always questions his/her own competencies, enters into a self-accounting process and should see change and development as a necessary process. In this context, the Ministry of National Education, the Council of Higher Education and universities have some responsibilities. In particular, the Ministry of National Education should financially support research teachers.

Research Article

Received: 9.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Keywords: Social Studies, Academic Research, Master's Degree, Teacher, Professional Development

**This article is derived from the thesis with the same title.*

[1] Corresponding author:
Master's Degree Student
melih.yildirim0061565@gmail.com
Orcid ID: 0009-0007-9831-8496
[2]*Prof. Dr.*
sahinoruc44@hotmail.com
Orcid ID:0000-0001-8666-3654

Introduction

Change is due to the fact that life is a dynamic process. Unstoppable and unstoppable change can only be managed positively. Teachers are practicing one of the professions that requires them to manage the change and development they will experience professionally in the best way possible and to do their job with a teaching approach that is appropriate for current conditions. Numanoğlu (1999) stated that teachers should keep their knowledge up-to-date, especially as a requirement of living in an information society today. Because keeping themselves up-to-date will also serve to ensure that the students they offer educational activities to receive up-to-date education. Russell (1926) drew attention to the fact that the education and training provided to students should be up-to-date by saying, "The sum of human knowledge and the complexity of human problems are increasing day by day; for this reason, each generation should review its own educational methods, if time is found for new ones." According to Büyükkaragöz et al. (1998), the teacher has a great responsibility in this regard. The quality and competence of the teacher are the leading factors in achieving the determined goals in educational activities. According to Kılıç (2006), one of the primary duties of teachers is to create effective learning environments and diversify the teaching methods they apply in a way that appeals to every student.

Yıldırım et all (2013) emphasized the importance of teachers following academic research for their professional development. Can (2004) stated that an idealistic teacher always questions his/her own competencies, enters into a self-accounting process and should see change and development as a necessary process. Stenhouse (1975) did not look favorably on the system where an expert produces information and the teacher transfers it to practice and argued that teachers should do research and practice together. Martimore (2000) argued that teachers' professional development is important and necessary and stated that teachers should follow educational research for their professional development and provide education in their classes in line with the results of these studies. It is extremely important for teachers to attach importance to their professional development, to follow publications that will help them improve themselves in this direction, and to reflect these changes and transformations they have made in themselves in the teaching they carry out in the classroom environment. Indeed, there are many other studies that draw attention to this issue.

Artvinli (2020) stated that teachers should not only be the ones who apply the results of academic research, but also the ones who carry out the academic research themselves.

Yavuz-Konokman, Tanrıseven, Karasolak (2013) expect teachers to be individuals who love learning, researching and questioning, and who develop themselves professionally.

It is not only a recommendation that teachers should constantly update themselves professionally and give importance to their development, but also a legal obligation according to the relevant legislation. In this sense, it can be said that legal regulations define teachers as a "career profession" and, based on this definition, require teachers to be in a constant state of professional change and development. Indeed, in Article 5 of the Teaching Profession Law No. 7528 titled "Teachers' rights, duties and responsibilities"; The following statements are included: ‘’He/she uses in-school and out-of-school opportunities for effective implementation of educational activities.’’ and ‘’He/she improves himself/herself professionally without disrupting educational activities and responsibilities in the educational institution he/she works in.’’ Similarly, the importance of teachers’ professional development and the duties and responsibilities of teachers and the Ministry of National Education are stated in the National Education Fundamental Law No. 1739.

The sub-objectives of the research are mainly as follows;

1. Which sources do you use when conducting an academic research? Do you use it?
2. How do you access academic research on Social Studies?
3. Do you follow academic research on Social Studies? If so, for what purpose do you follow it?
4. Do you use master's and doctoral theses in the Social Studies courses you take? If so, to what extent and how do you use them?
5. To what extent and how do master's and doctoral theses contribute to your professional development?
6. Are the academic researches conducted so far on the Social Studies course sufficient? If you think they are not sufficient, which topics should be researched on?

Method

Model

The method of the research is qualitative research method. Since the research was carried out in the form of interviews, it was thought that it would be more appropriate to work

with qualitative research methods. Data analysis was carried out by content analysis. Maximum variation sampling method was used.

Working Group

The universe of the research is all Social Studies Teachers working in official institutions affiliated with the Ministry of National Education in Turkey. The sample is a total of 20 Social Studies Teachers, 5 teachers from each district of Merkez, Sorgun, Sarıkaya and Boğazlıyan in Yozgat province. Care was taken to ensure that the teachers participating in the study were equally distributed in terms of gender. In this context, interviews were conducted with 10 male and 10 female Social Studies teachers. In terms of professional seniority, it was aimed to create a diversity that would represent almost every seniority group. In this context, interviews were conducted with 4 teachers with 0-5 years of seniority, 6 with 6-10 years, 3 with 11-15 years, 4 with 15-20 years, and 4 with 20 years and above.

Data Collection Tool

The data collection tool is an interview form with 6 questions. The following steps were taken in the preparation process of the questions in the interview form:

1. The questions were prepared by the researcher.
2. They were presented to the views and suggestions of the advisor faculty member.
3. They were rearranged with the views and suggestions of the advisor faculty member and given their final form.
4. In addition, it was examined by the Yıldız Technical University Ethics Commission during the process of obtaining the Ethics Committee Permission and was deemed appropriate, and it was also examined by the Yozgat Provincial Directorate of National Education during the process of obtaining the research permit. No technical or ethical problems were found regarding the questions in the form.

The following questions in the interview form were directed to the participants;

1. Which sources do you use when conducting an academic research? Do you use it?
2. How do you access academic research on Social Studies?
3. Do you follow academic research on Social Studies? If so, for what purpose do you follow it?

4. Do you use master's and doctoral theses in the Social Studies courses you take? If so, to what extent and how do you use them?
5. To what extent and how do master's and doctoral theses contribute to your professional development?
6. Are the academic researches conducted so far on the Social Studies course sufficient? If you think they are not sufficient, which topics should be researched on?

Collection of Data and Analysis

Face-to-face interviews were conducted with 20 Social Studies teachers, the questions in the interview form were asked, the responses given by the teachers were noted by the researcher, and the responses obtained from the interviews were analyzed using the content analysis method.

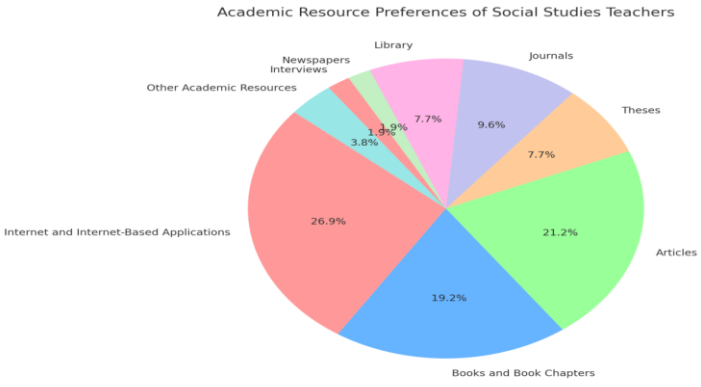
Ethical Committee Approval

Permission was requested from Yıldız Technical University Ethics Committee for the study, and the relevant permission was given with the decision taken at the Ethics Committee meeting dated 03.03.2025 and numbered 2025.03.

Findings

The first question asked within the scope of the interview was "Which sources do you use when conducting academic research?". The results in Graph 1 were reached with the content analysis conducted in line with the responses given by the teachers to the question.

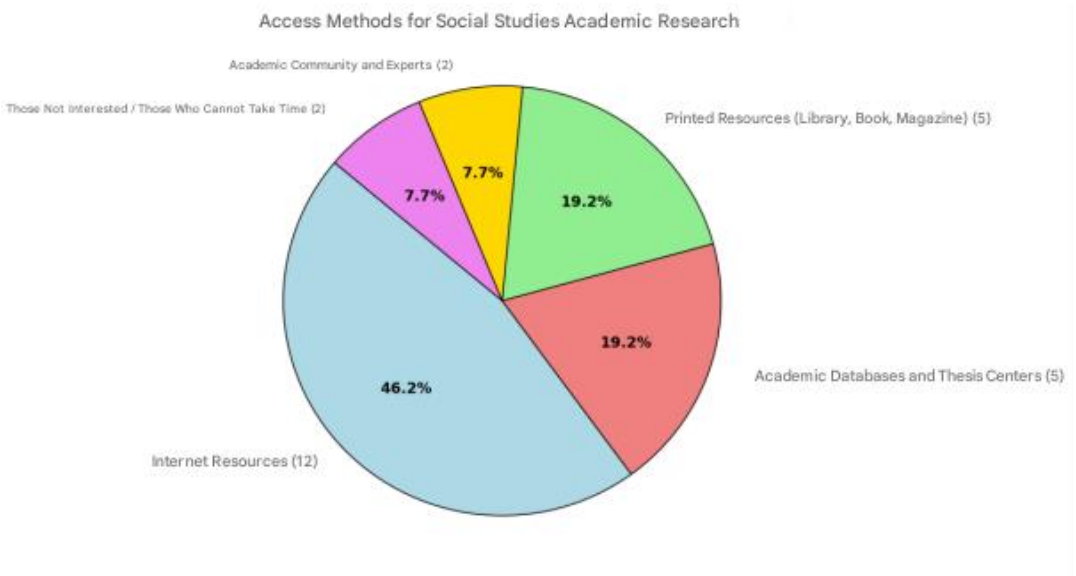
Graph-1



When the results are examined, it is seen that the source that Social Studies Teachers refer to most when conducting academic research is the Internet and Internet-Based Applications with 26.9%. In the study conducted by Yıldırım, İlhan, Şekerci and Sözbilir (2013), teachers stated that they mostly do their research on the Internet.

For this reason, it was stated in the study that the Ministry of National Education and universities should give importance to the internet in sharing information. This result, which emerged since our age is the age of technology, is understandable. After the internet, the most prominent responses were articles with 21.2% and books and book chapters with 19.2%.was **"How do you access academic research on Social Studies?" The analysis results of the answers given to the question are shown in Graph-2.**

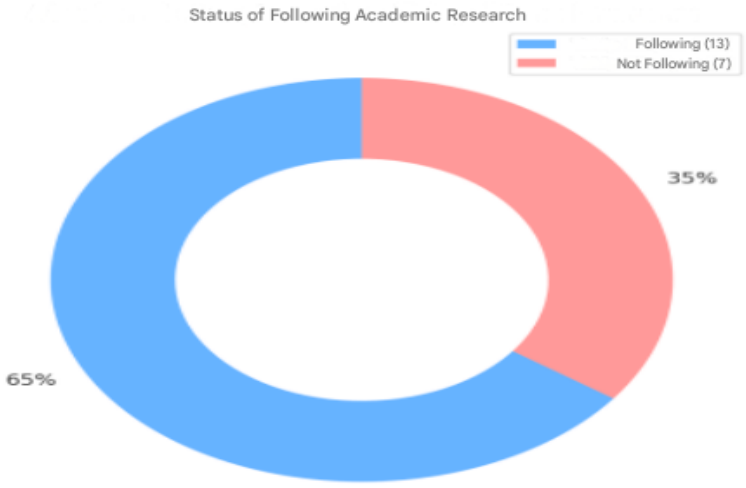
Graph-2



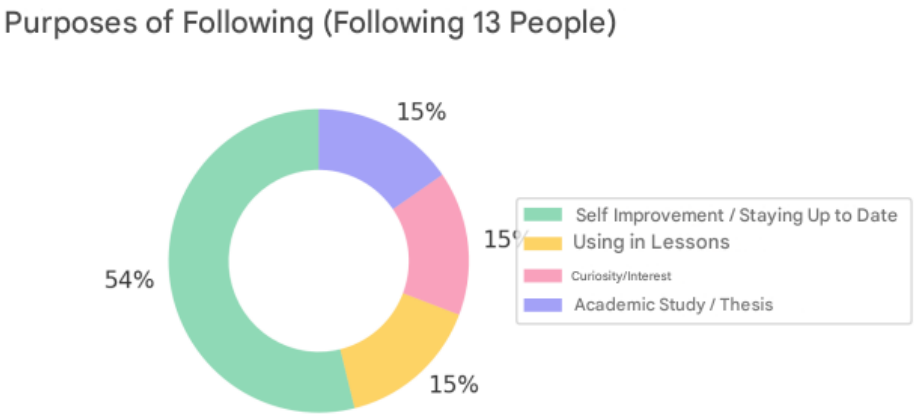
In this question, the first question is a bit more specific. It was aimed to learn from which sources Social Studies Teachers follow academic researches related to their fields. When the analysis results are examined, it is seen that Internet Resources are the source that Social Studies Teachers use the most with 46.2% while following academic researches in the literature. In fact, this situation is not seen only in Social Studies Teachers. It is known that in many academic studies, teachers/teacher candidates first turn to the internet while doing academic researches related to their fields. After the Internet, 19.2% of the participating Social Studies Teachers stated that they follow Academic Databases and Thesis Centers and Printed Resources for research in the literature.

Was **"Do you follow academic research on Social Studies? If so, for what purpose? " The analysis results of the answers given are given in Graph-3.1 and Graph-3.2.**

Graph- 3.1



Graph 3.2

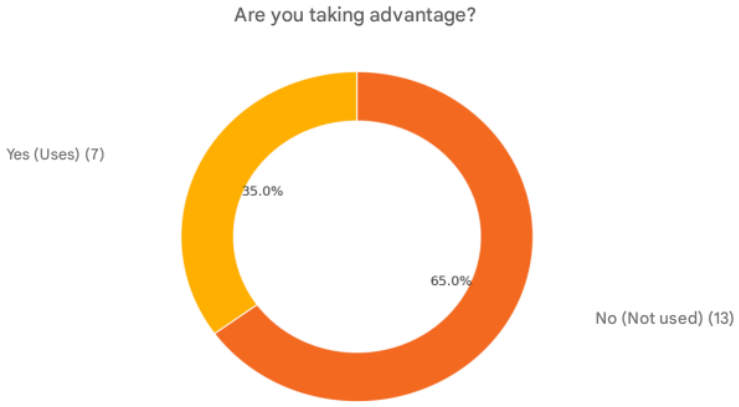


Çelikten, Şanal and Yeni (2005) stated that it is not possible for a teacher who does not learn continuously to provide education that is appropriate for current conditions. The first part of the question, which is whether they follow the research in the literature, was answered by 65% of the participating Social Studies Teachers as Yes and 35% as No. Based on these results, it can be said that the vast majority of Social Studies Teachers follow the academic research in the literature. In many studies conducted in the literature, the disinterest and non-following of teachers/teacher candidates in academic research has been determined. However, when it is considered that the participating Social Studies Teachers in the study significantly reflect the universe, we are faced with a different result than the results of the studies in the

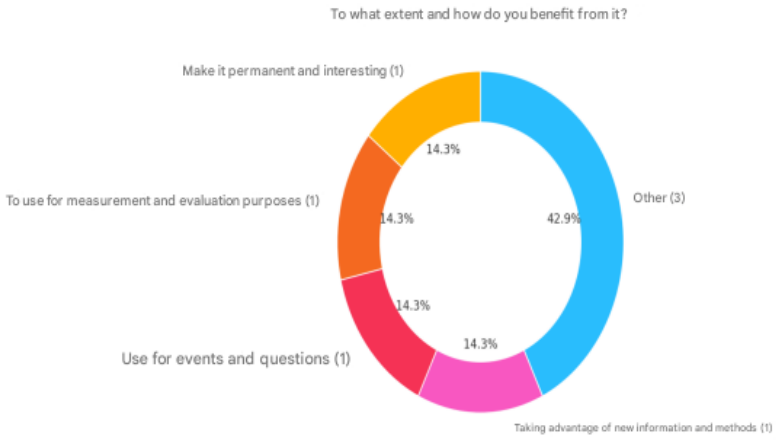
literature. When asked for the purpose of following, 55% of the participants answered "Self-Improvement/Staying Updated". 15% stated that they followed for "Using in Classes", 15% for "Curiosity/Interest" and 15% for "Academic Study/Thesis".

The fourth question asked during the interview was **" Do you use master's and doctoral theses in the Social Studies courses you take? If so, to what extent and how do you use them? "** The analysis of the answers given is given in Graphs 4.1 and 4.2.

Graph 4.1



Graph 4.2

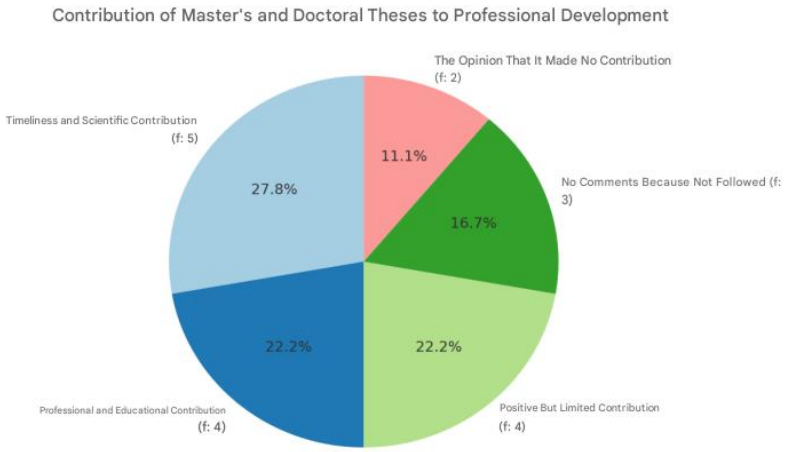


According to the analysis results, only 35% of the participating Social Studies Teachers stated that they benefit from their master's and doctoral theses in the courses they teach. 65% of the participating teachers stated that they do not benefit from them in the courses. Based on this data, it is understood that Social Studies Teachers do not use their master's and doctoral theses for R&D purposes in the education and training processes. As for how and to what extent they benefit, it was determined as a result of the content analysis that

they gave various answers in categories such as "To benefit from new information and methods", "To use for activities and questions", "To use for measurement and evaluation purposes", "To make teaching processes permanent and interesting". In the light of these results, it was not concluded that a category that could be generalized regarding how and to what extent Social Studies Teachers benefit from their master's and doctoral theses in the courses seems dominant and it was understood that each teacher follows their master's and doctoral theses in order to benefit from them in the teaching processes but their ways of using them in the teaching processes are different.

Was " **To what extent and how do master's and doctoral theses contribute to your professional development? " The analysis of the answers is given in Graph 5.**

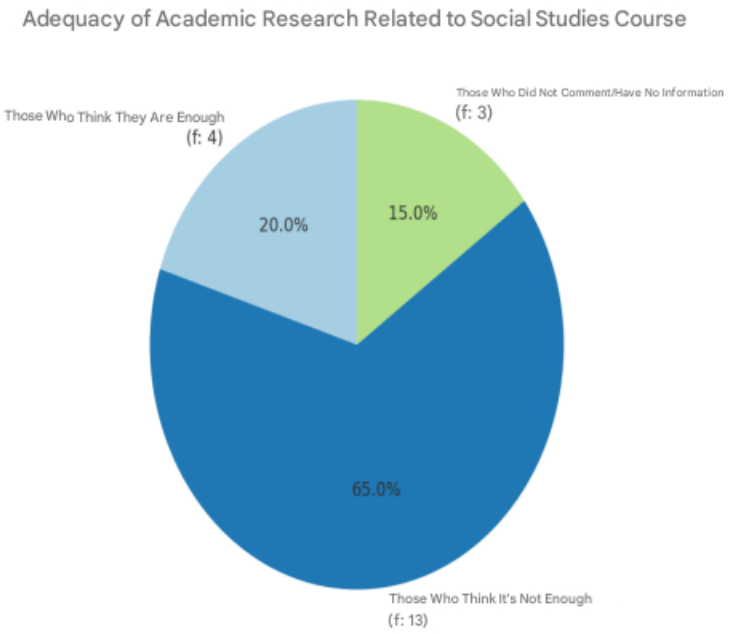
Graph 5



Regarding the extent to which and how master's and doctoral theses contribute to their professional development, teachers mostly gave answers in the category of "Currentness and Scientific Contribution" with 27.8%, "Professional and Educational Contribution" with 22.2% and "Positive but Limited Contribution" with 22.2%. 16.7% stated that they could not make any comments because they did not follow them and 11.1% stated that "It did not contribute at all".

The sixth question asked during the interview **was "About the Social Studies course " Is the academic research done so far sufficient? If you think it is not sufficient, on which topics should research be conducted? "** The analysis of the answers given is given in Graph 6.1 and Table 6.2.

Graph 6.1



When Graph 6.1 is examined, it is seen that 65% of Social Studies Teachers stated that the current research is not sufficient. In this direction, only the responses of those who think that the current research is not sufficient to the second part of the question were analyzed and Table 6.2 was created.

Table 6. 2

Suggested Topics

Category	**Frequency**	**Percentage (%)**
Teaching Methods and Techniques	5	38.46
Curriculum and Content Arrangement	3	23.08
Social and Current Needs	2	15.38
Equality and Diversity in Education	3	23.08

According to Table 6.2, 38.46% of the participating Social Studies Teachers stated that research should be conducted in the literature on "Teaching Methods and Techniques", 23.08% on "Curriculum and Content Organization", 23.08% on "Equality and Diversity in Education" and 15.38% on "Social and Current Needs".

Results and Discussion

Within the scope of the research, it was tried to examine the opinions of Social Studies Teachers regarding the contribution of academic research to their professional development. Teaching is a profession in which the teacher must constantly update himself/herself and organize the education and training activities he/she carries out in line with these updates he/she has made in himself/herself in a professional sense. Çelikten, Şanal and Yeni (2005) stated that it is not possible for a teacher who does not learn continuously to provide education in accordance with current conditions. Numanoğlu (1999) stated that the teacher should keep his/her knowledge up-to-date, especially as a requirement of living in an information society today.

Within the scope of the study, 6 questions were asked to the teachers. In this context, the first question asked was " Which resources do you use when doing academic research? " 26.9% of the teachers answered "Internet and Internet-Based Applications" to this question. This result is reasonable and understandable since our age is the age of technology. The widespread use of the internet in every subject and field naturally seems to have affected the research behaviors of teachers who do academic research. In the study conducted by Yıldırım, İlhan, Şekerci and Sözbilir (2013), teachers stated that they mostly do their research on the internet. In the study conducted by Subaşı (2020) with teacher candidates studying at the faculty of education, including Social Studies Teachers, teacher candidates stated that technology should be used when doing academic research. In the study conducted by Baş (2017) with 315 Primary/High School Mathematics Teachers, teachers stated that they mostly use the internet when doing academic research. Çekiç, Ozturk and Apaydin (2018) also reached similar results.

The second question asked was " How do you access academic research on Social Studies? " This question is a more specific version of the first question. It was aimed to find an answer to the question of how teachers access the research in the literature. 46.2% of the participating Social Studies Teachers stated that they access the research in the literature from "Internet Resources". This result shows that Social Studies Teachers use the internet more when doing research in the literature compared to general academic research.

The third question directed to the participating Social Studies Teachers in the interview was " Do you follow academic research on Social Studies? If so, for what purpose do you follow it? " When the answers given were examined, it was evaluated that 65% Yes, 35% No answers were given and in this context, it can be easily said that Social Studies

Teachers follow academic research in the literature. When the purposes of following of those who answered yes to the first part of the question were examined, it was seen that 55% of them follow research for the purpose of self-improvement/staying up to date. When the studies conducted in the literature are examined, it is seen that the majority of teachers/teacher candidates in different branches do not make an effort to conduct academic research either in their own field or on any subject. In fact, the studies of Çepni and Küçük (2003), Yıldırım, İlhan, Şekerci, and Sözbilir (2013), Ekiz (2006), Cerit Berber (2013) are some of them. In this direction, it can be said that Social Studies Teachers attach more importance to professional development.

The fourth question asked in the interview was " Do you use master's and doctoral theses in the Social Studies courses you take? If so, to what extent and how do you use them? " The question was. When the answers given were examined, 35% of the participants answered Yes and 65% answered No. According to the results, it is understood that Social Studies Teachers do not benefit from the data of their master's and doctoral theses in their lessons. When the answers of those who answered 35% Yes to the second part of the question, namely how and to what extent they benefit, were examined, it was determined as a result of the content analysis that they gave various answers falling into categories such as "Using new information and methods", "Using for activities and questions", "Using for measurement and evaluation purposes", "Making teaching processes permanent and interesting". In this direction, it is understood that teachers who use master's and doctoral theses in their lessons use them for different educational purposes.

The fifth question asked was " To what extent and how do master's and doctoral theses contribute to your professional development? " and the answers given were examined. In this context, the teachers mostly gave answers in the category of "Currentness and Scientific Contribution" with 27.8%, "Professional and Educational Contribution" with 22.2% and "Positive but Limited Contribution" with 22.2% regarding the extent and how do master's and doctoral theses contribute to their professional development. 16.7% did not make any comments because they did not follow 11.1% stated that they could not do it and "It did not make any contribution".

The sixth question asked within the scope of the interview was " About the Social Studies course: The question " Are the academic studies conducted so far sufficient? If you think they are not sufficient, on which topics should research be conducted? " was asked. 65% of the participants stated that they were not sufficient. When the responses given to the second part of the question were examined, 38.46% of the Social Studies Teachers stated that

research should be conducted in the literature on "Teaching Methods and Techniques", 23.08% on "Curriculum and Content Organization", 23.08% on "Equality and Diversity in Education" and 15.38% on "Social and Current Needs".

Recommendations

Some suggestions can be made to the Ministry of National Education, the Council of Higher Education, universities and teachers. The Ministry of National Education, the Council of Higher Education and universities may need to act by considering the fact that teachers and teacher candidates mostly conduct research activities on the internet and develop policies in this direction. In addition, some regulations can be implemented to reward teachers who do research and give importance to their personal and professional development in order to encourage teachers who are disinterested in academic research.

Ethical Committee Approval

Permission was requested from Yıldız Technical University Ethics Committee for the study, and the relevant permission was given with the decision taken at the Ethics Committee meeting dated 03.03.2025 and numbered 2025.03.

References

Artvinli, E. (2010). Coğrafya derslerini yapılandırmak: aksiyon (eylem) araştırmasına dayalı bir ders tasarımı. *Marmara Coğrafya Dergisi*, (21), 184-218.

Baş, F. (2017). Matematik öğretmenlerinin eğitim araştırmalarını takip etme durumları ve araştırmalara yönelik tutumları: Türkiye örneği. *Eğitim ve Bilim*, *42*(189), 249-267.

Büyükkaragöz, S. ve diğ. (1998). *Öğretmenlik mesleğine giriş (Eğitimin temelleri)*, Konya: Mikro Yayınları: No.07.

Can, N. (2004). Öğretmenlerin geliştirilmesi ve etkili öğretmen davranışları. *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *1*(16), 103-119.

Cerit-Berber, N. (2014). Ortaöğretim öğrencilerinin ve öğretmenlerinin eğitim araştırmalarına bakışı. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, 36,* 142-159

Çekiç, O., Öztürk, H. ve Apaydın, S. (2018). Öğretmenlerin eğitim araştırmalarına ilişkin görüşleri. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *19*(1), 856-879.

Çelikten, M. (2005). Öğretmenlik mesleği ve özellikleri. *Erciyes Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *1*(19), 207-237.

Çepni, S. & Küçük, M. (2003). Eğitim araştırmalarının fen bilgisi öğretmenlerinin uygulamaları üzerindeki etkilerinin belirlenmesi: Bir örnek olay çalışması. *Eğitim Araştırmaları*, *4*(2), 75-84.

Ekiz, D. (2006). Sınıf öğretmenlerinin eğitim araştırmalarına karşı tutumları. *Kuram ve Uygulamada Eğitim Bilimleri, 6*(2), 373-402.

https://www.mevzuat.gov.tr/mevzuatmetin/1.5.1739.pdf adresinden alınmıştır.

https://www.resmigazete.gov.tr/eskiler/2024/10/20241018-1.htm adresinden alınmıştır.

Kılıç, A. (2006). Öğretmen adaylarının öğretmenlik becerilerini uygulama ve gözleme düzeyleri. *Manas Üniversitesi Sosyal Bilimler Dergisi*, *8*(16), 155-168.

Mortimore, P. (2000). Does educational research matter?. *British Educational Research Journal, 26*(1), 5-24.

Numanoğlu, G. (1999). Bilgi toplumu-eğitim-yeni kimlikler-II: Bilgi toplumu ve eğitimde yeni kimlikler. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi. 32* (1-2), 341-350. https://doi.org/10.1501/Egifak_0000001170

Russell, B. (2018). *Eğitim üzerine.* (A. Uğur Çev.). Cem Yayınevi

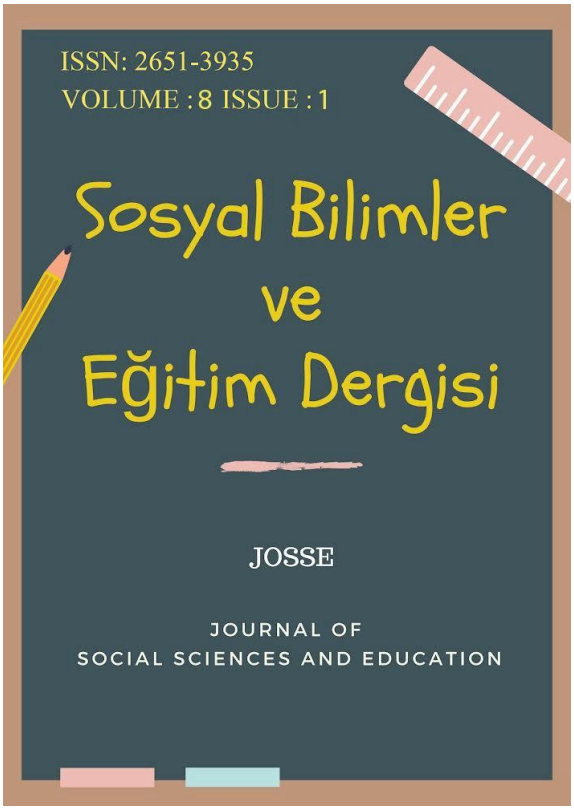
Stenhouse, L. (1975). *An introduction to curriculum research and development.* London: Heinemann

Subaşı, E. (2020). Öğretmen adaylarının akademik çalışmalara yönelik algıları. *Sosyal Bilgilerde Yenilikçi Araştırmalar Dergisi*, *3*(1), 18-32.

Yavuz-Konokman, G., Tanrıseven, I., & Karasolak, K. (2013) Öğretmen adaylarının eğitim araştırmalarına ilişkin tutumlarının çeşitli değişkenlere göre incelenmesi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi,14*(1),141-158

Yıldırım, A., İlhan, N., Şekerci, A. R. ve Sözbilir, M. (2014). Fen ve teknoloji öğretmenlerinin eğitim araştırmalarını takip etme, anlama ve uygulamalarda kullanma düzeyleri: Erzurum ve Erzincan örneği. *Kastamonu Eğitim Dergisi*, *22*(1), 81-100. *2,* 81-100

JOURNAL OF SOCIAL SCIENCES AND EDUCATION (JOSSE)



https://dergipark.org.tr/tr/pub/josse

Gender in School Administration: Problems of Women Administrators

Münir ŞAHİN[1]
Tokat Gaziosmanpaşa University, Erbaa Faculty of Social Sciences and Humanities,, Department of Communication and Desing
munir.sahin@gop.edu.tr
Orcid ID: 0000-0001-5722-496X

Article Type: Research Article
Received: 15.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Citation: Şahin, M. (2025). Gender in school administration: Problems of women administrators. *Journal of Social Sciences and Education*, *8*(1), 80-113.

Gender in School Administration: Problems of Women Administrators

Münir ŞAHİN [1]

Tokat Gaziosmanpaşa University, Erbaa Faculty of Social Sciences and Humanities, Department of Communication and Desing

Abstract

Gender reflects the biological characteristics that people are born with. Society attributes different characteristics and abilities to different genders. This study aims to determine the problems of female school principals who serve as school principals. A qualitative research was conducted in the study using a positive case study design. 12 out of a total of 26 female school principals serving in the 2024-2025 academic year in Tokat province were determined using the purposeful easy-to-access sampling method. Data were collected using a semi-structured interview form developed by the researcher. In the study consisting of gender-based problems of female administrators, difficulties and advantages of being a female administrator and suggestions, it was determined that women mostly experience problems related to communication and long working hours. It was observed that most women are stuck between home and management, have problems due to long working hours and male teachers avoiding communication. The general expectation that the manager or leader will be a man and the traditional perspective on women may prevent women from becoming managers. More encouragement of women to take part in school administration, financial support of administrators, rewarding successful administrators, making arrangements regarding working hours are important suggestions for women to become school administrators.

Keywords: Gender, education, school administration, women leaders female administrators problems

Research Article

Received: 15.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

[1] Corresponding author:
Assoc.Prof.
munir.sahin@gop.edu.tr
Orcid ID: 0000-0001-5722-496X

Introduction

Historically, when studies in educational administration are examined, the focus is generally on male educational administrators. In recent years, many studies have been conducted on determining female and male leadership styles (Çıkmaz, 2019; Eagly & Carli, 2003; Gunbayani, 2005; Haslett et al., 1992; McCollum, 2005). Clearly, it is seen in the 2022 statistics announced by the Ministry of National Education (MEB) that the number of female teachers working in the Ministry of National Education in Turkey is almost twice as much as male teachers. However, despite this, the rate of female administrators is very low. The rate of women in administrative positions remains at only 1.92% (Birgün, 2019).

There should be no gender in management, even in developed countries, the rate of female educational administrators is much lower than that of men. The fact that there are many female school administrators, at least in noticeable proportions, is important in terms of being a role model for girls in developing countries in particular, and representing gender equality and a fair division of labor. It is known that the first female school administrator in Turkey started with the appointment of Fatma Hanım as the principal of Beşiktaş İnas Rüstiye Mektebi. In 1881, Fatma Zehra Hanım was appointed as the principal of Darülmuallimat School (Aydın, 2009). Although the appointment of female school administrators dates back to 1881, the appointment of women as a district director of national education began for the first time with the appointment of Dane Carıllı to the Adana Kadirli District Directorate of National Education. Even today, in the context of educational administration, we do not see female administrators very often, especially in upper management positions. According to the YÖK (2021) report, the number of female professors in Turkey is above the European average. However, the number of women in upper management is 394. With 17 female rectors, 8.37% of the total rectors in Turkey are women, while this rate is 15% in EU countries. These figures show that the number of female administrators is very low compared to men. While women are generally overrepresented as classroom teachers, the roles in which women are least represented are school principals or vice principals (Kerr et al., 2014). In his study, Yılmaz (2016) determined that the rate of female administrators in the education sector in Turkey is 19%. This rate is an indicator of the problems experienced by female administrators.

Women are the majority in the education sector as teachers, the representation of women in educational leadership positions is strikingly disproportionate. With the increasing activities of feminist movements in the 1960s, there was an increase in the number of female administrators in Turkey and the world. However, this increase has never reached an equal

level. Female administrators are mostly employed in lower-level educational institutions such as kindergartens and primary schools in many countries of the world and in Turkey. Most of the research conducted in the field of education administration is shaped by dominant leadership theories that support the masculine leadership perspective, which is rarely applicable in a workplace where women are the majority (Campbel, 2010). Although both genders have leadership characteristics, it is observed that a male-dominated management style is adopted.

Acuner (2019) conducted a study to determine the problems women encounter in their career processes in the public sector. The study determined that the problems experienced by women are; gender-based judgment, taking on many responsibilities, success, organizational culture, obstacles that women create against themselves and problems created by other women, and problems related to the perception of women administrators.

This study on gender in school administration is considered important because it examines women administrators and their problems in education administration, and tries to determine the obstacles and problems that women face in reaching certain positions in education administration, both from the literature and in line with the views of women school principals. Leadership has a nature that is sensitive to the situation/context. In environments where men are predominantly present, leadership characteristics that are effective for men can be rendered ineffective when women leaders try to use them. For example, when women leaders have to display autocratic leadership characteristics, they may not be liked and this may reduce commitment and compliance to the organization (McCollum, 2005). Clearly seen that there is a gender inequality in the assignment of women to administrative positions.

Problems of Female Education Administrators

Kaplan (2022) conducted a meta-analysis of studies examining the problems of female school administrators and determined that the studies between 2016 and 2022 were grouped under three main themes: “general, obstacles, coping” in terms of purpose, and those three main results emerged in terms of the results of the studies: “views on management, general difficulties in management, gender-related results in management”. Since the problems arising from the regulations can be considered as common problems of female and male administrators, it can be said that gender-related problems are problems specific to female administrators.

Köse and Uzun (2017) investigated the problems of female administrators in preschool education institutions with a qualitative research design. In the study examining the

importance of gender in school administration, the strengths of women as administrators were determined as physical order and communication power, while their weaknesses were determined as professional inadequacy, weaknesses in personal and social areas.

There are many problems that female administrators face in the public sphere. Çıkmaz (2019), who conducted a study on these problems, stated that the problems are grouped under three headings: socio-cultural, psychological and environmental. The psychological pressure that women administrators face in business life can be expressed as social and cultural factors and environmental reasons (Tınaz, 2006). The traditional concept of leadership is seen as masculine. For this reason, women generally have difficulty in establishing a balance between the masculine expectations of the role and the expectations traditionally associated with being a woman. This situation can create psychological pressure on women.

Topçu (2021) stated the main problems preventing women from taking part in business life as administrators under four headings: cultural, religious, social and political. Women, who gained many legal rights with the establishment of the Republic, have been exposed to various obstacles in business life due to prejudices supported by cultural and religious ways of thinking.

In the literature, women's adaptation problems are generally defined with the concept of "role conflict" (Chin, 2011). Eagly and Carli (2003) stated that gender affects both the way women administrators lead and the way women administrators are perceived. It can be said that the way women administrators are perceived by the environment is problematic. Despite occupying a role such as an inspector or school administrator, male and female administrators may differ in their leadership behaviors or styles depending on their gender. Accordingly, their leadership styles may also change. As Hallinger (2011) stated, leadership is managed by the personal characteristics of the leaders and the source of diversity in leadership is the personal characteristics, values, beliefs, knowledge and experiences of the leaders. Kanter (1977), who stated that women who reached administrative positions in education administration were restricted from presenting alternative methods in management, stated that the male-dominated structure of the 20th century caused a male-dominated perspective to be established in the field of management. This perspective can prevent women from daring to use alternative methods and implementing new practices. However, leadership should be freed from stereotypical limitations and alternative perspectives should be valued. One of the biggest problems women face is seen as the glass ceiling syndrome. In fact, such an obstacle does not exist for anyone. However, there is such a problem for a significant portion of society that is subject to discrimination, such as women. Kanter (1977) states that the concept of glass

ceiling is a term that emerged in relation to career ladders in the business world. With this concept, it is stated that there are invisible obstacles to women's career ladder advancement. It is stated that although more opportunities are offered to women, there is more male dominance in administrative decisions. The characteristics and principles related to leadership are mostly expressed as specific to men (Blackmore, 1989).

Kirişci and Can (2020) examined the views of female administrators on the glass ceiling syndrome and determined that female administrators mostly face the glass ceiling syndrome. It was also determined that women create obstacles for themselves due to the fear of disrupting traditional roles and the deterrent nature of working hours.

Even if women have traditionally held leadership positions in their homes or in society, they prefer not to be seen as leaders. Laboratory studies have found that understanding and using power within the traditional leadership understanding is critical to women's leadership success. The underlying reason for this is the dominance of traditional values and characteristics in organizations.

Yoder (2001) determined that power is needed for leaders to be effective in environments where men are the majority. Since power is identified with men, women's leadership and management adventures are difficult. The gender perceptions of employees have positive and negative effects on leadership approaches and the way leaders themselves are evaluated. Therefore, it is useful to understand how socio-political elements related to leadership philosophy and behavior interact. Kezar (2002) suggested in his study with 36 female and male faculty members that in order to understand the perspectives of individuals, depending on the fact that power and position are located in similar social contexts, the environment in which they work and live should be examined.

Women who achieve leadership positions and advance to a certain level are more likely to remain childless than men. Burton (1993) states that this is because women tend to take on most of the childcare and household responsibilities, which is an additional disadvantage. Therefore, most women are forced to choose between having a family and being an administrator or in a certain position. For this reason, there are very few female leaders who can be role models in the field of educational leadership (Grogan, 2005). When examining studies on educational administrators, it is seen that there is a large numerical gap in terms of gender, especially in studies conducted with school principals. While the number of female teachers is almost twice that of male teachers, it is seen that the number of women in school administrator positions is much lower in favor of men (Birgün, 2019).

Feminists claim that there are some important differences between female and male administrators, and that women are more suitable for educational leadership than men because they are more collaborative and caring. However, they cannot explain the fact that female and male educational leaders use similar adjectives when describing their own leadership styles. Although female leaders are less likely to describe styles with traditionally masculine adjectives such as “formal, competitive, objective,” there is no evidence that women are soft or indecisive. Although it is widely believed that leadership is a role that requires masculine qualities such as decisiveness, assertiveness, and dominance, there is almost no evidence to support this (Campbel, 2010; Coleman, 2005). However, despite the lack of supporting evidence, this belief makes it difficult for women to advance to administrative positions and take part in certain roles.

It is seen that men tend to gain more power in education administration. This situation is seen to be against women. Women have much less support from their own gender, which can cause employees to be less compliant and to exhibit a hostile and complacent attitude towards the administrator. The decisions of women who lack power are also less credible. For this reason, women leaders have to spend much more time and effort than men to implement the decisions they make (Campbel, 2010). According to the gender model proposed by historian John Scott, gender is the primary area where power is expressed (Ecomoto, 2000). Ecomoto divided power into four dimensions to examine its positive and negative meanings: The first dimension of power is the contested or contradictory power a person has over others. The second dimension is the undisputed power that stems from a person's hierarchical position within a company, the organization or system as a whole. The third dimension is the power, cooperation or support obtained from the individual's connections with others such as mentoring, networks of relations. Finally, the fourth dimension is the power derived from personal power, expertise and endurance, which includes self-respect, autonomy and self-expression (Ecomoto, 2000).

When the power relationship in the context of women's positions in educational organizations in Turkey is considered, it is not yet a common structure to have women in senior management positions due to the traditional female figure, including the positioning of the socio-political system. Both the YÖK (2021) and the MEB (2021) data show that women administrators do not yet have a balanced hierarchy in power relations. Some adjectives used for women can create different perceptions when used for men. The definition of "leader like a mother" is a restrictive and trap expression for women. A mother is gentle and compassionate, and these adjectives for leadership can express weakness. While an aggressive

woman is considered oppressive, harsh, evil, disgusting and uncaring, aggressive men can be considered dominating, successful, talented, strong, heroic, powerful and masculine (Enomonto, 2000). The basis of this perspective is the society's gender.

As long as some characteristics are seen as more feminine and some characteristics are seen as more masculine, it is not possible to achieve balance. There has been much debate about the existence and extent of gender differences, and if there really is a difference, theories have been discussed and are still being discussed on the reasons for this. Models that attribute differences to hormonal, genetic, and physical characteristics are rejected as determinants of leadership style.

The theory of social role incongruity has been proposed to explain the interaction between gender stereotypes and social role requirements and the prejudice that emerges for women leaders. It has been attempted to show that the prejudice against women leaders is based on what characteristics women have and what characteristics leaders should have. It is argued that the attitude towards women leaders is less positive than men, and that it is more difficult for women leaders to successfully fulfill their leadership roles (Eagly & Karau, 2002). However, this situation can be evaluated as an indicator of gender inequality and a reflection of the perspective on gender.

Gender Differences in Management

Gender expectations or gender-consistent expectations affect self-perception as well as the perceptions of others regarding management and success. The general expectation that the administrator or leader will be male means that women's experiences as administrators tend to be very different from men's experiences as administrators. The extent to which female educational administrators adhere to gender norms or adopt more masculine characteristics is not reported in the literature. Christman and McClellan (2008) found in their study of female administrators that participants described leadership that defied gender classification. Gender expectations also vary by leadership level. While it is possible to see more school administrators at the elementary school level, this situation seems to change to the detriment of women when it comes to upper management (Mokaba-Bernardo, 2016).

Masculine values, language, definitions of knowledge, interaction patterns, and standards of behavior dominate school culture. Women may question these standards or prefer to work in accordance with them (Smulyan, 2000). In education administration, women and men administrators can describe their administrative styles as collaborative or people-centered (Coleman, 2003). Studies show that there are very few differences between men and women

in leadership approaches (Lewis, 1998). However, Smulyan (2000) revealed in his qualitative study that women education administrators have to make a lot of effort to prove their leadership style and competence. For example, women education administrators stated that they had to wear suits all the time in order not to highlight their feminine characteristics. Women education administrators are more likely to experience burnout syndrome. Women generally have less control over their work environments and tend to deny their own feelings and needs while satisfying the wishes of others, and women tend to undertake most of the household tasks, which is an important gender difference that increases the possibility of conflict between work and family (Oplatka, 2002).

Some studies (Bass, 1985; Gunbayani, 2005) have shown that female administrators encourage participation more, share power, and make an effort to increase the self-esteem of others. It has been observed that employees define female administrators as more charismatic and that female leaders are more inclined to soften criticisms with positive feedback. Coleman (2005) stated in his study that both female and male school principals tend to define their leadership styles with feminine adjectives such as collaborative and people-centered, and do not use masculine adjectives. It has been observed that women tend to exhibit female or male leadership characteristics depending on the situation. Coleman (2005) has shown the extent to which school principals exhibit feminine and masculine adjectives in the tables below.

Table 1

Feminine adjectives chosen by school principals to describe their leadership styles (Coleman, 2005)

Femine Descriptors	%Female Administrators	%Male Administrators
Caring	85	91
Intuitive	86	72
Tolerant	74	78
Creative	68	60
Informal	57	62
Non-competitive	13	19
Subjective	17	14
Aware of individual differences	90	88

As seen in Table 1, the most frequently chosen feminine adjective by school principals is “awareness of individual differences” and the least frequently chosen is subjective, that is, “acting individually”. Among the feminine adjectives chosen by male school principals, the most frequently chosen is “caring” and the least frequently chosen is “subjectivity”.

As seen in Table 1, the most frequently chosen feminine adjective by school principals is “awareness of individual differences” and the least frequently chosen is subjective, that is, “acting individually”. Among the feminine adjectives chosen by male school principals, the most frequently chosen is “caring” and the least frequently chosen is “subjectivity”.

Table 2

Masculine adjectives chosen by school principals to describe their leadership styles (Coleman, 2005).

Femine Descriptors	% Female Administrators	%Male Administrators
Evaluative	74	75
Disciplined	61	60
Competitive	50	62
Objective	50	64
Formal	13	19
Highly Regulated	13	10
Compliant	7	10
Prescriptive	3	6

When Table 2, which includes the masculine adjectives chosen by school principals, is examined, it is seen that the masculine adjectives chosen by female and male principals are similar, and in both groups, the adjective “evaluative” is the most frequently chosen and the adjective “prescriptive” is the least frequently chosen. When the percentages in both tables are examined, the adjectives chosen by female and male principals regarding their leadership styles have similar rates.

Table 3

Typical Leadership Characteristics of Women and Men (Adapted from Mokaba-Bernardo, 2016: 44)

Leadership characteristics specific to men	Leadership characteristics specific to women
Aggressive, competitive, controlling,	Collaborative, cooperative, caring, emotional, empathic, tactful, compromising and submissive
Intermediary, assertive, directive	Mother
Disciplinarian	Shared decision making, collaborative decision making
Power, individualism, hierarchy (top-down)	Spiritual leadership for social justice, relational leadership for learning, balanced leadership
Task-oriented, autocratic	Social, sensitive, Interpersonally focused and democratic

Table 3 includes a summary of women in educational leadership as well as their leadership styles and characteristics. This table also shows how women leaders are perceived.

Mokaba-Bernardo (2016) found in her study that all women leaders exhibit a transformational style. It was observed that women acted with their beliefs and used their leadership skills, understanding, empathy and awareness of people to shape their management style. Women educational leaders acted in accordance with both stereotypical feminine characteristics and sometimes masculine leadership concepts. It was stated that women's leadership styles were dynamic, and they alternated between leadership styles considered feminine and masculine depending on the situation.

Dana and Bourisaw (2006) tried to characterize women's leadership characteristics with a leadership style that focused on teaching, preferred a collaborative, transformational approach. According to the study, the leadership style that women superintendents generally preferred was not compatible with the culture of the school district. This situation caused women superintendents to have shorter terms of office. In such cases, women were inadequate in supporting their own gender. Unlike female educational administrators, male administrators are more supported by their colleagues and prefer to negotiate for their own interests and salaries. Female administrators generally prefer to accept the situation in such cases.

In other studies (Eagly et al., 1992; Taylor, 1994), it was revealed that female school administrators tend to adopt less autocratic and more democratic leadership styles than their male counterparts and are involved in more participatory decision-making processes. Researchers could not find a difference between task orientation and interpersonal orientation. Helgesen's (1990, cited in Taylor, 1994) research revealed that women prefer to strengthen relationships and seek ways to strengthen the bond between people, and that they give equal value to ends and means. Shakeshaft (1989, cited in Campbel, 2010) found that female inspectors spend more time in the classroom than male inspectors during classroom visits and spend more time helping teachers who have just started their education life with their problems.

Varying from transformational to laissez-faire depending on the situation, it is observed that women educational leaders exhibit a transformational leadership style. Women exhibit leadership approaches ranging from the compassionate, collaborative style defined as feminine to the directive, controlling, and autocratic leadership defined as masculine. Findings from studies show that women act dynamically and fluidly (Mokaba-Bernardo, 2016; Northouse, 2010). According to some studies (Barsh and Cranston, 2011; Duncan, 2007), although the leadership styles used by women educational leaders differ from men, these differences are not seen as an obstacle to women's advancement in educational administrative positions (Brundge, 2016).

Gender Inequalities in Leadership Roles

Glass ceilings, glass cliffs, glass escalators, mazes, zigzags, ivory basements, leaky pipelines and velvet ghettos are all concepts that have been used in the literature to point out gender inequality. Leadership studies that attempt to explain gender inequality have focused on determining the most effective roles of women in leadership. Understanding which characteristics are important for success could create a role map for taking action for professional advancement and promotion in educational leadership roles. The ivory basement phenomenon, proposed by Eveline (2004), was put forward to understand how the bias of the social role incongruity theory is reflected in the gender inequality in women's subordinate roles in the education system (Brundage, 2016).

Bagihole (2012) likens the inequalities in educational leadership roles to trends in local government institutions and states that this can be explained by the glass ceiling phenomenon. According to the glass ceiling model, Cotter et al. (2021) women have difficulty reaching leadership roles because they are women and because of their gender. The glass ceiling is defined as gender-related differences that cannot be explained by other work-related characteristics of employees. In other words, the concept of the glass ceiling refers to gender inequality in leadership roles. Weyer (2007) states that although 20 years have passed since the glass ceiling phenomenon was introduced, gender differences continue to create prejudices in the evaluation of women. The glass ceiling has been perceived by women as partially threatening, and women have attributed the existence of such a phenomenon to their family life choices, personal characteristics, and perceptions of obstacles to advancement in their positions (Ezzedeen et al., 2015).

Women's belief in the existence of the glass ceiling is observed to significantly affect their career satisfaction, emotional and physical health, and commitment to work (Smith et al., 2012). Until recently, concepts such as glass ceiling, labyrinth, and zigzag have been used to conceptualize the difficulties women leaders face on their path to leadership. In the research literature, these concepts largely cover the difficulties women face on the path to leadership, describing the difficulties on the path to women's leadership roles. The labyrinth framework provides explanations and suggestions for understanding gender inequality in leadership roles (Eagly and Carli, 2007). Olid (2013) defined the processes on the path to women's leadership as a zigzag.

The glass ceiling phenomenon has also been associated with the concept of the glass cliff over time. A study on the possibility of women being promoted to leadership positions revealed that women leaders face obstacles that prevent them from failing from the moment

they are appointed to leadership roles. This situation is also evaluated as a relationship with the assignment of women leaders during periods when organizations experience a decline in performance. The glass cliff effect may have been created by providing an environment with less freedom to pull an organization out of a crisis. The glass cliff is completed by saying that the pine cliff effect occurs as a result of women being promoted to leadership roles when the organization is experiencing a decline in performance. Women take on leadership roles in achieving strategic goals in risky situations and environments where support is low, and their leadership roles are generally shorter-term than men (Cook & Glass, 2013).

In a similar study, Malcahy and Lineham (2014) concluded that women are more likely to attain board positions during periods of dangerous organizational decline. However, when these same women leaders provide input into the decision-making process, feel empowered, and perceive organizational justice, the glass cliff is reduced (Sabharwal, 2015). The concept of the velvet ghetto, introduced by Guillaume and Pochic in 2009, reflects the idea that women have high visibility but low power, that is, are placed in lower-level positions. This situation can create an illusion in women about diversity, intention, equality, and inclusion in the organization (Guillaume & Pochic, 2009).

There are six barriers in the literature that create the glass ceiling in women's leadership roles. Three of these barriers are valuing masculine characteristics more than feminine characteristics, women's success being less likely to be associated with talent than men, and women having the same agency as men but being described as less likable and more hostile than men. The other three barriers are choosing to pursue parenting and leadership roles, prejudices and threats to identity, and women constantly evaluating themselves as less talented than men (Isaac et al., 2012).

Another study supporting the concept of the glass ceiling was conducted by Maume (1999). The study found that in professions with a high proportion of women, men were able to reach supervisory roles more easily than women. The high proportion of female employees in the profession reduces the likelihood of women coming to administrative roles such as supervisory. In addition, Maume determined in her study that women waited longer than men to reach supervisory roles. She defined this situation as the glass staircase for men and the glass ceiling for women.

Nguyen (2013) found that family responsibilities are an obstacle for women to reach leadership roles. However, there are studies that show the opposite. Nguyen (2013) states that strong family support for women leaders is critical for success in leadership roles. The long period women spend out of the public sphere due to having children and the fact that they

prefer to have children early or later in their working lives have a significant effect on reaching leadership roles. In most cases, women reject leadership roles in favor of family responsibilities. In addition to discrimination, there are also obstacles such as lack of self-confidence, learned sexist roles and self-sexism in women leaders. According to the study by Fitzsimmons et al. (2014), women set limits for themselves in reaching leadership roles based on gender from birth.

Some studies have revealed that women and men employees mostly prefer male leaders (Vuksanovic, 2012). Although leaders have equal abilities, it was determined that 53% of the participants in the study preferred male leaders. Similarly, women leaders have more difficulty in gaining legitimacy in terms of power balance. In a study conducted with 26 women who reached senior management roles at the university level, it was observed that personal negativities such as conflict with family and health problems constituted obstacles to reaching leadership roles (Diehl, 2014). Koening et al., (2011) surprisingly concluded as a result of a meta-analysis of 70 studies that leadership is equal to masculinity, but this situation is less valid for educational institutions. In addition, traditional career processes do not support gender-based female leadership.

Kaplan (2022) stated that three of the studies conducted on female school administrators were based on views about the problems of female school administrators. Therefore, it can be said that studies on the gender-based problems of female school administrators are few in the literature. The aim of this study is to determine the problems that female education administrators face in business life. In order to achieve this aim, the following questions were answered;

1. What are the gender-based problems of female administrators?
2. What are the difficulties of being a female administrator?
3. What are the advantages of being a female administrator?
4. What suggestions can be developed for female administrators and those women who want to become administrators?

Medhod

This part of the research includes the research model, study group, data collection tool, data collection, data analysis, validity and reliability studies.

Research Design

This study aims to determine the problems of female educational administrators in line with the views of female school administrators and is a descriptive study designed in accordance with the case study, which is one of the qualitative research methods. Kaptan (1998) states that descriptive studies aim to explain the "what" of an event, object, institution, group, entity or various areas. The case study design is used to express different things in different disciplines and is related to the intensive study of an event. It includes the in-depth and longitudinal examination of the data obtained through interviews (Glesne, 2013). In the case study design, the factors related to a situation are investigated with a holistic approach and the focus is on how they affect the relevant situation and how they are affected by the relevant situation (Yıldırım and Şimşek, 2011). In this study, it was aimed to describe the views of female school administrators regarding the problems they face based on gender with a holistic approach and in accordance with the case study design.

Working Group

In the formation of the working group of the research, the easily accessible criterion sampling method was used. According to Baltacı (2018), the reason for using maximum diversity in qualitative research is to investigate differences and diversities and to deepen the basic analysis. There are 26 female school principals working in public formal education institutions within the borders of Tokat province. Data was collected from 12 easily accessible school principals who have at least 2 years of management experience and work at different school levels. Participants were coded as A1, A2… (Administrator 1, Administrator 2…). The table containing demographic information about the participants is given below.

Table 4

Participant Demographic Information

Participant	Age	Education Level*	School Type**	Professional Seniority	Seniority in Management	Branch
A1	37	2	3	10	3	Chemistry
A2	45	1	3	15	12	English
A3	32	2	3	15	9	Mathmatics
A4	39	1	2	14	8	Phys. Educ.
A5	46	2	2	16	9	Turkish Lang.And Lit
A6	40	2	2	20	9	Math
A7	39	1	1	19	8	Class
A8	34	3	1	13	5	Class

A9	33	1	1	8	5	Class
A10	38	2	1	11	3	Class
A11	38	1	0	16	7	Kindergarten
A12	41	1	0	18	6	Kindergarten

*Education level, 1 Bachelor's, 2 Master's, 3 Doctorate,

**School type is coded as preschool education 0, primary school 1, middle school 2, high school 3.

When Table 4 is examined, it is seen that 12 school administrators participated in the study, 3 high schools, 3 middle schools, 4 primary schools and 2 kindergartens. The average service years of the participants as administrators are 7 years. It is seen that the minimum service years of the administrators are 3 and the maximum is 12. The professional seniority of the participants varies between 8-20 years. It is also observed that the branches of the participants are diverse.

Data Collection Tool

In this study, data was collected through interviews. A semi-structured interview form developed by the researcher was used in the interviews. Considering the suitability of the questions for the purpose of the study, a literature review was conducted, the raw questions were developed in line with the expert opinions by receiving opinions from 2 different experts with doctoral education, and a pilot application was conducted to evaluate whether the questions were suitable for the purpose of the study, understandable and properly sequenced. As a result of the evaluation, it was concluded that no problems were observed in terms of form, purpose and scope, and that the interview form could be used in the actual application in its current form.

Interviews are conducted with pre-prepared questions in order to focus the participants on similar topics and to elicit the same type of information (Patton, 2014). The interviewer has the opportunity to ask the questions he/she has prepared based on the topics and areas he/she has determined in advance and to ask additional questions depending on the flow of the interview (Yıldırım and Şimşek, 2011: 122). Semi-structured interviews have some benefits. Open-ended semi-structured questions provide the opportunity to obtain in-depth information from the participants. It helps to obtain in-depth information about the phenomenon by ensuring that the participants provide detailed information directly, and helps the researcher to ask more detailed questions (Creswell, 2012: 218). In semi-structured interviews, the researcher is free to ask additional questions by remaining loyal to the questions (Yıldırım and Şimşek, 2011). The first part of the two-part form includes questions about the demographic information of the participants. The second part includes 4 open-ended

questions aimed at determining the problems faced by female educational administrators. The female administrators participating in the research were given codes starting from A1 (Administrator 1) to A12.

Data Collection

Before the interviews, ethics committee permission was obtained and a preliminary interview was held with the participants, and they were informed about the nature, purpose, data collection method, data analysis and where the study would be used. They were informed that no personal information about the participants would be shared, if they gave permission, audio recording would be used, if they did not give permission, the interview would be conducted by the researcher taking notes. It was stated that appropriate interview conditions were needed and they were asked whether they would volunteer to participate in the study. The study was conducted in the schools where the school administrators and participants who accepted to volunteer to participate study, in the school principal's offices. The interview questions were asked by the researcher, and it was decided that it would be appropriate to write down the answers and note them. Since the participants did not want audio recordings, no audio recordings or images were taken. The interviews lasted an average of 20 minutes. The interviews lasted approximately 240 minutes/4 hours. The collected data was converted into an MS Word document on a computer.

Data Analysis

The data obtained from the participants were converted into a Word file, first conceptualized, and then content analysis was used to determine the themes explaining the concepts that emerged (Yıldırım and Şimşek, 2013). In the coding of the data, a faculty member who is experienced in qualitative research, has a doctorate level education and works as an associate professor in the Department of Educational Administration at a public university, performed the coding as the second coder. The researcher compared the coding he made with the coding from the other coder, and as a result of this comparison, it was decided what the codes and themes would be. The codes and themes obtained with the content analysis method were converted into tables. The codings in the tables were supported by direct quotes from the participants.

Validity and Reliability

In the study, expressing the information regarding the method and analysis of the research in a clear and understandable language and storing the collected raw data in a way that can be examined by others are considered as important issues that ensure the external reliability of the research. The path followed in developing the research questions, conducting a pilot application, paying attention to collecting data appropriate to the questions and purpose in data collection, and using a second competent coder in the field other than the researcher in coding the data should be considered as contributions to the internal reliability of the research (Yıldırım and Şimşek, 2013). Since the consensus between the coders will contribute to the reliability of the study, the consensus between both coders was calculated with the formula used by Miles and Huberman (1994: 64) and determined as 82%. According to Miles and Huberban (1994: 64), a consensus of 70% and above between the coders indicates that the study is reliable.

In case studies, validity is expressed that knowledge does not exist on its own, but is found together, and that it exists with those who experience it. Valid knowledge is clear. (Langdridge, 2007: 155). Yardley (2007: 220) states that the data obtained from the study should be sensitive to the context, should be evaluated in terms of dedication and meticulousness, transparency and logical conformity, impact and importance. It is emphasized that the findings in the current study should be sensitive to the context and the findings of previous qualitative research. The current study shows sensitivity to the context in terms of revealing similarities and differences with the studies in the literature. Transparency, meticulousness and logical conformity were tried to be provided by expressing the data collection and analysis in detail. The study was carried out in a long period of time such as 6 months. This time allocated shows dedication.

Expert evaluation was also used in order to increase the validity of the study. Different expert opinions were received both in the development of the research questions and in the analysis stage, and the study was evaluated from different perspectives. According to Shenton (2004), different expert opinions will change the researcher's perspective on events and will contribute to the validity of the study as they will provide the opportunity to evaluate the study from different perspectives.

Ethics Committee Permission

It was conducted with the approval decision taken in the 21st session of Tokat Gaziosmanpaşa University Social and Human Sciences Research Ethics Committee, dated 24.12.2024, number 01-51, ethical ssessment certificate number: 504270

Findings and Comments

The questions in the semi-structured interview form developed to collect data for the study were asked to 12 participants consisting of female school principals in order and their answers were obtained. The answers converted to written Word format were content analyzed and given in this section.

Gender-Based Problems of Female Administrators

The question "What are the difficulties you face regarding your gender?" was asked to the female administrators, and the content analysis of the answers obtained from the participants was given in Table 5.

Table 5

Gender-Based Problems of Female Administrators

Participant Problems	***Participant Codes (A=Administrator)***	***f***
Communication problems,	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12	12
Gossiping,	A1, A2, A4, A5, A6, A8, A9, A10, A11	9
Fear of being misunderstood,	A1, A2,A3, A4, A6, A8, A9, A11,	8
Not eager to enter administrator room,	A1, A2, A8, A9, A11, A10, A12	7
Getting permission from the assistant administrator,	A1, A,2, A3, A5, A6, A8	6
Not accepting female administrator as an administrator,	A1, A2, A4, A5, A9, A12	6
Provocative behaviors,	A1,A7, A8, A9	4
Looks like saying who are you,	A1, A12	2
Attitudes as if I took their rights.	A8	1
Ignorance.	A8	1

When Table 5 is examined, the main problem experienced by female administrators based on gender is “communication problems”. The second important problem is “gossiping”

caused by the presence of a female administrator in the school. The third problem is "fear of being misunderstood" while communicating with administrators. Therefore, they prefer to do their jobs with male vice principals, teachers and other employees rather than the school administrator. The underlying factor of all these problems is observed to be communication problem between women and men. Below are excerpts from the views of some participants supporting the Table 5;

> *I had problems with teachers at first. They did not want to enter my room. They got their permission from the vice principal, I later learned about it, they were more afraid of being misunderstood, I think we had a bit of a communication problem, but we broke it over time. Some teachers, especially in the first days, displayed provocative attitudes such as asking who are you. They also gossiped about me a lot, but I continued without paying attention, and I can say that they got used to it after a while (A1).*
> *We had communication problems, they didn't want to talk to me, they went to the assistant administrators. What upset me the most was the unfounded gossip? Like I was someone's nephew and that's why I was appointed. However, my efforts, the criteria for appointment, the awards I received are obvious. Nobody sees what I do. When they talked, they always started a sentence saying "Don't misunderstand me" (A6).*
> *Interestingly, they couldn't accept me. They acted as if it was their right and I had taken it. Gossip, loud conversations in front of the door. They ignored me for a while and tried to handle their work with the assistant administrator (A8).*

Difficulties of Being a Female Administrator

In order to obtain the opinions of school principals regarding the difficulties of being a female administrator, the question "What are the difficulties of being a female administrator?" was asked to the participant administrators. The participants' responses were recorded by the researcher and analyzed using the content analysis method. The subthemes regarding the difficulties of being a floor administrator are given in Table 6.

Table 6

Difficulties of being a female administrator

Difficulties	***Participant Codes*****(A=Administrator)**	***f***
Long working hours,	A1, A2, A3, A4, A5, A6, A8, A9, A11, A12	10
No time for housework,	A1, A2, A3, A4, A5, A6, A7, A9, A11,	9
Exposure to slang expressions,	A1, A7, A8, A9, A10, A11,	6
Bad dialogues with parents,	A1, A2, A4, A10, A12	5
Technical issues,	A1, A4, A6, A11, A12	5
Employee discipline issues,	A1, A3, A5, A6, A11,	5
Communication with external masters,	A4, A6, A8, A9, A11	5
Learning regulations,	A1, A4, A8,	3
Difficulty in motherhood.	A12,	1

When Table 6 is examined, it is seen that the majority of the participants (f=10) stated that working hours are long as the most important difficulty. The participants stated that they have no time for housework (f=9) as the second most important problem. Some other

important problems expressed are being exposed to slang expressions, problems in meetings with parents, technical issues, and disciplinary problems of employees, respectively, as a female school principal. The following direct quotes from the participants support the table;

First of all, at first, technical issues, regulations, legislation, how to handle the school's fractures and dislocations, and communication with the masters who come were really difficult. I had to do the work at school that I had my wife do at home or that my wife did. So sometimes it was useful for me to have men assistant principals. When the masters and some technical issues were done by them, I could relax (A4).

Due to the region where our school is located, our parent profile is a bit advanced socio-culturally, and sometimes it is not nice for the parents to talk to us in a high tone. I had to argue with a few parents because of this. There are those who talk in a very high tone. For example, the administrator of a place said, "What can we do? You are our guardian here; you have to follow the rules like everyone else. The guy at the security told the gentleman that there are no meetings with teachers without an appointment. I have often encountered situations like, 'Sir, I can meet with whomever I want whenever I want, who are you?' But being a woman sometimes allows these people to restrain themselves. I think I would have more problems if I were a man. Apart from that, there is not much to be difficult about. First, I was both a teacher and an administrator in a village school. I was familiar with some problems (A10).

There is not much to be difficult about actually. We had some problems with discipline. As a woman, there were some slack behaviors and people coming to work late. We overcame these in time. But the most difficult thing for me is the working hours. You have to be at school from morning to evening. When the teacher doesn't have a lesson, they may not come or they may leave when their lesson is over, they do other things, but when you are an administrator, you have to wait here. Especially when you are a woman administrator, you don't have time for housework (Y11).

Advantages of Being a Female Administrator

Participants were asked "What are the advantages of being a female administrator?" Participants' statements regarding the advantages of working as a female school administrator in an educational institution are analyzed and content analysis of the data given in the table below.

Table 7

Advantages of being a female administrator

Advantages	Participant Codes (A=Administrator)	f
Having the opportunity to express ourselves better,	A1, A2, A3, A4, A5, A6, A8, A9, A11, A12	10
More support by upper administrators,	A1, A2, A3, A4, A5, A6, A7, A9, A11,	9
More polite (respectful) conversations,	Y1, Y7, Y8, Y9, Y10, Y11,	6
Checking their behavior when they see us,	A1, A2, A4, A10, A12	5
Parents love women administrators,	A1, A4, A6, A11, A12	5
Understanding girls more,	A1, A3, A5, A6, A11,	5
Parents' views on school have changed positively,	A4, A6, A8, A9, A11	5
People trust women more,	A1, A4, A8, A12,	4
As if they entrust their children to their mothers,	A1, A4, A8,	3

When Table 6 is examined, the most important advantage is that the participants stated that they "have the opportunity to express themselves better" (f=10). Secondly, the participants stated that they are supported by the "upper administrators more" than men because they are female administrators (f=9). It is seen that advantages such as being respected more, especially having more polite conversations and other teachers' checking their behaviors when female administrators are there like changing their sitting positions, being able to understand girls better, being more trustful and changing the views of families to school positively are stated. The statements of some participants are supporting the table given below;

I am one of those who experience many advantages. Especially parents trust us and leave their children to school as if they are entrusting them to a mother. In addition, since we are a model for girls, we understand them better (A2).

In other words, there is a satisfaction that can be seen on the faces of the parents because I am a female administrator. They see us as mothers. When we go to meetings at school or other meetings, when there is a woman, people pull themselves together, whether they want to or not, that is how I see it. We express ourselves better to both parents and other stakeholders, I think the parents' perspective on the school has changed (A3).

First of all, we have become like a family, parents find us more cheerful. They are comfortable with their children, we are accountable to both parents and upper management, and I think I can express myself correctly in this sense. I think the environments we are in are more civilized, people are starting to speak more politely, perhaps the best advantage is that we beautify our environment in this way (A11).

The above quotes from the participants support Table 7. As stated in the participant statements, since women are culturally identified with mothers and family in our society, it is

understood that parents are happy to have a female administrator in the school and consider the school as a continuation of the family.

Suggestions for Female Administrators

Having experience in school administration is considered important to overcome problems. For this reason, the question "What do you recommend to female administrators and those who want to become administrators?" was asked to school administrators to find out what suggestions they have for women who are or are thinking of becoming school administrators like themselves. Participants' answers were analyzed in content and are given in the table below.

Table 8

Recommendations for women administrators

Recommendations	***Participant Codes (A=Administrator)***	**f**
Working hours should be reduced,	A1, A2, A3, A4, A5, A6, A8, A9, A10, A11, A12	11
Successful administrators should be rewarded,	A1, A2, A3, A4, A5, A6, A8, A9, A11, A12	10
Administration positions should be encouraged,	A1, A2, A3, A4, A5, A8, A9, A11, A12	9
They should be supported financially,	A1, A2, A4, A5, A6, A8, A9, A11, A12	9
They should be confident,	A1, A2, A3, A4, A6, A8, A9, A11, A12	9
They should know their legal rights,	A1, A2, A3, A4, A5, A6, A9, A12	8
They should be good communicators,	A1, A2, A4, A5, A6, A7, A9, A11,	8
They should be brave,	A1, A2, A3, A4, A5, A8, A9,	7
They should create their own style,	A1, A7, A8, A9, A10, A11,	6
They should support each other,	A1, A4, A6, A9, A11, A12	6
Priority in nursery and care services,	A1, A2, A4, A10, A12	5
They should create new opportunities for themselves,	A1, A2, A4, A10, A12	5
They should cooperate with stake holders.	A1, A3, A5, A6, A11,	5

When Table 9 is examined, it is seen that the majority of the participants (f=11) made suggestions that “arrangements regarding working hours” should be made. The second important suggestion to encourage women to become administrators is “rewarding successful administrators” (f=10), “administration positions should be encouraged” (f=9). It is also seen that the participants made suggestions such as “ giving financial support, having confidence, knowing legal rights, being a good communicator, being brave, creating their own administration style, supporting each other, psychological support, priority in nursery and care services, extension of maternity leave”. It is seen that the following quotes from the statements of some participants support Table 9.

Working as a woman is very difficult. Even when I was a regular teacher, there was very little time left for housework. After becoming a administrator, you have to spend more time at school, so I suggest that something be done about working hours. When I came, we had a revolving fund that declared a loss every year, and this year we made a profit with me. However, there is no reward for our success. I think successful administrators should be rewarded and encouraged. Maybe management can be encouraged so that there are more women administrators. There should be a nursery opportunity for children. Especially experienced administrators can be provided to support those who are appointed for the first time (A4).

I think working hours are the most important problem. You spend the whole day at school, there is no time left for the children at home. Nursery or childcare support can be provided, working hours can be flexible. In addition, school principalship should be made attractive, management should be encouraged, but the number of female administrators can increase accordingly. Most friends experience the difficulty of juggling home and work, and when management is involved, I think it depends on the person (A6).

First of all, I would suggest that management should be encouraged. This can be done with a reward system, at least by rewarding successful administrators, or administrators can be supported financially. You have to be at school early in the morning. It is necessary to check whether the school is ready for education, whether there are any problems, and the classrooms are cleaned or not. Working hours can really create problems in the family, I can say that we open the school in the morning and close it in the evening. Our spouses and children do not have much time. Maternity leave can be extended, psychological support can be provided (A10).

When the above quotations from the participants are examined, it is understood that female school administrators have time problems due to the heavy burden of motherhood, housewifery, and wife roles outside of their work lives, and have problems in fulfilling other roles outside of school because they have to work overtime like a regular civil servant. Some positive arrangements can be made for female administrators by taking into account the suggestions of the school principal participants. It is recommended that arrangements be made on issues such as providing childcare and care services for children and financial support so that more female administrators can work in educational institutions and women can be more comfortably to fulfill their roles outside of work.

Results and Discussion

Eeffective leadership is contingent to the context, and historically thought that men can do better leadership. Job title, context of the workplace and demands of the work with its roles should be considered when successful leadership is evaluated (Eagly, 2003). However, as Balyer (2017) emphasized, we need to go beyond the traditional leadership qualities before deciding the school administrators. In a male dominated culture, demands from women administrators are incompatible. To open the doors of a modern world why should not we give the opportunity to manage schools to women as they do in most of men's homes.

The leadership roles that women have undertaken in different sectors globally show that they can take more place in educational institutions as school leaders and in other managerial positions. Obviously, there is no significant obstacle to women taking part in educational leadership positions, other than psychological reasons, with the changing conditions.

At a time when it is not possible to manage the world from a patriarchal perspective, the fact that women administrators take more place in educational management positions can further develop them and therefore society. Women stand out with their more transformational and collaborative characteristics. These characteristics of theirs, which emphasize change and acting together, can be used for the development, change and transformation of society.

In this study, which aims to determine the opinions of female school principals regarding their problems, the case study, which is one of the qualitative research designs, was carried out using a semi-structured interview form. The data obtained from the interviews conducted with 12 out of a total of 26 school principals working within the borders of Tokat province were content analyzed and some findings were reached in the study. The most important of the findings obtained was that the participants expressed the difficulties they experienced in communication based on gender. Gender-based problems were experienced due to reasons such as male teachers not wanting to accept female principals, having problems in communication, and fear of gossip or misunderstanding. The second important finding expressed as the most important difficulty of female principals is long working hours and not having enough time for housework. In a culture that defines housework as women's work as a result of a patriarchal social structure, this difficulty should be evaluated as an expression of women both working in a job and doing house and family chores.

According to the findings obtained from the study, the most important advantage of being a female administrator is that women have the opportunity to express themselves more

comfortably, upper management tends to be more helpful to female administrators, and the greater respect that comes with being a woman and being in an administrative position due to the position they are in is stated as important advantages. It was determined that the most important suggestions of the participants for women who are or are considering becoming school administrators like themselves are reducing working hours and rewarding successful administrators. According to the participants, arrangements can be made regarding working hours to increase women's interest in management. Working hours are stated to be very long for women who have to cope with both housework and school work.

Studies show that female education administrators are defined as collaborative, team-oriented, sharing, empathic, caring, motivating and supportive. In addition, female leaders are defined with characteristics such as protector, mother, mentor and teacher. Female administrators can be task-oriented, disciplined and directive when necessary (Chirstman and McClellan, 2008; Mokaba-Bernardo, 2016). When evaluated in terms of these characteristics, female school administrators should be at least as high up in education administration as male administrators. In light of the findings obtained from the study, arrangements such as prioritizing female school administrators in appointments to administration positions, reducing working hours, giving financial support, prioritizing in nursery and care services can be made to ensure that more women take part in education administration.

Recommendations

The results of the study reflects that gender as a criteria for administrative positions is not supportable by itself. Women deserve more to be in administrative positions as men do especially in education. From this point of view apparently there are some recommendations for the policy maker and researchers.

1. The presence of women in school administrator positions at the secondary school level and above can increase sensitivity in schools for the welfare of adolescent girls and girls can positively influence their career choices by having female administrators as role models. Considering the vital role that a country's education system plays in both national development and the development of a gender-equal society, women also need to be actively involved in leading educational change.
2. Women have the necessary skills and understanding to effectively participate in educational management and policy-making processes at both school and national levels in order to be active participants in the process of change and development.

However, it is seen that they are not sufficiently represented in education management in many developed and developing countries such as Turkey. By examining the characteristics of female educational administrators and the way they are perceived in educational institutions and the way female leaders perceive themselves, more women can be encouraged to become educational administrators.

3. Female educational leaders can be role models and guide the new generations in gaining the self-confidence they may need. The fact that women take on fewer roles in senior management positions can negatively affect their work motivation. Therefore, women should be adequately represented in senior management roles.
4. Examining the relationship between the problems women face in reaching administrative positions and the motivation of female employees can help develop new propositions regarding job satisfaction and the adequate representation of women in business life.
5. In terms of education management, action plans should be developed for the gender-based problems experienced by women administrators, and arrangements should be made to help women administrators advance in managerial positions in order to develop a more egalitarian society in the field of education management, as in every area of society.

Ethical Committee Approval

It was conducted with the approval decision taken in the 21st session of Tokat Gaziosmanpaşa University Social and Human Sciences Research Ethics Committee, dated 24.12.2024, number 01-51, ethical ssessment certificate number: 504270

References

Acuner, Ş. (2019). Kadın Çalışanların Kariyer Geliştirme Sürecinde Karşılaştıkları Sorunlar. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, (23), 35-52. https://doi.org/10.18092/ulikidince.456582

Aydın, İ. (2009). *Türk eğitim yönetiminde öncü kadınlar*. Pegem Akademi Yayınları.

Bagihole, B. (2012). A cross-national analysis of gender equality and the shift form collegiality to managerialism in higher education policy. *Acta Paedagogica Vilnensia, 28*, 23-36.

Baltacı, A. (2018). Nitel Araştırmalarda Örnekleme Yöntemleri ve Örnek Hacmi Sorunsalı Üzerine Kavramsal Bir İnceleme. *BEÜ SBE Dergisi, 7*(1), 231-274.

Balyer, A. (2017). School principals' views on administration work, their "frequent urnover" and its effects on their work. *The Qualitative Report, 22*(5), 1471–1487

Barsh, J. & Cranston, S. (2011). *How remarkable women lead: The breakthrough model for work and life*. Crown Business.

Bass, B. M. (1985). *Leadership and performance beyond expectations*. New York: The Free Press

Birgün (2019). MEB'de kadın yöneticilerin oranı yüzde 1,92: Erkek Eğitim Bakanlığı https://www.birgun.net/haber/meb de-kadin-yoneticilerin-orani-yuzde-1-92-erkekegitim-bakanligi-268876 19.01.2023

Blackmore, J. (1989) Educational leadership: A feminist critique and reconstruction. In J. Smyth, (Ed) *Critical perspectives on educational Leadership* (pp. 93-129). Barcombe: Falmer Press.

Brundage, M.R. (2016). *Women's ınherent and learned leadership characteristics: Navigation to success in educationalleadership roles* (Unpublished Disertation), Grand Canyon University.

Burton, L. (1993). Management, "race" and gender: An unlikely alliance? *British Educational Research Journal, 19*(3), 275-290.

Campbell, S. (2010). *A comparative study of educational leadership behavıor by gender and race* (Unpublished disertation) Faculty of the Graduate School of Saint Louis University

Chin, J.L. (2011). Women and leadership: Transforming visions and current contexts. *The Forum on Public Policy*, 1-15.

Christman, D. & McClellan, R. (2008). "Living on barbed wire": Resilient women administrators in educational leadership programs, *Educational Administration Quarterly, 44*(1), 3-29.

Çıkmaz, E. (2019). Problems that women managers encountered in public organizations: A qualitative study. *Electronic Journal of Soscial Sciences, 18* (72), 1767-1775.

Coleman, M. (2005). Gender and secondary school leadership. *International Studies in Educational Administration, 33*(2), 3-20.

Cook, A. & Glass, C. (2013). Above the glass ceiling: When are women and racial/ethnic minorities promoted to CEO? *Strategic Management Journal, 35*, 1080-1089.

Cotter, D. A., Hermsen, J. M., Ovadia, S. & Vanneman, R. (2001). The glass ceiling effect. *Social Forces, 80*(2), 655–81.

Creswell, J. W. (2007). *Qualitative Inquiry and Research Design: Choosing among Five Approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Dana, J. & Bourisaw, D. (2006). Overlooked leaders. *American School Board Journal, 193*(6), 27-30.

Diehl, A. B. (2014). Making meaning of barriers and adversity: Experiences of women leaders in higher education. *Advancing Women in Leadership, 34*, 54-63.

Duncan, P. A. (2007). *Women in positions of leadership and gender-specific emotional intelligence attributes* (Unpublished doctoral dissertation). Retrieved from ProQuest Dissertations and Theses. (Order No. 3252973).

Eagly, A. H. & Karau, S. J. (2002). Role congruity theory of prejudice toward female leaders. *Psychology Review, 109*(3), 573-598.

Eagly, A. H., Karau, S. J. & Johnson, B. T. (1992). Gender and leadership style among school principals: A meta-analysis. *Educational Administration Quarterly, 28* (1), 76 102.

Eagly, A.H. & Carli, L.L. (2003). The female leadership advantage: An evaluation of the evidence. *The Leadership Quarterly, 14*, 807-834.

Enomoto, E. (2000). Probing educational management as gendered: An examination through model and metaphor. *Teachers College Record, 102*(2), 375-397.

Eveline, J. (2004). *Ivory basement leadership: Power and invisibility in the changing university*. Crawley: University of Western Australian Press.

Ezzedeen, S. R., Budworth, M. H. & Baker, S. D. (2015). The glass ceiling and executive careers: Still an issue for precareer women. *Journal of Career Development*. doi:10.1177/0894845314566943

Fitzsimmons, T. W., Callan, V. J. & Paulsen, N. (2014). Gender disparity in the C- suite: Do male and female CEOs differin how they reached the top? *The Leadership Quarterly, 25*, 245-266.

Glesne, C. (2013). *Nitel araştırmaya giriş*, A. Ersoy ve P. Yalçınoğlu (Çev.). Anı Yayıncılık.

Grogan, M. (2005). Echoing their ancestors, women lead school districts in the United States. *International Studies in Educational Administration, 33*(2), 21-30.

Guillaume, C. & Pochic, S. (2009). What would you sacrifice? Access to top management and the work-life balance. *Gender, Work and Organization, 16*(1), 1-26.

Gunbayani, I. (2005). Women and men teachers' approaches to leadership styles. Social Behavior & Personality: *An International Journal, 33*(7), 685-698.

Hallinger, P. (2011),"Leadership for learning: lessons from 40 years of empirical research", *Journal of Educational Administration, 49*(2), 125 – 142.

Haslett, B. J., Geis, F. L. & Carter, M. R. (1992). *The organizational woman: Power and paradox*. Norwood, NJ: Ablex Publishing Corporation.

Isaac, C. A., Kaatz, A. & Carnes, M. (2012). Deconstructing the glass ceiling. *Sociology Mind, 2*(1), 80-86.

Kanter, R.M. (1977). *Men and women of the corporation*. New York: Basic Books.

Kaplan, A. E. (2022). Kadın Okul Yöneticilerinin Sorunlarınıinceleyen 2016-2021 Yılları Arasındaki araştırmaların meta Sentezi", *International Social Mentality and Researcher Thinkers Journal, 8* (66), 2309- 2323

Kaptan, S. (1998). *Bilimsel araştırma ve istatistik teknikleri*. Tekışık Web Ofset Tesisleri.

Kerr, B., Kerr, G. R. & Miller, W. (2014). Bureaucratic, leadership, and workforce representation among female administrators, *Public Administration Quarterly,* 38 principals, assistant principals, and classroom teacher in U.S. school districts, 2002 2008. (3), 371-404.

Kezar, A. (2002). Expanding notions of leadership to capture pluralistic voices: Positionality theory in practice. Journal of College Student Development, *43*(4), 558-578Lewis, D. (1998). How useful a concept is organizational culture? *Strategic Change, 7*, 261-76.

Kirişçi, G. & Can, N. (2020). Eğitim ve Okul Yöneticilerinin Cam Tavan Sendromuna İlişkin Görüşleri, *Ahi Evran Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 6* (2), 618-636.

Köse, A. & Uzun, M. (2017). Okul Öncesi Eğitim Kurumlarında Kadın Yönetici Olmak: Sorunlar ve Eğilimler, *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 13*(3), 1058-1083.

Langdridge, D. (2007). *Phenomenological Psychology: Theory, Research and Method*. Harlow: Pearson.

Malcahy, M. & Lineham, C. (2014). Females and precarious board positions: Further evidence of the glass cliff. *British Journal of Management, 25*, 425-438.

Maume, D. J. (1999). Glass ceiling and glass escalators. *Work and Occupations, 26*(4), 483-509.

McCollum, P. (2005). Review of literature on leadership – an excerpt from the new book, The Ohtli Encuentro –Women of Color Share Pathways to Leadership. *Intercultural Development Research Association* (IDRA, http://www.idra.org/newslttr/2005/Jun/Pam.htm 21.01.2023.

MEB (2022). 2021-2022 Örgün eğitim istatistikleri açıklandı. https://www.meb.gov.tr/20212022orgunegitimistatistikleriaciklandi/haber/27552/tr#:~:textKad%C4%B1n%20%C3%B6%C4%9Fretmenler%0%C3%A7o%C4%9Funluk ta,bin%20379'u%20kad%C4%B1nlardan%20olu%C5%9tu.19.01.2023

Mokaba-Bernardo, D. (2016). *An examination of women and educational leadership: A postmodern feminist analysis of the leadership styles of women superintendents* (Unpublished Disertation), Office of Graducate Studies, University of Massachusetts.

Nguyen, T. L. H. (2013). Barriers to and facilitators of female Deans' career advancement in higher education: An exploratory study in Vietnam. *Higher Education, 66*, 13-138.

Northouse, P. G. (2010). *Leadership: Theory and practice* (5th ed.). Washington DC: Sage.

Olid, C. S. (2013). Models of professional career of the managerial women. *Universitas Psychologica, 12(*4), 1237-1254.

Oplatka, I. (2002). Women principals and the concept of burnout: An alternative voice? *International Journal of Leadership in Education, 5*(3), 211-226.

Özkan, H., Demir Özkan, H., Altınok, T. & Pısıl, Y. O. (2023). Kadın Yöneticilerin Gözünden Okul Yönetiminde Karşılaşılan Sorunlar, J*ournal of Social, Humanities and Administrative Sciences, 9*(69), 3661-3666. http://dx.doi.org/10.29228/JOSHAS.72537

Patton, M. Q. (2014). *Nitel Araştırma ve Değerlendirme Yöntemleri*. (Çev. Edt. M. Bütün, S.B. Demir). Pegem Akademi.

Sabharwal, M. (2015). From glass ceiling to glass cliff: Women in senior executive service. *Journal of Public Administration Research and Theory, 25*(2), 399-426.

Şahin, M. (2019). Authentic Leadership. *Journal of Current Researches on Social Sciences 9*(1), 39-60.

Şahin, M. (2021). Opinions of university students on effects of distance learning in Turkey during the Covid-19 pandemic. *The African Educational Research Journal, 9*(2), 526-543.

Şahin, M. (2022). The problems and opportunities of hybrid education for school management. *Education Quarterly Reviews, 5*(4), 96-103.

Şahin, M. (2023). The place and importance of family in education. *Milli Eğitim Dergisi, 52*(240), 3195-3220.

Şahin, M. (2024). İnsan hakları eğitiminin önemi. *Eğitimin Renkleri: Farklı Disiplinler, Ortak Hedefler 1*. 85-112.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information, 22*, 63-75.

Smith, P., Caputi, P. & Crittenden, N. (2012). How are women's glass ceiling beliefs related to career success? *Career Development International, 17*(5), 458-474.

Smulyan, L. (2000). Feminist cases of nonfeminist subjects: Case studies of women principals. *International Journal of Qualitative Studies in Education (QSE), 13*(6), 589-609.

Taylor, P. (1994). *Leadership in education. Emergency Librarian*, *21*(3), 9-17.

Tınaz, P., (2006). Mobbing: İşyerinde Psikolojik Taciz. *Çalışma ve Toplum, 3*(10), 11-22.

Topçu, F. (2021). *Bağımsız Devlet Okullarında Çalışan Yöneticilerin Kadın Yöneticilere İlişkin Cam Tavan Algılarının İncelenmesi: Küçükçekmece Örneği* (Yüksek Lisans Tezi), İstanbul Sabahattin Zaim Üniversitesi Lisansüstü Eğitim Enstitüsü.

Valentine, S. (1998). Self-esteem and men's negative stereotypes of women who work. *Psychological Reports, 83*, 920-922.

Vuksanovic, M. (2012). Is manager's gender an important factor in selection to a position? *Megatrend Review, 9*(1), 253-264.

Weyer, B. (2007). Twenty years later: Explaining the persistence of the glass ceiling for women leaders. *Women in Management Review, 22*(6), 482-496.

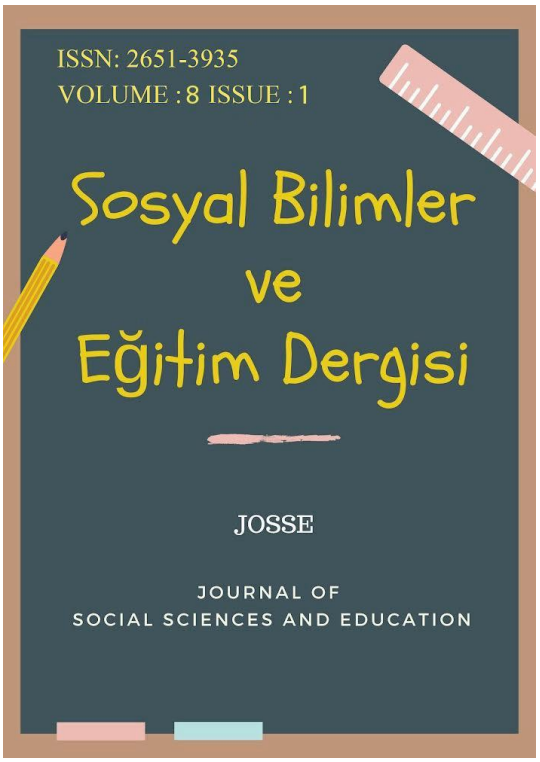
Yıldırım, A. & Şimşek, H., (2011). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri* (8.Baskı). Seçkin Yay.

Yılmaz, S. (2016, Haziran). *Okul yöneticileri ve öğretmenlerin toplumsal cinsiyetçiliğe ve kadın yöneticilerin liderlik becerilerine yönelik görüşleri* (Doktora Tezi). Eskişehir Anadolu Üniversitesi.

Yoder, J. D. (2001). Making leadership work more effectively for women. *Journal of Social Issues, 57*(4), 815-828.

YÖK (2021). Türk üniversitelerindeki kadın profesör sayısı Avrupa ortalamasının geride bıraktı. https://www.yok.gov.tr/Sayfalar/Haberler/2021/turk-universitelerindeki-kadinprofesor-orani-avrupaortalamasini-gecti.aspx

JOURNAL OF SOCIAL SCIENCES AND EDUCATION (JOSSE)



https://dergipark.org.tr/tr/pub/josse

Environmental Justice Education: Awareness or Transformation in Classrooms? A Systematic Review

***** *This study was presented as an oral presentation at the 1. International Black Sea Educational Sciences Congress in Trabzon on May 2-4, 2025.*

Zümrüt VAROL SELÇUK[1]
Ordu University, Faculty of Education, Department of Mathematics and Science Education
PhD Student, MSc.
zumrutvarolselcuk@gmail.com
Orcid ID: 0000-0001-50150291

Gamze MERCAN[2]
Hacettepe University, Faculty of Education, Department of Mathematics and Science Education
Dr
gmercn@gmail.com
Orcid ID: 0000-0001-5515999X

Erdem KAYA[3]
Ordu University Unye Vocational School Department of Computer Technologies
Assist. Prof. Dr.
kayaerdem@odu.edu.tr
Orcid ID: 0000-0002-1524-7829

Article Type: Research Article
Received: 19.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Citation: Varol Selçuk, Z., Mercan, G., & Kaya, E. (2025). Environmental justice education: awareness or transformation in classrooms? a systematic review. *Journal of Social Sciences and Education*, *8*(1), 114-133.

Environmental Justice Education: Awareness or Transformation in Classrooms? A Systematic Review*

Zümrüt VAROL SELÇUK[1]

Ordu University, Faculty of Education, Department of Mathematics and Science Education

Gamze MERCAN[2]

Hacettepe University, Faculty of Education, Department of Mathematics and Science Education

Erdem KAYA[3]

Ordu University Unye Vocational School Department of Computer Technologies

Abstract

The escalating environmental crisis has underscored the urgent need for a paradigm shift in environmental education (EE), particularly toward models that integrate environmental justice (EJ) and foster critical engagement. This systematic review examines whether classroom-based EE interventions between January 2010 and February 2025 have primarily cultivated awareness or catalyzed transformative learning rooted in justice. Using the PRISMA methodology, 49 peer-reviewed articles were analyzed, encompassing interventions across early childhood education, primary school settings, and pre-service teacher training programs. Four core dimensions were evaluated: thematic content, pedagogical depth, student engagement, and instructional resources. Findings reveal a persistent emphasis on ecological content transmission, with limited incorporation of social or distributive justice themes. Most interventions promoted individual behavior change rather than collective, critically informed action. Student tasks often lacked depth, prioritizing information recall over participatory inquiry or civic engagement. Additionally, the widespread use of teacher-generated materials, while creative, seldom reflected interdisciplinary or socio-political complexities of EJ. This trend signals a missed opportunity to empower learners as agents of systemic change. The review concludes that although awareness of environmental issues is growing in educational contexts, the integration of environmental justice remains marginal and superficial.

Research Article

Received: 19.05.2025
Accepted: 31.05.2025
Published online: 31.05.2025

Keywords: Environmental justice, environmental education, transformative learning, critical pedagogy, teacher education

***** *This study was presented as an oral presentation at the 1. International Black Sea Educational Sciences Congress in Trabzon on May 2-4, 2025.*

Corresponding author:
[1] *PhD Student, MSc.*
zumrutvarolselcuk@gmail.com
Orcid ID: 0000-0001-50150291
[2]*Dr*
gmercn@gmail.com
Orcid ID: 0000-0001-5515999X
[3]*Assist. Prof. Dr.*
kayaerdem@odu.edu.tr
Orcid ID: 0000-0002-1524-7829

Introduction

The environmental crisis is no longer a looming threat—it is an undeniable reality shaped by decades of unsustainable practices (Carson, 1962). Accelerated climate change, biodiversity loss, and the inequitable distribution of natural resources such as food and water are consequences of societal models that prioritize economic growth over ecological balance (Wolff et al., 2017; Almond et al., 2020). In response to this escalating situation, a variety of global strategies have emerged to mitigate anthropogenic impacts, spanning social, economic, and health-related dimensions (Hofman-Bergholm, 2018).

Since the 1972 Stockholm Conference, education has been identified as a key driver for environmental action. Environmental education (EE), as first defined by Stapp et al. (1969), was envisioned as a tool to empower individuals with the knowledge, motivation, and skills needed to address environmental issues. UNESCO and other international bodies have since underscored the importance of nurturing sustainable values from early childhood (UNESCO, 2017). Yet, despite such theoretical advancements, practical classroom implementations remain scarce and often fail to foster transformative change (Olsson & Gericke, 2016; Liefländer & Bogner, 2014).

One of the main criticisms leveled at EE is its overreliance on knowledge transmission, rather than fostering meaningful behavioral change (Mogensen & Mayer, 2009). Fear-based narratives and top-down instruction models have discouraged students, particularly adolescents, from engaging in sustainability-oriented behaviors (Bartlett et al., 2022). Moreover, research has traditionally prioritized ecological literacy while sidelining crucial dimensions such as social equity, economic justice, and ethical responsibility (Dawson & Carson, 2020).

A growing body of literature argues that environmental issues are deeply entwined with justice and equity. The environmental justice (EJ) framework highlights how marginalized populations often bear the brunt of environmental degradation while contributing the least to its causes (Lele, 2017; Agyeman, 2014; Tsuji, 2021). From forced climate migration to disproportionate exposure to pollution, EJ brings to light the systemic inequities embedded in environmental challenges and the policy responses to them.

In educational contexts, integrating EJ within EE can empower students to act as agents of change (Dimick, 2012; Walter et al., 2020). Though not explicitly mentioned in the 2030 Agenda's Sustainable Development Goals (Menton et al., 2020), EJ aligns closely with the vision of participatory, critical, and emancipatory education (Sjöström & Eilks, 2018; Valladares, 2021). However, for EJ to become actionable in classrooms, pedagogical

approaches must go beyond content knowledge to foster systems thinking, critical literacy, and action competence (Lorenzo-Rial et al., 2020; Bächtold et al., 2022).

Despite emerging models, such as the use of argumentation, modelling, and future-oriented thinking in science education (Uskola & Puig, 2023; Esquivel-Martín et al., 2023; Brocos & Jiménez-Aleixandre, 2022), comprehensive frameworks for implementing EJ in everyday classroom instruction remain limited (Moore, 2023). While systematic reviews exist regarding EE interventions across education levels (Varela-Losada et al., 2016; Ardoin & Bowers, 2020; Güler Yıldız et al., 2021; O'Flaherty & Liddy, 2018), few if any address the integration of EJ, especially through a lens of transformative pedagogy.

Given this significant gap, the present systematic review aims to explore how environmental justice is addressed within formal education, particularly in early childhood education (ECE), primary education (PE), and pre-service teacher training (PTT). By focusing on classroom-based interventions, this study seeks to understand how EJ principles are (or are not) incorporated into teaching practices and what pedagogical elements are necessary to bridge the theory-practice divide.

Method

This study employed a quantitative, exploratory-descriptive design based on a systematic literature review approach. The objective was to investigate the extent to which environmental justice (EJ) is integrated into classroom-based environmental education (EE) practices within early childhood education (ECE), primary education (PE), and pre-service teacher training (PTT). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework was adopted to ensure transparency, reproducibility, and academic rigor in the review process (Page et al., 2021).

Model

This study adopted a quantitative research approach with an exploratory-descriptive methodology, conducted through a systematic literature review. Systematic reviews are particularly valuable for mapping existing knowledge, identifying patterns, and detecting gaps in research (Page et al., 2021). The aim was to assess how environmental education (EE) practices have integrated the environmental justice (EJ) perspective in early childhood education (ECE), primary education (PE), and pre-service teacher training (PTT). The review

followed the PRISMA 2020 guidelines for transparency and reproducibility (Page et al., 2021). The process is illustrated in Figure 1.

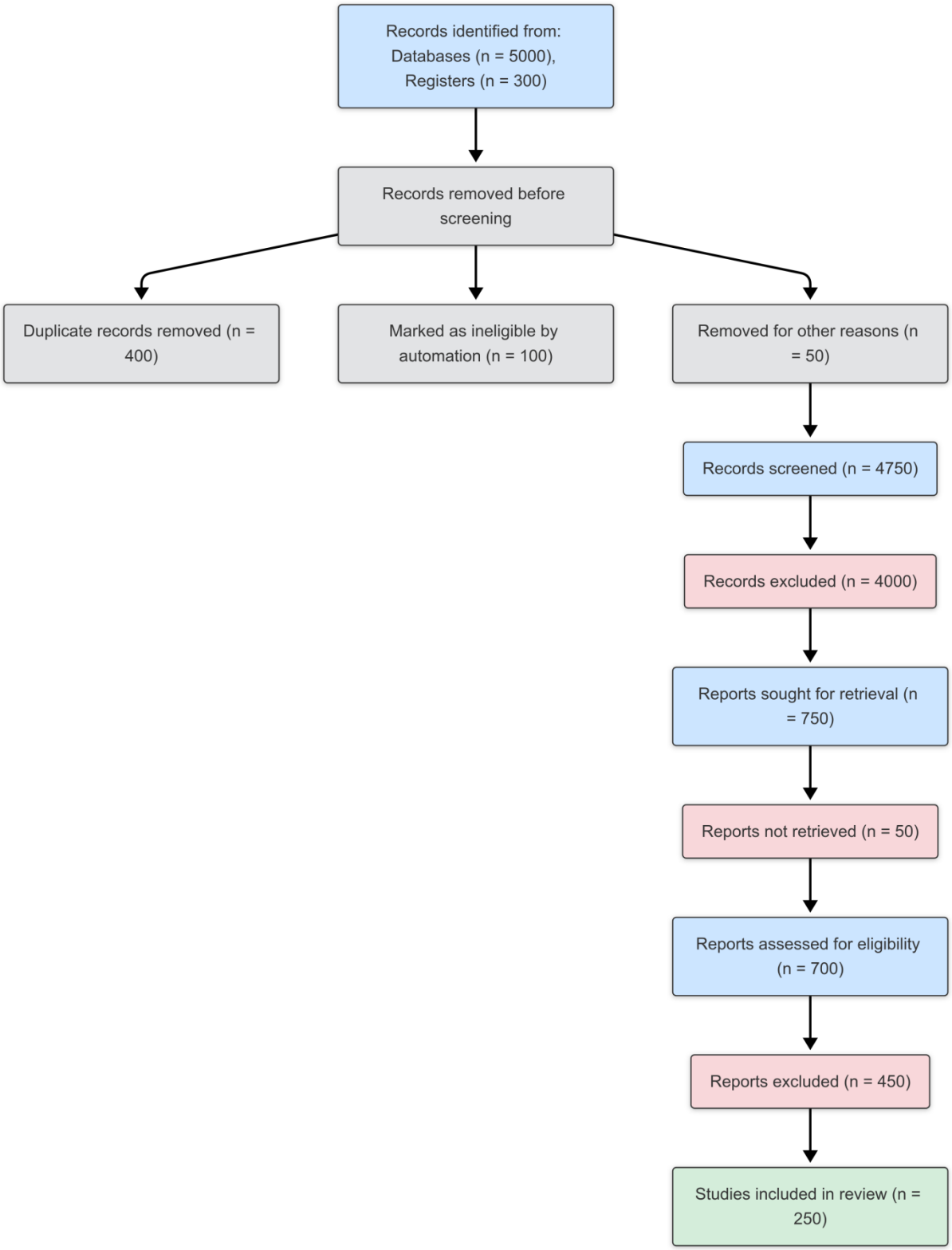


Figure 1 *PRISMA 2020 Flowchart – Systematic Review*

Data Sources and Sampling Criteria

A total of 22 high-impact journals indexed in JCR-SJR databases were selected across the fields of science education and social justice education, considering their academic influence and relevance in environmental education discourse. The articles were screened if they included the following keywords in English: "Environmental Education", "Environmental Justice", "Education for Sustainability", "Sustainable Development Goals", "Science, Technology, Society and Environment"

The timeframe was limited to January 2015 through December 2021 to align with the influence of the 2030 Agenda and the adoption of the SDGs, which emphasize environmental equity and social dimensions (UNESCO, 2017).

Selection Process

Articles were initially filtered for relevance and depth of intervention. In total, 88 interventions were identified: ECE (n = 8), PE (n = 45), and PTT (n = 35). These were evaluated based on whether they could be analysed in the context of EJ-oriented educational practices. Articles were classified as follows:

- Analysable: clear intervention details with EJ content
- Not analysable: relevant content but insufficient detail
- Not applicable: unrelated to environmental education despite matching keywords

As shown in Table 1, 49 articles were included for detailed analysis.

Table 1

Inclusion and Exclusion Criteria for Systematic Review

Type of Criterion	Inclusion	Exclusion
Environmental education topic	✓	
Published in JCR or SJR-indexed journal	✓	
Keywords in title/abstract	✓	
"Education for Sustainability"	✓	
"Sustainable Development Goals"	✓	
"Science, Technology, Society, Env."	✓	

Analytical Framework

The analysis grid included variables such as:

- Educational stage (ECE, PE, PTT)
- Content of intervention

- Level of depth (content knowledge, awareness-raising, action-taking)
- Student involvement
- Types of resources used

The classification of depth levels was guided by historical EE goals (Belgrade Charter, 1975; UNESCO, 2017):

- Content Knowledge: conceptual understanding
- Awareness-Raising: emotional and ethical engagement
- Action-Taking: initiatives led by students

These categories helped assess whether the interventions fostered transformative learning or remained limited to ecological knowledge (Medir et al., 2016).

Statistical Analysis

Two external evaluators validated the coding scheme. Then, both descriptive (absolute and relative frequencies) and inferential statistics (chi-square test, $p \leq .05$) were computed using IBM SPSS Statistics 19 and Microsoft Excel.

For example, Table 2 summarizes the observed frequencies of resources used across educational stages.

Table 2

Observed Frequencies of İnstructional Resources Used Across Educational Stages.

Resource Type	ECE	PE	PTT	Total	p-value
Self-made materials	6	12	8	26	.169
Other (misc.)	4	8	10	22	.104
Games/group dynamics	5	7	9	21	.045*
Field outings	1	12	7	20	.301
Images	6	6	4	16	.005*
Literary resources	5	4	0	9	.000*
Audiovisual materials	3	2	3	8	.078
Expert visits	1	4	3	8	.948
Total	33	59	49	141	

To ensure robustness, expected values were calculated (Table 3), based on row and column totals.

Table 3

Expected Frequencies of Instructional Resources Based on Educational Stage

Resource Type	ECE	PE	PTT
Self-made materials	6	11	9

Others	5	9	8
Games/group dynamics	5	9	7
Field outings	5	8	7
Images	4	7	6
Literary resources	2	4	3
Audiovisual materials	2	3	3
Expert visits	2	3	3

Ethical Considerations

The decision numbered 2025/04, dated 16/04/2025, was issued by the İstinye University Human Research Ethics Committee.

Findings

This section presents the findings of the systematic review across four key variables: contents, depth level, actions required of students, and resources. In each case, general patterns are identified and then broken down by educational stage: Early Childhood Education (ECE), Primary Education (PE), and Pre-service Teacher Training (PTT). Chi-square (χ^2) analyses were used to determine statistically significant differences ($p \leq 0.05$).

Contents of Environmental Education Interventions

Analysis of the content addressed (Figure 2) revealed a strong emphasis on the natural environment (33.1%) and ecological environmental problems (20.0%), which together accounted for over half of the reviewed interventions. Content related to socioeconomic, ethical, or health-based perspectives was much less frequent, each comprising less than 5% of the sample.

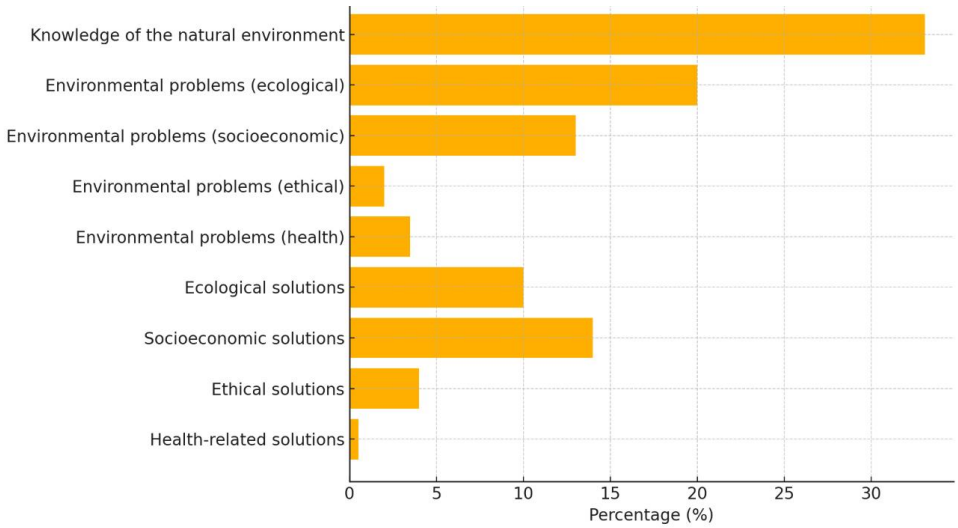


Figure 2. *Distribution of Content Types in Reviewed Environmental Education Interventions*

A comparison of content by educational stage (Table 4) revealed no significant variation in the overall topics addressed across stages (χ^2, $p > 0.05$). However, minor trends were observed. For example, ECE showed relatively more emphasis on socioeconomic solutions (18.8%), while PE and PTT leaned toward ecological problem-solving (21.9% and 20.0%, respectively).

Table 4

Frequency (%) Of Content Addressed According to Educational Stage

Content Type	ECE (%)	PE (%)	PTT (%)
Knowledge of the natural environment	37.5	34.4	30.0
Environmental problems (ecological perspective)	12.5	21.9	20.0
Environmental problems (socioeconomic perspective)	12.5	12.5	14.0
Environmental problems (ethical perspective)	0.0	0.0	2.0
Environmental problems (health perspective)	0.0	4.7	6.0
Ecological solutions	12.5	10.9	10.0
Socioeconomic solutions	18.8	9.4	14.0
Ethical solutions	6.3	4.7	4.0
Health-related solutions	0.0	1.6	0.0

Depth Level of Interventions

The depth of engagement in the interventions was examined based on three categories: content knowledge, awareness-raising, and action-taking. As shown in Figure 3, most activities focused on awareness (44.1%) or knowledge transmission (40.1%), with only 15.8% encouraging students to take action.

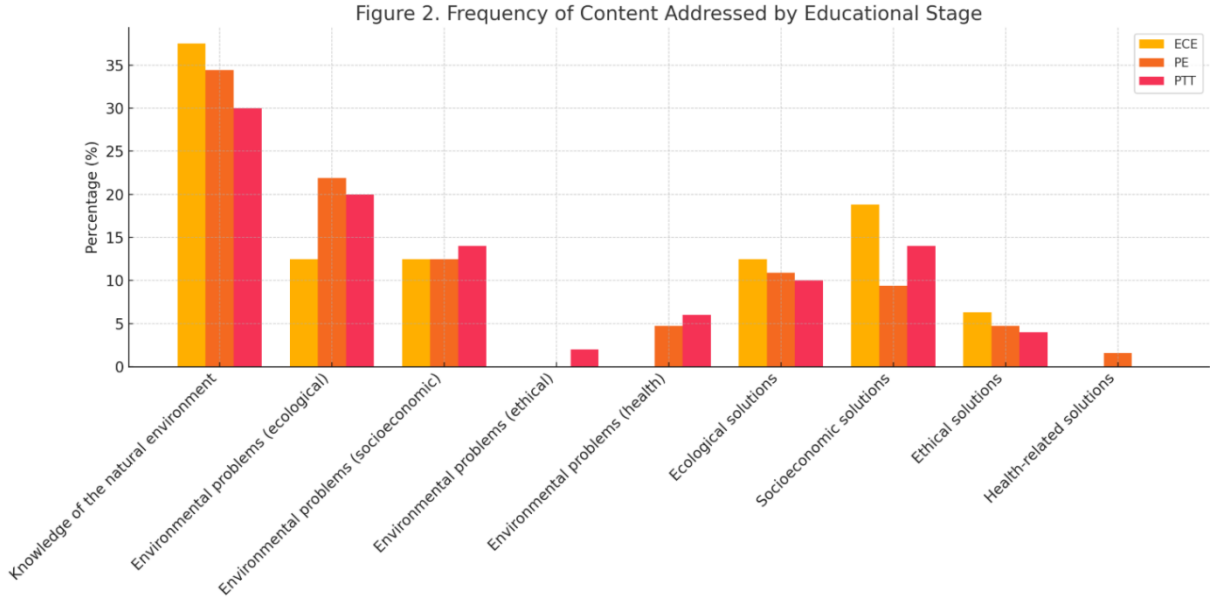


Figure 3. *Depth Level of Environmental Education Interventions*

Subcategory analysis revealed an ecological bias in both knowledge and awareness components. For action-taking, most interventions merely encouraged idea generation, with very few extending to local or global action.

Figure 4 presents depth level across educational stages. Notably, ECE exhibited a relatively high proportion of action-based interventions (36.0%), unlike PE (10.5%) and PTT (17.5%). In contrast, awareness-raising increased with education level, reaching its peak in PTT (52.3%).

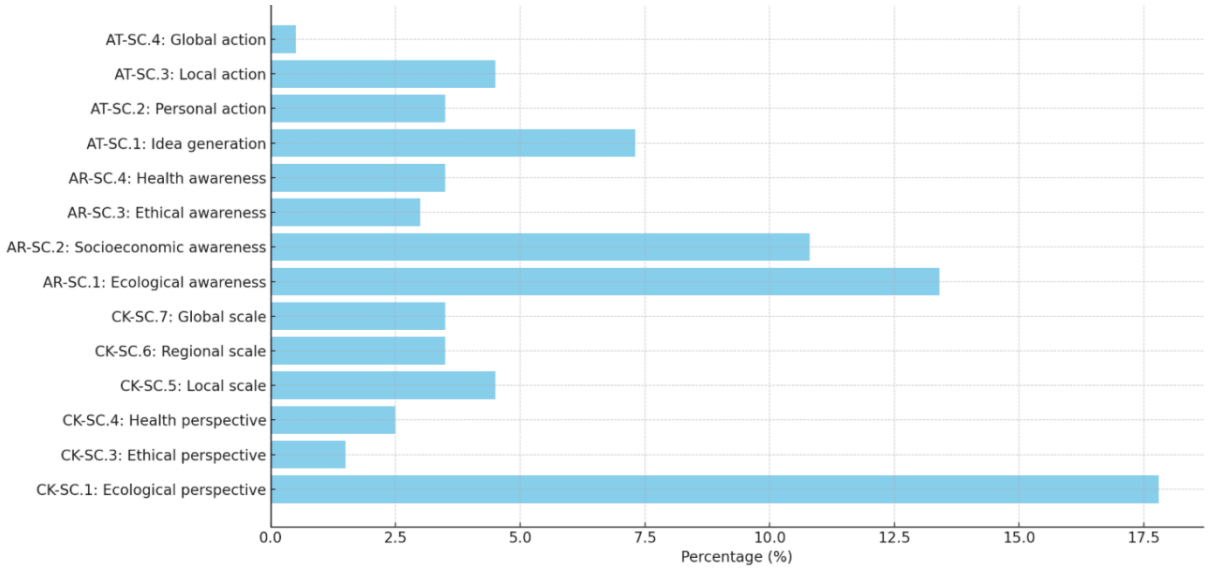


Figure 4. *Depth Level By Educational Stage (Significant Differences: $p \leq 0.05$)*

Actions Required of Students

Table 5 outlines the types of actions required from students. The most common were acquiring conceptual knowledge (13.8%), collaborative work (9.8%), and information search (8.0%). Actions promoting critical thinking, attitudinal change, or reflection on future scenarios were far less frequent (all under 6%).

Table 5

Frequency (%) of Actions Requested from Students by Educational Stage

Action Type	ECE	PE	PTT	Total (%)
Learning conceptual knowledge	1.8	7.7	4.3	13.8
Working collaboratively	1.8	4.0	4.0	9.8
Searching for information	1.5	3.1	3.4	8.0
Discovering basic environmental aspects	1.5	4.3	2.1	8.0
Learning procedural knowledge	1.5	4.6	1.5	7.7
Questioning prior knowledge	0.9	1.8	3.4	6.1
Developing critical thinking	0.6	2.1	3.1	5.8

Taking action for the environment	0.9	2.5	0.6	4.0
Reflecting on everyday life	0.6	2.1	1.2	4.0
Reflecting on desired future	0.6	1.2	0.9	2.8

Significant differences were found between educational stages only for the category "questioning assumed knowledge", which was higher in PTT (χ^2, $p \leq 0.05$). Furthermore, action types also varied with content type: conceptual learning and critical thinking were linked to ecological issues, while health and ethical issues promoted more reflective or value-based responses (χ^2, $p \leq 0.05$).

Resources Used

As shown in Figure 5, self-made materials (18.4%) were the most commonly used resources in interventions, followed by group dynamics (14.9%) and field outings (14.2%). Less frequent were literary materials, audiovisual content, and expert visits, each under 6.5%.

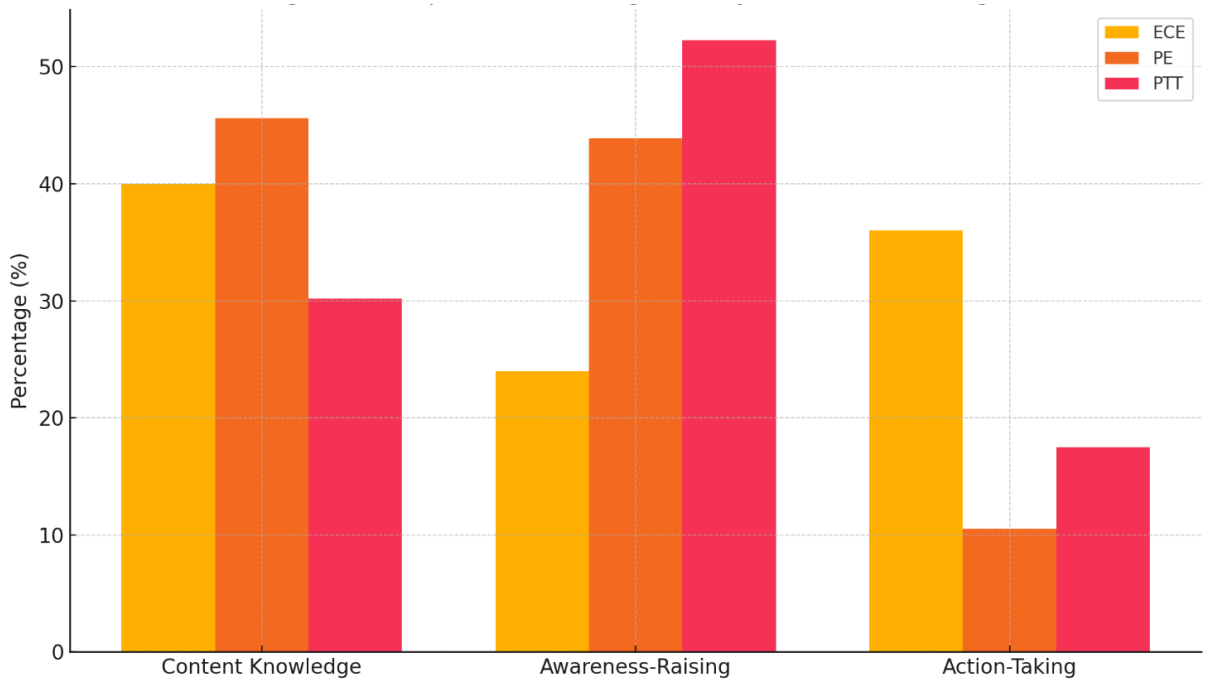


Figure 5. *Distribution of Resources Used in Environmental Education*

Table 6 displays the distribution of resources by educational stage. Differences were found for group dynamics, literary resources, and images. ECE relied more on literary and visual content, while PTT focused more on group activities (χ^2, $p \leq 0.05$).

Table 6

*Resources Used By Educational Stage (in %) (*Significant if p ≤ 0.05)*

Resource Type	ECE (%)	PE (%)	PTT (%)	p-Value
Self-made materials	18.2	20.3	16.3	0.169
Group dynamics/games	15.2	11.9	18.4	0.045 *
Field outings	3.0	20.3	14.3	0.301
Images	18.2	10.2	8.2	0.005 *
Literary resources	15.2	6.8	0.0	0.000 *
Audiovisual material	9.1	3.4	6.1	0.078
Expert visits	3.0	6.8	6.1	0.948

Significant associations were also found between resource type and content. For instance, field trips were frequently used to teach natural environment knowledge (χ^2, $p \leq 0.05$), while self-made materials were more prevalent in interventions addressing socioeconomic solutions (χ^2, $p \leq 0.05$).

Results and Discussion

The primary aim of this systematic review was to examine how environmental education (EE) has been implemented in Early Childhood Education (ECE), Primary Education (PE), and Pre-Service Teacher Training (PTT) classrooms from the perspective of environmental justice (EJ). The findings indicate that despite increased attention to sustainability and justice-oriented goals in global educational agendas, such as the 2030 Agenda for Sustainable Development (United Nations, 2015), classroom practices continue to reflect limited integration of these paradigms.

The analysis revealed that more than half of the reviewed classroom interventions focused on either “knowledge of the natural environment” or “ecological environmental problems.” This supports earlier studies indicating that EE in practice remains primarily ecological in scope, often marginalizing socioeconomic, ethical, and health dimensions (Clark & Miles, 2021; Dawson & Carson, 2020). These results also align with critiques of EE's conceptual narrowness, where scientific-technical knowledge is privileged over social, ethical, and participatory dimensions (Mogensen & Mayer, 2009; Olsson & Gericke, 2016).

The persistent prioritization of ecological issues could be attributed to curricular traditions that treat environmental science as a natural science topic rather than a multidisciplinary field (Hofman-Bergholm, 2018). Despite the explicit call for an integrated, systemic perspective by international frameworks such as the Belgrade Charter (1975) and

subsequent UNESCO reports (UNESCO, 2017), the findings suggest that such integration is yet to be realized in most classrooms. Teachers may lack training or resources to effectively incorporate diverse perspectives such as environmental ethics, health equity, or social justice (Dimick, 2012; Pérez-Martín et al., 2022).

When examining the pedagogical depth of interventions, the majority were found to emphasize either content knowledge or awareness-raising. Action-taking activities—those that allow students to engage with real-world problems and propose or implement solutions—comprised less than 16% of interventions. This imbalance raises concerns, particularly in light of the theoretical foundations of transformative environmental education, which emphasize participatory and experiential learning as essential for fostering sustainability-oriented behavior change (Rodríguez Aboytes & Barth, 2020; Valladares, 2021).

These results are in line with earlier findings indicating that simply transmitting environmental knowledge does not necessarily lead to pro-environmental behavior (Otto & Pensini, 2017; Olsson et al., 2022). While interventions aimed at raising awareness are important, they must be complemented by strategies that promote critical reflection and agency (Bächtold et al., 2022). The lack of such action-based approaches is especially problematic in PTT programs, where future educators should be equipped to model and facilitate environmental citizenship (Mora & Guerrero, 2022).

Interestingly, the data also show that ECE interventions included a relatively higher proportion of action-oriented activities compared to PE and PTT. This may reflect the more hands-on, experiential nature of early childhood curricula, but also raises questions about missed opportunities in higher stages of education. As Otto et al. (2019) argue, early experiences with nature and social responsibility are foundational for long-term environmental engagement, and should be built upon rather than replaced by abstract knowledge as students advance through the education system.

Further analysis of the "actions required of students" revealed a strong focus on lower-order cognitive skills such as conceptual understanding, information search, and basic environmental exploration. Actions linked to critical thinking, ethical reasoning, or civic engagement—such as "questioning assumed knowledge," "reflecting on everyday life," or "acting in favor of the environment"—were significantly less frequent.

These findings suggest a disconnect between the goals of environmental justice education and actual classroom practices. As noted by Sjöström and Eilks (2018), critical scientific literacy should empower learners to engage with complex socio-environmental issues

in thoughtful and transformative ways. However, our findings suggest that such literacy is rarely cultivated through current EE interventions.

Furthermore, the study identified a lack of progression in pedagogical goals across educational stages. One would expect increasingly complex and autonomous student actions in PTT, particularly given the importance of cultivating reflective teaching practice (Walter et al., 2020; Pérez-Martín & Bravo-Torija, 2018). Instead, the tasks required of pre-service teachers mirrored those of younger students, lacking the depth needed to prepare them for integrating environmental justice into their future classrooms.

In terms of instructional resources, the predominance of self-made materials points to a possible lack of access to or dissatisfaction with existing EE resources. This interpretation is consistent with studies showing that commercially available textbooks often fail to address sustainability in meaningful ways, focusing on reductive themes such as recycling without fostering deeper understanding (Martínez-Medina & Arrebola, 2019).

Group games and field outings were common, particularly in ECE and PE. While such activities can support experiential learning (Herman et al., 2023), they must be structured to include reflection and decision-making to align with the goals of environmental justice education. Otherwise, they risk becoming mere recreational activities devoid of transformative potential (Herman et al., 2021).

The study also found that certain types of resources, such as literary texts and audiovisual materials, were underutilized, particularly in PTT. Given their potential to humanize environmental issues and provoke ethical reflection (Ben-Zvi-Assaraf & Knippels, 2022), integrating such resources could greatly enhance the EJ orientation of EE practices.

Recommendations

The lack of differentiation in content and pedagogy across educational stages underscores the need for clear curricular frameworks that define learning outcomes related to environmental justice by age group. Without such guidance, educators may default to traditional, knowledge-centered approaches that fail to build the competencies required for sustainability and justice.

The underrepresentation of classroom interventions in the literature (only 49 out of over 700 articles reviewed) points to a research-practice gap that limits our understanding of how EJ principles can be effectively implemented in real educational settings (Moore, 2023; Guevara-

Herrero et al., 2023). This may be due in part to the theoretical nature of much environmental justice literature, which tends to lack pedagogical specificity (Clark & Miles, 2021).

Moreover, the methodological decision to include only JCR and SJR-indexed journals, while ensuring quality, may have excluded relevant case studies and classroom-based research published in local or practitioner-oriented outlets. Future reviews should consider incorporating a broader range of sources to capture the diversity of practices and contexts in environmental education.

Ethical Committee Approval

The decision numbered 2025/04, dated 16/04/2025, was issued by the İstinye University Human Research Ethics Committee.

References

Agyeman, J. (2014). Environmental justice and sustainability. In G. Atkinson, S. Dietz, E. Neumayer, & M. Agarwala (Eds.), *Handbook of sustainable development* (2nd ed., pp. 188–205). Edward Elgar Publishing. https://doi.org/10.4337/9781782544708.00021

Almond, R. E. A., Grooten, M., & Petersen, T. (2020). *Living Planet Report 2020—Bending the curve of biodiversity loss*. World Wildlife Fund. https://www.wwf.org.uk/updates/living-planet-report-2020

Ardoin, N. M., & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review*, *31*, 100353. https://doi.org/10.1016/j.edurev.2020.100353

Bächtold, M., Pallarès, G., De Checchi, K., & Munier, V. (2022). Combining debates and reflective activities to develop students' argumentation on socioscientific issues. *Journal of Research in Science Teaching*, *60*(5), 761–806. https://doi.org/10.1002/tea.21843

Bartlett, M., Larson, J., & Lee, S. (2022). Environmental justice pedagogies and self-efficacy for climate action. *Sustainability*, 14(22), 15086. https://doi.org/10.3390/su142215086

Ben-Zvi Assaraf, O., & Knippels, M. C. P. J. (2022). Lessons learned: Synthesizing approaches that foster understanding of complex biological phenomena. In *Fostering understanding of complex systems in biology education* (pp. 249–278). Springer. https://doi.org/10.1007/978-3-030-82750-2_13

Brocos, P., & Jiménez-Aleixandre, M. P. (2022). Social responsibility and critical disposition for considering and acting upon conflicting evidence in argumentation about sustainable diets. In B. Puig & M. P. Jiménez-Aleixandre (Eds.), *Critical thinking in biology and environmental education* (pp. 211–227). Springer. https://doi.org/10.1007/978-3-030-86100-2_11

Carson, R. (1962). *Silent spring*. Houghton Mifflin.

Clark, S. S., & Miles, M. L. (2021). Assessing the integration of environmental justice and sustainability in practice: A review of the literature. *Sustainability, 13*(20), 11238. https://doi.org/10.3390/su132011238

Dawson, V., & Carson, K. (2020). Introducing argumentation about climate change socioscientific issues in a disadvantaged school. *Research in Science Education, 50*(3), 863–883. https://doi.org/10.1007/s11165-018-9724-2

Dimick, A. S. (2012). Student empowerment in an environmental science classroom: Toward a framework for social justice science education. *Science Education, 96*(6), 990–1012. https://doi.org/10.1002/sce.21035

Esquivel-Martín, T., Pérez-Martín, J. M., & Bravo-Torija, B. (2023). Does pollution only affect human health? A scenario for argumentation in the framework of One Health education. *Sustainability*, *15*(9), 6984. https://doi.org/10.3390/su15096984

Güler Yıldız, T., Öztürk, N., İlhan İyi, T., Aşkar, N., Banko Bal, Ç., Karabekmez, S., & Höl, Ş. (2021). Education for sustainability in early childhood education: A systematic review. *Environmental Education Research*, *27*(6), 796–820. https://doi.org/10.1080/13504622.2021.1895364

Herman, B. C., Newton, M. H., & Zeidler, D. L. (2021). Impact of place-based socioscientific issues instruction on students' contextualization of socioscientific orientations. *Science Education, 105*(3), 585–627. https://doi.org/10.1002/sce.21611

Herman, B. C., Poor, S. V., Oertli, R. T., & Schulte, K. (2023). Promoting young learners' NOS views through place-based SSI instruction. *Science Education, 32*(4), 947–992. https://doi.org/10.1002/sce.21869

Hofman-Bergholm, M. (2018). Could education for sustainable development benefit from a systems thinking approach? *Systems*, *6*(4), 43. https://doi.org/10.3390/systems6040043

Lele, S. (2017). Sustainable Development Goal 6: Watering down justice concerns. *WIREs Water*, *4*(6), e1224. https://doi.org/10.1002/wat2.1224

Liefländer, A. K., & Bogner, F. X. (2014). The effects of children's age and sex on acquiring pro-environmental attitudes through environmental education. *The Journal of Environmental Education*, *45*(2), 105–117. https://doi.org/10.1080/00958964.2013.875511

Lorenzo-Rial, M. A., Pérez-Rodríguez, U., Varela-Losada, M., & Vega-Marcote, P. (2020). Do pre-service teachers' personal characteristics influence their attitudes towards transformative environmental education? *Pensamiento Educativo*, *57*(1), 1–22. https://doi.org/10.7764/PEL.57.1.2020.1

Martínez-Medina, R., & Arrebola, J. C. (2019). Analysis of sustainability activities in Spanish elementary education textbooks. *Sustainability, 11*(18), 5182. https://doi.org/10.3390/su11185182

Medir, R. M., Heras, R., & Magin, C. (2016). Una propuesta evaluativa para actividades de educación ambiental para la sostenibilidad. *Educación XXI, 19*(1), 331–355. https://doi.org/10.5944/educxx1.16436

Menton, M., Larrea, C., Latorre, S., Martinez-Alier, J., Peck, M., Temper, L., & Walter, M. (2020). Environmental justice and the SDGs: From synergies to gaps and contradictions. *Sustainability Science*, *15*, 1621–1636. https://doi.org/10.1007/s11625-020-00789-8

Mogensen, F., & Mayer, M. (2009). Perspectivas sobre la educación ambiental: Un marco de trabajo crítico. In F. Mogensen, M. Mayer, S. Breiting, & A. Narga (Eds.), *Educación para el desarrollo sostenible. Tendencias, divergencias y criterios de calidad* (pp. 21–42). Graó.

Moore, E. B. (2023). Utilization of a novel pedagogical framework to create and implement an environmental justice strategies undergraduate course: A case study. *Journal of Environmental Studies and Sciences*, 1–6. https://doi.org/10.1007/s13412-023-00844-2

Mora, P., & Guerrero, G. (2022). Las competencias ambientales clave en las actividades docentes del profesorado de ciencias. *Tendencias Pedagógicas, 51*, 299–316. https://doi.org/10.15366/tp2022.51.17

Olsson, D., & Gericke, N. (2016). The adolescent dip in students' sustainability consciousness. *The Journal of Environmental Education, 47*(1), 35–51. https://doi.org/10.1080/00958964.2015.1075464

Olsson, D., Gericke, N., & Boeve-de Pauw, J. (2022). The effectiveness of education for sustainable development revisited—A longitudinal study on secondary students' action competence for sustainability. *Environmental Education Research, 28*(3), 405–429. https://doi.org/10.1080/13504622.2021.1954053

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behavior. *Global Environmental Change, 47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Otto, S., Evans, G. W., Moon, M. J., & Kaiser, F. G. (2019). The development of children's environmental attitude and behavior. *Global Environmental Change, 58*, 101947. https://doi.org/10.1016/j.gloenvcha.2019.101947

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Pérez-Martín, J. M., & Bravo-Torija, B. (2018). Experiencias para una alfabetización científica que promueva la justicia ambiental en distintos niveles educativos. *Revista Internacional de Educación para la Justicia Social, 7*(1), 119–140. https://doi.org/10.15366/riejs2018.7.1.006

Pérez-Martín, J. M., Esquivel-Martín, T., & Guevara-Herrero, I. (2022). En busca de la dimensión abandonada: La Didáctica de la Educación Ambiental. In J. M. Pérez-Martín, T. Esquivel-Martín, & I. Guevara-Herrero (Eds.), *Educación Ambiental de Maestros Para Maestros* (pp. 9–15). Dykinson.

Puig, B., & Jiménez-Aleixandre, M. P. (2022). The integration of critical thinking in biology and environmental education. In B. Puig & M. P. Jiménez-Aleixandre (Eds.), *Critical thinking in biology and environmental education* (pp. 269–276). Springer. https://doi.org/10.1007/978-3-030-86100-2_13

Rodríguez Aboytes, J. G., & Barth, M. (2020). Transformative learning in the field of sustainability: A systematic literature review (1999–2019). *International Journal of Sustainability in Higher Education, 21*(5), 993–1013. https://doi.org/10.1108/IJSHE-05-2019-0168

Shukla, H., & Ferrara, A. (1986). Rapid estimation of insertional length of umbilical catheters in newborns. *American Journal of Diseases of Children*, *140*(8), 786–788. https://doi.org/10.1001/archpedi.1986.02140220068034

Sjöström, J., & Eilks, I. (2018). Reconsidering different visions of scientific literacy and science education based on the concept of Bildung. In Y. Dori, Z. Mevarech, & D. Baker (Eds.), *Cognition, Metacognition, and Culture in STEM Education* (pp. 65–88). Springer. https://doi.org/10.1007/978-3-319-66659-4_5

Sjöström, J., & Eilks, I. (2018). Reconsidering different visions of scientific literacy and science education based on the concept of Bildung. In Y. Dori, Z. Mevarech & D. Baker (Eds.), *Cognition, metacognition, and culture in STEM education* (pp. 65–88). Springer. https://doi.org/10.1007/978-3-319-66659-4_5

Stapp, W. B., Bennett, D., Bryan, W., Fulton, J., MacGregor, J., Nowak, P., Swan, J., Wall, R., & Havlick, S. (1969). The concept of environmental education. *Environmental Education*, 1(1), 30–31. https://doi.org/10.1080/00139254.1969.10801479

Tsuji, S. R. J. (2021). Indigenous environmental justice and sustainability: What is environmental assimilation? *Sustainability*, 13(15), 8382. https://doi.org/10.3390/su13158382

UNESCO. (2017). *Education for Sustainable Development Goals: Learning objectives*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000247444

United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. https://sdgs.un.org/2030agenda

Uskola, A., & Puig, B. (2023). Development of systems and futures thinking skills by primary pre-service teachers for addressing epidemics. *Research in Science Education*, 53, 741–757. https://doi.org/10.1007/s11165-021-10019-w

Valladares, L. (2021). Scientific literacy and social transformation. *Science Education, 30*(4), 557–587. https://doi.org/10.1007/s11191-021-00237-0

Varela-Losada, M., Vega-Marcote, P., Pérez-Rodríguez, U., & Álvarez-Lires, M. (2016). Going to action? A literature review on educational proposals in formal Environmental Education. *Environmental Education Research*, 22(3), 390–421. https://doi.org/10.1080/13504622.2015.1101751

Walter, M., Weber, L., & Temper, L. (2020). Learning and teaching through the online Environmental Justice Atlas: From empowering activists to motivating students. *New Directions for Teaching and Learning, 161*, 101–122. https://doi.org/10.1002/tl.20408