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Message from the Editor,

I am very pleased to inform you that we have published the second issue in 2026. As an editor of International Online Journal of Primary Education (IOJPE), this issue is the success of our authors, very valuable reviewers who undertook the rigorous peer review of the manuscripts, and those of the editorial board who devoted their valuable time through the review process. In this respect, I would like to thank to all reviewers, researchers and the editorial board members. The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Online Journal of Primary Education (IOJPE). For any suggestions and comments on IOJPE, please do not hesitate to send me e-mail. The countries of the authors contributed to this issue (in alphabetical order): Azerbaijan, Greece, and Türkiye.

Prof. Dr. Nergüz BULUT SERİN

Editor in Chief

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A SYSTEMATIC REVIEW ON ARTIFICIAL INTELLIGENCE-BASED ACADEMIC AND PSYCHOSOCIAL INTERVENTIONS FOR STUDENTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

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Abstract

Attention-Deficit/Hyperactivity Disorder (ADHD) presents persistent academic and psychosocial challenges across the lifespan. This systematic literature review examines the emerging role of Artificial Intelligence (AI) as a potential supportive tool in addressing these difficulties. Following PRISMA guidelines, nine empirical studies published between 2020 and 2025 were synthesized to evaluate the effectiveness of AI-based interventions. Results indicate that academic interventions, such as electroencephalogram (EEG)-based game frameworks and socially assistive robots, may enhance concentration, task management, and academic performance across primary, secondary, and higher education. Psychosocially, AI-driven tools like digital journaling and mood trackers show promise in promoting emotional regulation and improving quality of life. The synthesis reveals that AI acts as a dynamic cognitive and emotional scaffold, facilitating real-time personalization and non-judgmental feedback. This systematic literature review concludes that AI-based interventions can function as a valuable support framework in specialized education, providing students with ADHD the personalized and adaptive support necessary to achieve their full academic potential and psychosocial resilience.

Keywords: ADHD, artificial intelligence, academic interventions, psychosocial interventions, special education, educational technology.

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD) is a chronic neurodevelopmental condition characterized by persistent patterns of inattention, hyperactivity, and impulsivity that interfere with

functioning or development (Tanner & Hsu, 2025). Epidemiological data indicate that the prevalence of ADHD ranges from 3.2% to 10.5% among children and adolescents, and from 1.4% to 4.6% among adults (Martin et al., 2025). Moreover, ADHD often co-occurs with a wide range of other developmental and psychiatric conditions, including learning disorders, autism spectrum disorder, anxiety disorders, and oppositional defiant disorder (Antshel et al., 2016; D'Agati et al., 2019; Liu et al., 2025; Masi, 2015).

A substantial body of literature has documented that students diagnosed with ADHD encounter persistent challenges across academic and psychosocial domains (Antoniou et al., 2021; DuPaul et al., 2021; Ek et al., 2007; Healey & Rucklidge, 2006). Academically, these students tend to exhibit inefficient learning strategies, difficulties in sustaining attention and completing tasks, working memory impairments, and consequently, lower academic achievement (Abrahão & Elias, 2021; Ek et al., 2007; Zoëga et al., 2012). Psychosocially, they often experience deficits in social communication, peer interaction, and emotional regulation, which may compromise the development of stable interpersonal relationships and social bonds (Abrahão & Elias, 2021; Healey & Rucklidge, 2006; Pintos Lobo et al., 2025). Collectively, these findings underscore the critical need for targeted interventions designed to enhance both academic performance and psychosocial functioning among students with ADHD.

The effectiveness and design of ADHD interventions often vary depending on the developmental stage and educational context. In early childhood education, interventions typically focus on enhancing attention span, behavioral regulation, and task persistence (DuPaul, Kern et al., 2011; Hand & Lonigan, 2025). At the elementary school level, programs often target the acquisition of time management, organizational, and study skills (DuPaul & Weyandt, 2006; Santos & Albuquerque, 2019). In secondary education, interventions tend to prioritize executive functioning, task prioritization, and sustained engagement in learning activities (Chronis et al., 2006; Evans et al., 2020; Giannakopoulos, 2025). Finally, in higher education, students with ADHD benefit from programs aimed at fostering academic self-efficacy, self-regulated learning, and institutional integration (Chacko et al., 2024; Eiraldi et al., 2012; Tresco et al., 2010).

Parallel to academic interventions, psychosocial programs have demonstrated considerable benefits in improving emotional and social competencies among individuals with ADHD. For preschool and school-age students, these interventions emphasize emotion recognition, peer relationship building, and social skill acquisition (LaForett et al., 2008; Tourjman et al., 2022). For adolescents, programs often promote self-management, social problem-solving, and emotion regulation (Evans et al., 2014; Giannakopoulos, 2025). In the college and university context, psychosocial interventions tend to enhance self-esteem, psychological well-being, and overall quality of life (Ali et al., 2024; Wolf, 2001). While these traditional developmental models are well-documented, a significant gap remains in understanding how emerging digital tools can be systematically integrated into these established frameworks to provide scalable and adaptive support.

In recent years, Artificial Intelligence (AI) has emerged as a significant technological development within education, psychology, and special education. AI-based systems integrate ma-chine learning, adaptive algorithms, and data-driven personalization to support individualized learning and mental health interventions. Research suggests that AI-driven academic tools can enhance learning efficiency, personalize instructional content, and increase student motivation and engagement (Hasan & Khan, 2023; Wu & Yu, 2024). Similarly, AI-based psychosocial interventions—ranging from virtual therapeutic agents to emotion-recognition and feedback systems—have shown promising outcomes in reducing clinical symptoms, improving emotional awareness, and enhancing self-regulation among adolescents and adults (Alshammari, 2025; Gual-Montolio et al., 2022; Wang et al., 2022).

Given its capacity for personalization and real-time adaptation, AI represents a promising frontier for psychology and special education, offering opportunities for clinicians and educators to design data-informed, dynamic, and context-sensitive interventions (Liu et al., 2022; Wang & Xue, 2024).

This potential becomes particularly salient for students with ADHD, who benefit from structured, feedback-based, and interactive modalities of learning and behavior management. Indeed, technology-enhanced approaches, such as computer-assisted training and virtual reality-based interventions, have already been shown to yield significant improvements in attention, executive functioning, academic engagement, emotional regulation, and behavioral control among children with ADHD (Doulou et al., 2025; Pfiffner et al., 2006; Wong et al., 2023). However, despite the potential of AI to act as a "cognitive scaffold", there is a lack of synthesized evidence on whether these benefits are sustained across different educational levels or if they are primarily limited to early childhood settings.

Despite the increasing integration of AI in educational and clinical contexts, the empirical evidence concerning AI-based interventions specifically for students with ADHD remains limited and fragmented. Existing findings tend to be scattered across age groups (e.g., preschool vs. adolescence) and educational levels (e.g., primary vs. secondary education), offering an incomplete understanding of AI's potential impact on this population. Furthermore, there is a noticeable absence of a structured comparison between academic and psychosocial AI outcomes, leaving a critical void in the literature regarding which AI modalities are most effective for specific ADHD-related deficits. Consequently, the application of AI to psychoeducational interventions for ADHD constitutes a notably under-investigated and under-represented field in the current academic discourse. The present review addresses these gaps by providing a systematic synthesis of the current evidence, highlighting the overlooked developmental areas in existing research.

Building upon this theoretical framework, the present systematic literature review aims to systematically examine the effectiveness of AI-based academic and psychosocial interventions for students diagnosed with ADHD. Specifically, it seeks to explore:

1. The types of AI-based interventions (academic vs. psychosocial).
2. The benefits of AI-based academic interventions, categorized by educational level.
3. The benefits of AI-based psychosocial interventions, categorized by educational level.

METHOD

Literature Search

A comprehensive literature search was conducted across major scientific databases, including Google Scholar, PsycINFO, ERIC, PubMed, Scopus and Web of Science, from August to November 2025. The search strategy involved the systematic combination of keywords and Boolean operators (AND, OR) to maximize the retrieval of relevant studies. The full search string utilized was: ("attention deficit hyperactivity disorder" OR "ADHD") AND ("artificial intelligence" OR "AI" OR "machine learning" OR "robotics") AND ("academic intervention" OR "learning support" OR "psychosocial intervention" OR "emotional regulation"). Search limits were applied to include only peer-reviewed publications and articles available in full text. Additionally, the search was restricted to publications in English and Greek to align with the reviewers' linguistic competencies. The reference lists of the finally included studies were also manually searched to identify any additional relevant records that were not identified through the electronic database search.

Eligibility Criteria

Titles and abstracts of all retrieved studies were screened independently by two reviewers to identify potentially relevant papers for inclusion. To ensure the reliability of the selection process, any discrepancies between the two reviewers were resolved through consensus or by consulting a third senior researcher. When an abstract indicated that a study might meet the inclusion criteria, the full text was subsequently reviewed. Studies were included if they met the following criteria:

1. Published in peer-reviewed scientific journals, books, edited volumes, or conference proceedings.
2. Written in English or Greek.
3. Reported empirical research (i.e., studies with primary data).

4. Involved student populations diagnosed with ADHD, or ADHD comorbid with other disorders.
5. Examined the effectiveness of AI-based academic or psychosocial interventions. To ensure a consistent classification, interventions were defined as AI-based if they utilized autonomous data processing components, such as machine learning for pattern recognition (e.g., in EEG-based systems), natural language processing for social interaction (e.g., in socially assistive robots), or adaptive algorithms for real-time content personalization and automated feedback (e.g., in digital journaling and counseling platforms).

Studies not meeting any of the above criteria were excluded. Initially, 5.596 records were retrieved from the databases. Following title and abstract screening, only 21 articles were deemed suitable for full-text assessment. The full-text review was also conducted independently by two researchers to verify that all inclusion criteria were strictly met. At this stage, we excluded review papers (n = 12), studies that did not include participants with ADHD (n = 7), and studies that did not employ AI-based interventions (n = 5). Consequently, nine (9) studies met all inclusion criteria and were included in the final synthesis. A full list of the excluded studies and the specific reasons for their exclusion is available from the corresponding author upon request. The article selection process is summarized in Figure 1.

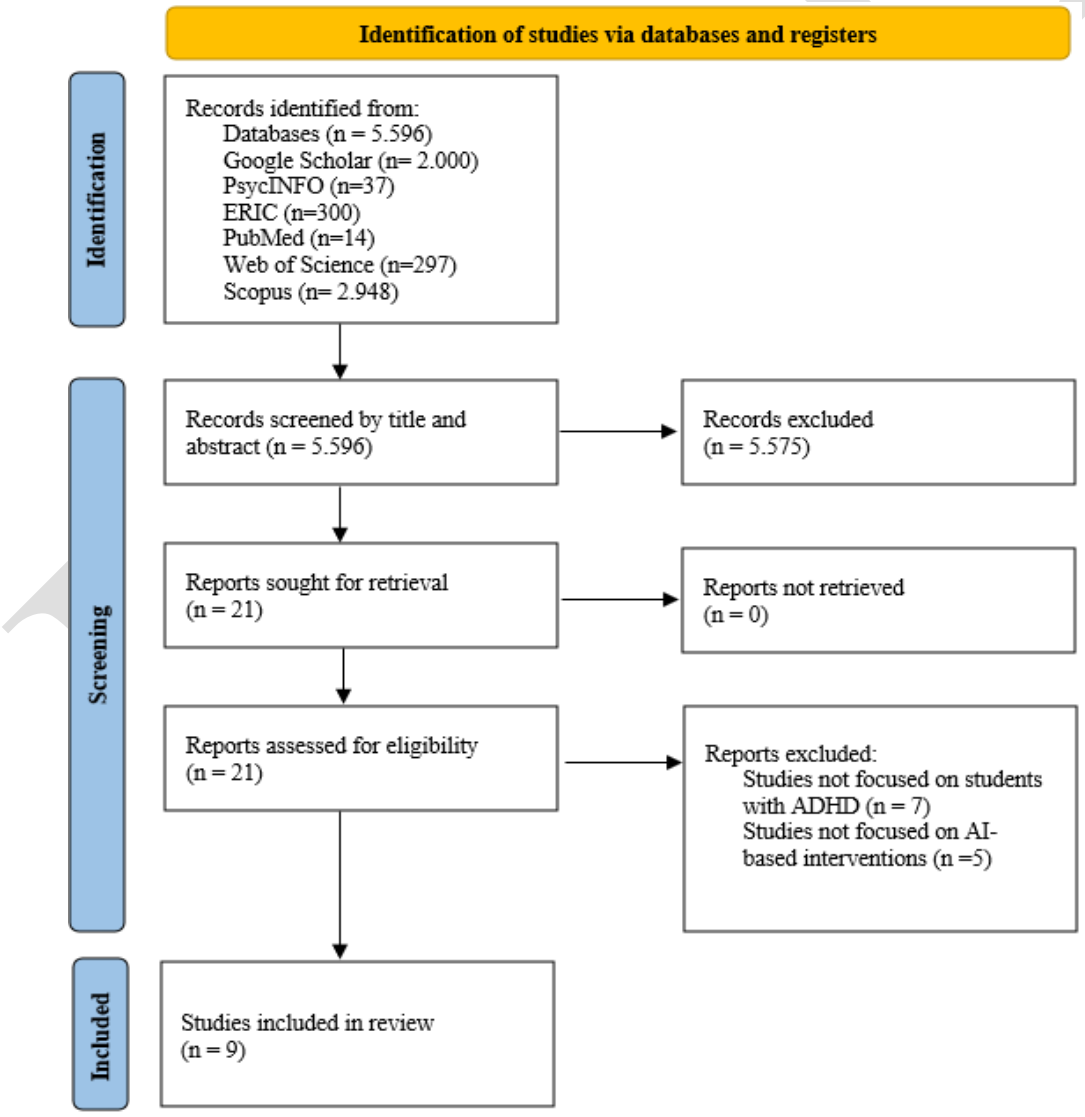

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of the study selection process.

Data Extraction and Management

To ensure the accuracy and reliability of the synthesized data, a standardized data extraction form was employed. Two independent reviewers screened the titles/abstracts and extracted relevant information from the final nine studies. The extracted data included author details, publication year, geographical context, participant demographics (age, sample size, ADHD diagnosis/comorbidity), AI intervention characteristics, research methodology, and primary outcomes. The primary outcomes of interest were defined as improvements in academic performance (e.g., concentration, writing skills) and psychosocial resilience (e.g., emotional regulation). Any discrepancies between the reviewers regarding the extracted data were resolved through discussion and consensus or by consulting a third senior researcher to ensure objectivity and minimize extraction errors.

Quality Assessment

The methodological quality of the included empirical studies was critically appraised to ensure the robustness of the review's conclusions. Given the heterogeneity of the research designs (ranging from Randomized Controlled Trials to quasi-experimental and quantitative surveys), appropriate appraisal tools, such as the Cochrane Risk of Bias tool for RCTs and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for quasi-experimental studies, were utilized. Studies were evaluated based on their internal validity, sample representation, and the clarity of their statistical findings. To provide a more systematic overview of the study quality, the results were synthesized by categorizing each study into a specific risk-of-bias level: low, moderate, or high. Two reviewers independently assessed the risk of bias for each study, and a high level of agreement was reached, with any minor differences resolved by a third researcher. This assessment allowed for a nuanced interpretation of the effectiveness of AI interventions while acknowledging the methodological limitations inherent in emerging research areas.

Effect Measures

Given the methodological heterogeneity of the included studies, which employed diverse quantitative and qualitative metrics, no single statistical effect measure (such as Cohen's d or Odds Ratios) was uniformly applied. Instead, the synthesis focused on the reported direction and significance of changes in academic and psychosocial outcomes. The primary indicators of effect included improvements in concentration levels, task completion time, emotional regulation scores, and quality of life dimensions as reported in the original studies.

Synthesis Methods

Studies were grouped for synthesis based on the type of AI intervention (academic or psychosocial) and the educational level of the participants (primary, secondary, or higher education). The diverse technologies were categorized according to their primary AI function: systems using physiological sensors (e.g., EEG) were classified based on their automated state-detection algorithms; robotic platforms were classified based on their use of adaptive engagement and interaction protocols; and software-based tools (e.g., digital journals) were classified by their integration of data-driven feedback loops and predictive analytics. A narrative synthesis approach was adopted, as the diversity of intervention modalities and outcome measures, ranging from EEG data to qualitative surveys, precluded a meta-analysis. To systematically account for heterogeneity, the synthesis evaluated how variations in sample sizes (ranging from small-scale pilots of n = 12 to larger surveys of n = 200), intervention durations (varying from a single-session interaction to 32-session programs), and measurement tools (e.g., objective biometric data vs. subjective parent-proxy reports) influenced the consistency of the reported benefits. The synthesis involved a thematic analysis of the findings, focusing on identifying patterns in how AI-based academic and psycho-social scaffolds address specific ADHD deficits across different developmental stages.

Included Studies

The final research sample comprised nine empirical studies published in English-language peer-reviewed journals and conference proceedings between 2020 and 2025. Given that research on

AI-based academic and psychosocial interventions for ADHD remains limited (Singh, 2025), no date restriction was applied during article selection.

Of the studies included, nine (9) addressed the first research goal, five (5) were related to the second research goal, and four (4) pertained to the third research goal. Table 1 presents an overview of the key characteristics of the selected studies, including authors, publication year, country, research aim, sample, methodology, and main findings.

Table 1. Summary of key characteristics and main findings of the included empirical studies on AI-based interventions for students with ADHD.

Authors	Country	Research Aim	Sample	Methodology	Main Findings
Faria et al. (2020)	Brazil	The introduction of adaptive AI-based game for boosting and maintaining concentration levels for children with disabilities.	30 children, 6-10 years old, (24 males, 6 females) with various neurodevelopmental disorders (ID, ASD, ADHD, ODD & Hydrocephaly), without specifying the proportion of students with ADHD. Comorbidity is not specified by the authors.	The experimental design contained one group measured in three states: concentration state, relaxed state and neutral state. The measurement of concentration was based on EEG and observations of the researchers. Moderate risk of bias.	The classification of the concentration by the framework achieved 96% accuracy. The participants gave positive feedback on the game and the intervention.
Lalwani et al. (2025)	USA	Use of Socially Assistive Robot (SAR) for conversation, task prioritization and scheduling, engagement detection, and emotion recognition.	15 undergraduate students, 18-24 years old (8 females, 7 males) with ADHD	Experimental design contained one group from which all participants had a session with the SAR. Participants completed pre and post experiment questionnaires that included the evaluation of the SAR, the assistance in prioritization/rescheduling and refocus during the session. High risk of bias.	The participants were more organized after the use of SAR and 80% expressed interest in using it again. They scored above 2.5 in ESQ-R.
Aldakhil (2024)	Saudi Arabia	Examination of the impact of AI-based play activities on the quality of life of 61 Saudi children with ADHD diagnosis.	61 boys, 8-12 years old with ADHD (M_{age} = 10.0, SD = 1.4)	Randomized controlled design contained two groups. The experimental group engaged with AI-based play activities 3 times a week for four weeks. The control group didn't receive any intervention. The children and their parents completed the PedsQL pre-test, post-test and follow up after seven weeks. Low risk of bias.	Significant improvements in the PedsQL for the experimental group compared to the control group. Specifically, improvements in physical, social, school and emotional dimensions were observed in the experimental group for both child self-reports and parent-proxy reports.

Table 1 (Continued). Summary of key characteristics and main findings of the included empirical studies on AI-based interventions for students with ADHD.

Authors	Country	Research Aim	Sample	Methodology	Main Findings
Mahmoudi-Dehaki & Nasr-Esfahani (2025)	Iran	Examination of the efficacy and acceptability of human and AI hybrid tutoring in improving the writing skills of bilingual students with motor dysgraphia and ADHD.	12 twice exceptional bilingual students, 13-18 years old, with comorbidity motor dysgraphia and ADHD.	The study utilized a quasi-experimental design. The experimental group with six participants received human-AI hybrid tutoring in writing skills. The control group, with six participants, received traditional instructions in writing skills. The intervention consisted of 32 sessions 90 minutes each. Pre-test and post-test performance in writing assessed with DASH-2. Moderate risk of bias.	The experimental group showed significantly enhanced handwriting fluency and composition skills. These improvements were observed in within-group and between-group comparisons.
Berrezueta-Guzman et al. (2021)	Spain	Assessment of a robotic assistant aimed at providing therapeutic support in the performance of homework (distraction from the task and time for task competition) in children with ADHD.	12 children, 6-12 years old (8 girls and 4 boys), including children with suspected ADHD and children without ADHD.	Experimental design: The sample formed 3 groups, one of which was assigned with specific tasks (math, language and English). For the first 2 weeks all the groups carried out the tasks without the robotic assistant and for last 2 weeks with the robotic assistant. The sessions were not exceeding 70 minutes each. Moderate risk of bias.	The robotic assistant allows remote homework monitoring with therapeutic contribution and improves the routines of children with or without suspected ADHD. Specifically, the degree of distraction from the task decreased after the third week and the time for task completion also decreased.
Aslam et al. (2025)	N/A	Investigation of the effectiveness of AI-based tools in children's emotional learning and emotional regulation.	200 students, 7-12 years old, with dyslexia and ADHD or ASD (authors don't specify the existence of comorbidity).	Quantitative methodology: Various interventions were applied for anxiety, self-control or motivation. The data were collected through survey (more information regarding the execution of interventions, the existence of experimental and control group or the survey were not available). High risk of bias.	Positive and significant connection between AI-based emotional learning tools and emotional control were observed. Also, AI-tools help in improving emotional regulation. Moreover, the use of AI-tools is a predictor for improved emotional regulation.

Table 1 (Continued). Summary of key characteristics and main findings of the included empirical studies on AI-based interventions for students with ADHD.

Authors	Country	Research Aim	Sample	Methodology	Main Findings
Su et al. (2024)	Taiwan	Investigation of the effectiveness of AI-based digital journaling platform in enhancing counseling efficiency.	22 students, 10-12 years old with emotional disorders, ADHD, or ASD	Experiment design: All participants completed 468 journal entries. The data collected via teacher assessments and digital platform data. Self-Awareness, Self-Management, Social Awareness, Relationship Skills and Responsible Decision Making were measured during pre-test and post test phase. Moderate risk of bias.	The results revealed significant improvement in all five variables for the students who were using the digital journal platform.
Katsarou et al. (2025)	Greece	Investigation of the use of AI in assessing and supporting grammar performance among children with learning disabilities.	100 children, 8-12 years old with various neurodevelopmental disorders (e.g. dyslexia, ADHD, language disorders, and other related disorders), without specifying the proportion of students with ADHD. Comorbidity is not specified by the authors. Experimental group: M_{age} = 10.2, SD = 1.4 Control Group: M_{age} = 10.1, SD = 1.5	Experimental design: Experimental group consisted of 50 students who received AI-facilitated grammar assessments and personalized feedback. Control group consisted of 50 students who completed conventional paper-based grammar tests without personalized feedback. Low risk of bias.	There was an improvement for the experimental group in grammar accuracy, task completion, engagement levels and grammar strategies.
Xu et al. (2025)	China	The main goal was the evaluation of AI-assisted drawing therapy for children with ADHD in core symptoms and functional impairments.	41 children, 7-10 years old with ADHD. Experimental group: n = 19 Control group: n = 22	Randomized controlled trial: The guardians of the participants completed the SNAP-IV and WFIRS scales to set the baseline values before the intervention. The same scales were completed after the intervention. The experimental group included AI-assisted and traditional drawing intervention. The control group included only traditional drawing intervention. Low risk of bias.	Both AI and traditional interventions reduced significantly core ADHD symptoms. Within groups: AI group had improvements in attention and oppositional defiant behavior, traditional therapy group had broader symptom reductions across all domains. Between-groups: AI group had grater improvement in inattention and the traditional group improved more on oppositional defiant behavior.

Note: ASD = Autism Spectrum Disorder, DASH-2 = Detailed Assessment of Speed of Handwriting 2nd Edition, EEG = electroencephalogram, ESQ-R = Executive Skills Questionnaire-Revised, ID = Intellectual Disability, NARS = Negative

Attitude Towards Robot Scale, ODD = Oppositional Defiant Disorder, PedsQL = Pediatric Quality of Life Inventory, SAR = Socially Assistive Robot, SNAP IV = Swanson, Nolan and Pelham-IV rating scale, SUS = System Usability Scale, WFIRS = Weiss Functional Impairment Rating Scales-Parent.

Figure 2 illustrates that five of the selected studies focused on AI-based academic interventions, whereas four studies addressed AI-based psychosocial interventions.

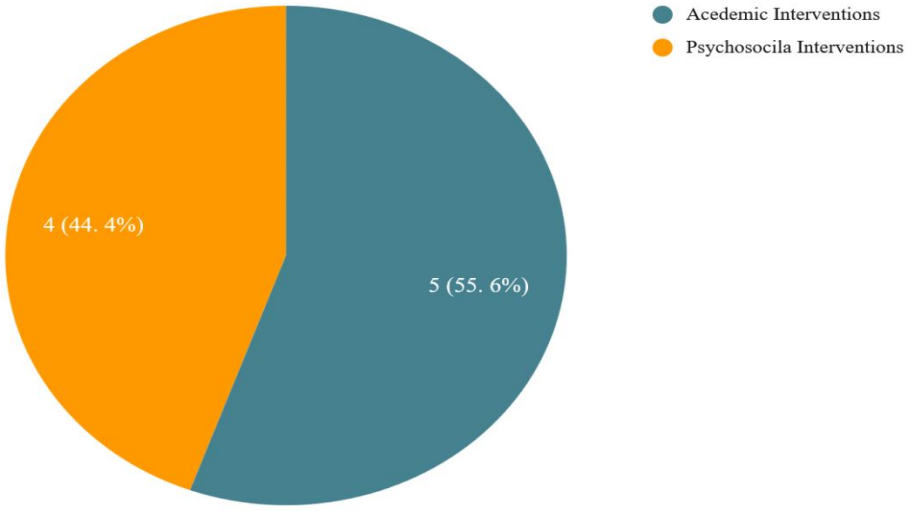

Figure 2. Distribution of AI-based interventions based on their academic and psychosocial content.

Moreover, as depicted in Figure 3, five studies examined AI-based academic interventions implemented across various educational levels (from primary to higher education), excluding preschool settings. Specifically, three studies investigated interventions applied to primary education student samples, one study conducted in secondary education, one study conducted in higher education and none of the studies included a mixed education level sample (Figure 3). In contrast, the rest four AI-based psychosocial interventions were identified exclusively within primary education settings.

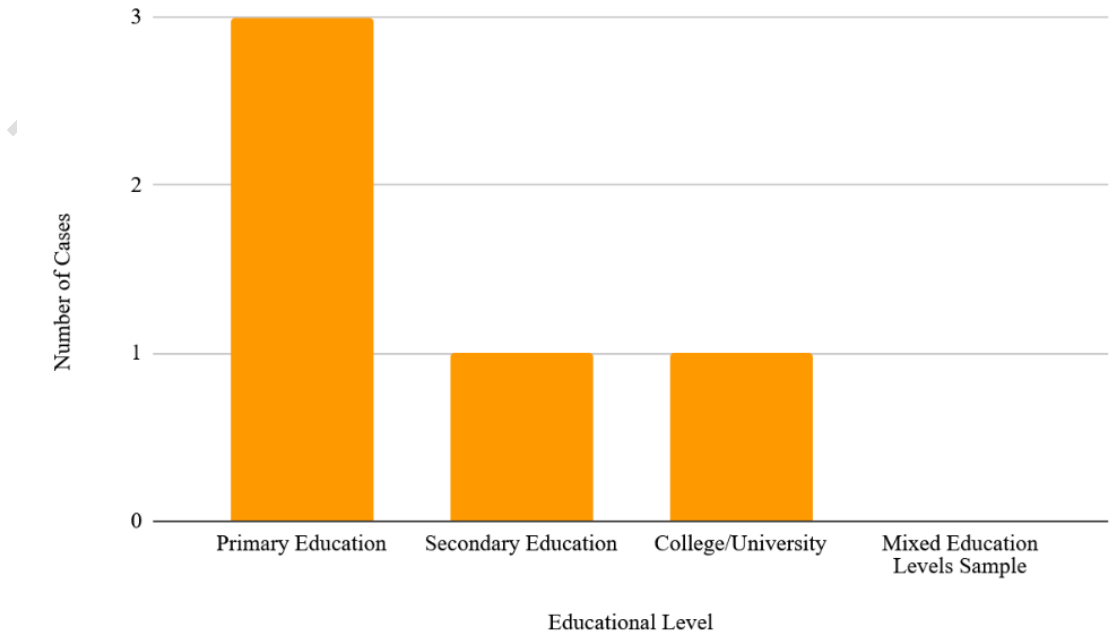

Figure 3. Distribution of AI-based academic interventions by educational level.

RESULTS

Types of AI-based Interventions (Academic vs. Psychosocial)

Regarding the first research objective and the types of AI-based interventions for students with ADHD, nine (9) studies were identified. These studies were categorized into academic and psychosocial interventions. Moreover, according to Figure 2, it appears that most of these studies target the academic deficits of students with ADHD, while fewer address psychosocial deficits.

Specifically, the studies by Berrezueta et al. (2021), Faria et al. (2020), Katsarou et al. (2025), Lalwani et al. (2025), as well as Mahmoudi-Dehaki and Nasr-Esfahani (2025), implemented AI-based interventions with an academic focus. Their objectives ranged from improving task concentration and task/time management to enhancing reading and writing performance. On the other hand, the studies by Aldakhil (2024), Aslam et al. (2025), Su et al. (2024), and Xu et al. (2025) focused on AI-based psychosocial interventions targeting areas such as quality of life, emotional learning and regulation, and effective counseling.

Benefits of AI-based Academic Interventions Categorized by Educational Level

Regarding the second research objective, which concerns the benefits of AI-based academic interventions across educational levels, five (5) studies were identified. Of these, three (3) examined benefits in primary school students, one (1) in secondary school students, and one (1) in college/university students.

Regarding primary education, Faria et al. (2020) detected and categorized electro-encephalogram (EEG) data from children with various disorders, including ADHD, into three states: concentration, relaxation, and neutral. The findings indicated high levels of engagement among participating students. Teachers reported that even the most challenging students remained fully focused during interactions with the games. Students also stated that the games were easy to use, enjoyable, and that they would be willing to play them again (Faria et al., 2020). Similarly, Berrezueta-Guzman et al. (2021) found that the use of a robotic assistant enabled remote homework monitoring with therapeutic benefits. Notably, after the third week of intervention, a reduction in ADHD-related symptoms was observed. These included decreases in the frequency of distractions, pauses between tasks, requests for assistance, impulsivity, and sound emissions. Additionally, improvements were reported in concentration, time management, and organization. The robot also reduced the need for breaks and impulsive behaviors, facilitated task completion, and minimized anxiety and distractions (Berrezueta-Guzman et al., 2021). The study by Katsarou et al. (2025) demonstrated improvements in grammar accuracy, time management, and student engagement. Specifically, the experimental group that utilized AI showed statistically significant improvement compared to the control group. Furthermore, the experimental group reduced test completion time by 5.3 minutes. Higher engagement levels were also observed, with 76% of students demonstrating strong commitment compared to those in the control group. An additional benefit was the provision of real-time personalized feedback, with AI dynamically adjusting the level of difficulty to meet individual student needs (Katsarou et al., 2025).

Regarding secondary education, Mahmoudi-Dehaki and Nasr-Esfahani (2025) re-ported that the AI-based intervention significantly improved all domains of the De-tailed Assessment of Speed of Handwriting-2 (DASH-2), including handwriting fluency, orthographic coding, fine motor control, and composition skills. Participants in the experimental group demonstrated clear improvements in post-test measurements compared to both baseline and control group results. Moreover, as AI assumed responsibility for managing aspects of the educational process, teachers were able to focus more on providing emotional encouragement and support, thereby making the learning experience more enjoyable and less stressful (Mahmoudi-Dehaki & Nasr-Esfahani, 2025).

At the university/college level, Lalwani et al. (2025) showed that a social assistive robot (SAR) helped undergraduate students with ADHD to prioritize and schedule their tasks more effectively and efficiently. Students reported feeling more organized, as the SAR assisted in prioritizing tasks and

creating realistic schedules. Furthermore, the robot's ability to break tasks into smaller, manageable steps reduced stress and alleviated feelings of being overwhelmed by academic obligations (Lalwani et al., 2025).

Benefits of AI-based Psychosocial Interventions Categorized by Educational Level

Regarding the third research objective, which examines the benefits of AI-based psychosocial interventions across educational levels, four (4) studies were identified. All of these studies targeted students in primary education.

Specifically, the study by Aldakhil (2024) demonstrated improvements in total scores on the Pediatric Quality of Life Inventory (PedsQL). Enhancements were also observed across all PedsQL dimensions, including physical, social, emotional, and school functioning. Notably, these improvements were maintained at the seven-week follow-up for both child self-reports and parent-proxy reports, with no statistically significant differences compared to post-test scores, indicating the durability of the intervention effects (Aldakhil, 2024).

Similarly, Su et al. (2024) found that the experimental group receiving the AI-based intervention combined with counseling demonstrated significant improvements across all five Social and Emotional Learning (SEL) indicators. In contrast, the control group, which received counseling alone, showed improvement only in self-awareness (Su et al., 2024). The integration of AI enabled students to express their thoughts and emotions through creative processes. For example, the use of a Mood Tracker allowed counselors to identify students experiencing negative emotions and prioritize targeted interventions. Additionally, engaging students in comic book creation enhanced their motivation for self-directed learning and transformed journaling into a more enjoyable activity (Su et al., 2024).

In their study, Aslam et al. (2025) reported that AI-based emotional learning tools can significantly benefit students with ADHD. Correlational analyses revealed a statistically significant positive relationship between the use of AI-based emotional learning tools and emotional regulation. Furthermore, one-way *t*-tests indicated that students who used these tools achieved higher emotional regulation scores compared to those who did not. The AI tools functioned as supportive frameworks, helping students recognize, label, and regulate their emotions through immediate, personalized feedback. As a result, students developed greater self-awareness, which contributed to increased classroom attentiveness and improved relationships with peers and family members (Aslam et al., 2025).

Finally, Xu et al. (2025) reported mixed findings regarding the three core symptoms of ADHD. The AI-assisted drawing group demonstrated improvements in concentration, whereas the traditional drawing group showed greater reductions in impulsivity. No significant improvements were observed in hyperactivity in either group. However, the AI intervention group exhibited enhanced overall functioning, with notable gains in both family and school domains of the Weiss Functional Impairment Rating Scale-Parent Report (WFIRS-P). In terms of therapeutic engagement, real-time AI feedback improved flow and intrinsic motivation by reducing stress during task execution. Additionally, AI-generated images acted as positive reinforcement, boosting students' confidence. Both groups demonstrated high levels of participation, suggesting that creative activities are particularly engaging for students with ADHD (Xu et al., 2025).

Methodological Quality and Risk of Bias

The results of the risk of bias assessment for each individual study are integrated into the "Methodology" column of Table 1. A systematic synthesis of these assessments reveals that three studies (33.3%) were classified as having a low risk of bias, four studies (44.4%) as moderate risk, and two studies (22.2%) as high risk. Following the quality assessment of the nine included studies, most were found to be of moderate to high methodological quality. Specifically, the randomized controlled trials (RCTs) (Aldakhil, 2024; Xu et al., 2025) and the experimental study by Katsarou et al. (2025) demonstrated a low risk of bias regarding intervention protocols and participant selection. The moderate-risk category included four studies (Berrezueta-Guzman et al., 2021; Faria et al., 2020;

Mahmoudi-Dehaki & Nasr-Esfahani, 2025; Su et al., 2024), which generally provided robust outcomes but were limited by smaller sample sizes or lack of randomization. However, certain quasi-experimental studies (Aslam et al., 2025; Lalwani et al., 2025) exhibited a higher risk of bias due to small sample sizes and the absence of a control group and notable sample heterogeneity, as several studies combined participants with different neurodevelopmental profiles without conducting ADHD-specific subgroup analyses. Beyond sample characteristics, the significant variability in intervention duration and the lack of standardized assessment tools across the reviewed studies further complicate the comparative evaluation of AI effectiveness and limit the precision of the overall conclusions. Despite these limitations, all studies provided clear reporting on AI intervention mechanisms and their respective outcomes for students with ADHD, justifying their inclusion in the qualitative synthesis.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

The synthesis of current empirical evidence demonstrates that AI-based interventions for students with ADHD represent a notable evolution from static instructional methods to dynamic, ecologically sensitive support systems. This review highlights that AI does not merely function as a digital substitute for traditional teaching but acts as a cognitive and emotional scaffold that addresses the core neurodevelopmental deficits of ADHD, such as inattention, impulsivity, and executive dysfunction (Antshel et al., 2016; Tanner & Hsu, 2025). The findings suggest that AI provides a form of "scaffolding" that aligns with the Zone of Proximal Development, offering just enough support to allow neurodivergent students to succeed in tasks that would otherwise be cognitively overwhelming (Vygotsky & Cole, 1978). This transition from human-dependent support to AI-driven scaffolding addresses a long-standing gap in traditional developmental models, which often struggle to provide the high frequency of feedback required for neurodivergent learners (Antoniou et al., 2021; DuPaul et al., 2021).

A critical finding of this review is the efficacy of AI in fostering academic engagement through real-time physiological feedback. As evidenced by Faria et al. (2020), the use of EEG-based game frameworks allowed for a 96% accuracy rate in detecting concentration states. This level of precision is vital for students with ADHD, whose engagement levels are notoriously fluctuant. By identifying these states, AI systems can dynamically adjust the difficulty or pace of a task, preventing the "cognitive overload" that often leads to task abandonment in this population (Katsarou et al., 2025). This aligns with broader educational theories suggesting that personalized feedback loops are essential for maintaining the "flow" state in neurodivergent learners (Luckin et al., 2016). However, it is noteworthy that this physiological precision is currently concentrated in primary education samples. The lack of similar data for adolescents and university students represents a missed opportunity to understand how AI might mitigate the more internalized forms of inattention, such as mind-wandering, that become more prevalent in older age groups (Biederman et al., 2010). Without targeted interventions for higher education, students with ADHD remain at risk for lower academic trajectories compared to their neurotypical peers (DuPaul et al., 2021).

Furthermore, the role of Socially Assistive Robots (SARs) and robotic assistants emerged as a powerful tool for bridging the "executive function gap". Studies such as those by Berrezueta-Guzman et al. (2021) and Lalwani et al. (2025) suggest that robots provide a structured, non-judgmental environment that facilitates task prioritization and time management. The reduction in symptoms, specifically distractions and impulsive sound emissions, observed when students worked with robotic assistants (Berrezueta-Guzman et al., 2021) indicates that the physical presence of an AI agent can serve as an external regulator of behavior. This is particularly relevant for homework completion, where the absence of a teacher often leads to a breakdown in self-regulation (DuPaul et al., 2021). The efficacy of SARs across both primary (Berrezueta-Guzman et al., 2021) and higher education (Lalwani et al., 2025) illustrates a "lifespan" utility of robotic assistants, suggesting that while the complexity of tasks changes, the funda-mental need for an external organizational proxy remains a constant for the ADHD brain. This external regulation is crucial because social profiles among youth

with ADHD often reveal significant impairments in social awareness and relationship skills that traditional classroom settings may exacerbate (Pintos Lobo et al., 2025).

Psychosocially, AI interventions appear to be uniquely positioned to enhance Social and Emotional Learning (SEL). The integration of AI with counseling, as seen in the use of digital journaling and "Mood Trackers", allows for a more granular under-standing of a student's emotional landscape (Su et al., 2024). For students with ADHD, who often struggle with emotional dysregulation and social communication (Pintos Lobo et al., 2025), AI tools like those described by Aslam et al. (2025) provide a safe space to recognize and label emotions. The long-term durability of these psychosocial benefits, evidenced by the seven-week follow-up in Saudi children (Aldakhil, 2024), suggests that AI-driven play and counseling can lead to sustainable improvements in the overall quality of life. However, while these digital tools promote emotional self-awareness, they must be carefully integrated to ensure they do not replace the development of authentic interpersonal social bonds, which are already compromised in this population (Healey & Rucklidge, 2006; Pintos Lobo et al., 2025). Critically, all identified psychosocial studies were conducted in primary school settings, highlighting a significant research void. Given that psychosocial challenges in ADHD often evolve into more severe interpersonal and vocational difficulties in adulthood, the absence of AI-based social-emotional tools for secondary and university students is a concerning gap that limits our understanding of AI's preventative potential.

An overlooked but significant dimension revealed in this review is the synergy between AI and human educators. Mahmoudi-Dehaki and Nasr-Esfahani (2025) demonstrated that when AI handles the technical aspects of feedback (e.g., in hand-writing fluency), human tutors are liberated to provide higher-level emotional encouragement. This hybrid model minimizes student anxiety and transforms the learning experience from one of constant correction to one of collaborative growth. This suggests that the future of ADHD intervention lies not in the replacement of human professionals, but in the augmentation of clinical and pedagogical expertise through AI-driven data analytics (Mahmoudi-Dehaki & Nasr-Esfahani, 2025; Wang & Xue, 2024). By automating the "drudgery" of repetitive skill monitoring, AI allows the human element to focus on the "affective loop" of learning, which is essential for building the resilience and self-esteem that students with ADHD often lack (Ali et al., 2024; Antoniou et al., 2021; DuPaul et al., 2021). Nevertheless, the implementation of such hybrid models requires a standardized international definition of ADHD to assist in the development of coherent educational policies and equitable technology access (Tanner & Hsu, 2025).

Limitations of the Study

Despite the promising findings, several significant limitations persist in the current literature. First, the limited number of identified empirical studies (n = 9) restricts the scope of the synthesis and prevents the application of meta-analytical techniques to quantify overall effect sizes. Second, the interventions exhibit significant technological heterogeneity, ranging from socially assistive robots to EEG-based game frameworks and digital journaling platforms, which complicates the direct comparison of outcomes and limits the generalizability of findings across different technological platforms. This heterogeneity is further compounded by differences in intervention duration—from single sessions to longitudinal eight-week programs—and the use of diverse measurement tools (ranging from standardized tests like DASH-2 to subjective qualitative surveys), which may lead to varying levels of evidence regarding the efficacy of AI-based support. Third, there is a clear geographical and demographic imbalance; most studies are conducted in specific cultural contexts (e.g., Brazil, Saudi Arabia, Taiwan, Greece), which may affect the cross-cultural validity of the results. Second, methodological heterogeneity remains a challenge. While some studies employed rigorous Randomized Controlled Trials (Aldakhil, 2024; Xu et al., 2025), others relied on quasi-experimental designs with very small sample sizes, limiting the statistical power and generalizability of the findings (Lalwani et al., 2025; Mahmoudi-Dehaki & Nasr-Esfahani, 2025). Third, there is a lack of research focusing on comorbidity Fifth, a significant issue regarding variability in participant characteristics and sample heterogeneity was observed. A considerable number of the included studies (e.g., Faria et al., 2020; Katsarou et al., 2025; Su et al., 2024) involved

participants with diverse neurodevelopmental disorders, such as Autism Spectrum Disorder, Intellectual Disability, and Dyslexia, in addition to ADHD, frequently failing to differentiate the results for the ADHD subgroup. This heterogeneity limits the internal validity of the review, as it remains unclear whether the observed AI benefits are specific to ADHD or influenced by the complex interaction of these comorbid conditions. Ultimately, the interaction of these methodological variances (size, duration, tools) means that current findings should be viewed as exploratory rather than definitive. Sixth, the absence of longitudinal data (except for Aldakhil, 2024) leaves questions regarding the long-term impact of AI on cognitive development and potential dependency on these tools. Additionally, the systematic review process itself has certain constraints, as it was restricted to English and Greek publications, potentially overlooking relevant studies in other languages, while the exclusion of "gray literature" may have introduced a reporting bias in favor of positive results. Finally, a profound developmental imbalance exists within the current body of research; seven out of the nine identified studies focus exclusively on primary education. This skew leaves the needs of adolescents in secondary education and adults in higher education largely unaddressed, particularly regarding psychosocial interventions.

Future Research Directions

Future research should prioritize the following: (a) Large-scale, multi-site RCTs to establish robust evidence base across different age groups, with a concerted effort to address the research void in the secondary education sector. (b) Longitudinal designs that track students over several years to assess the sustainability of academic and psychosocial gains and to ensure that AI assistance does not hinder the development of internal self-regulation skills. (c) Comparative studies that evaluate which AI modalities (e.g., robots vs. software-based apps) are most effective for specific ADHD subtypes (Inattentive vs. Hyperactive-Impulsive) across different developmental stages. (d) Ethical investigations into data privacy and the potential for AI to replace human social interaction in therapeutic settings. (e) Developing and testing AI-driven psychosocial tools for university students to support the transition to independent adult living and complex social navigation.

Practical Applications and Implications

The findings of this systematic review offer several actionable pathways for clinicians, educators, and parents. First, AI-based tools should be formally integrated into Individualized Education Programs (IEPs) as "dynamic scaffolds" that provide real-time adjustments for concentration and task management (Katsarou et al., 2025). For instance, EEG-based games can be utilized as preparatory "warm-up" activities to calibrate a student's focus before high-stakes academic tasks (Faria et al., 2020). Second, Socially Assistive Robots (SARs) can be deployed in home settings to support homework completion, acting as non-judgmental organizational proxies that reduce family conflict and student anxiety (Berrezueta-Guzman et al., 2021; Lalwani et al., 2025). Third, school counselors can utilize AI-driven mood trackers and digital journaling to identify "at-risk" emotional states in real-time, allowing for more targeted and timely psychosocial interventions (Su et al., 2024). Finally, the adoption of these technologies must be accompanied by clear ethical guidelines and legislative frameworks concerning data privacy, particularly regarding the sensitive biometric and emotional data collected from neurodivergent minors, ensuring that these overlooked developmental areas in policy are addressed (Singh, 2025; Tanner & Hsu, 2025).

Contribution

This systematic literature review makes a valuable contribution to the fields of special education and educational psychology by providing a structured synthesis of the emerging AI-ADHD intervention landscape. It moves beyond general technology reviews to specifically categorize AI benefits into academic and psychosocial domains across different educational levels. By identifying the potential role of real-time adaptation and non-judgmental feedback, this work provides the scientific community with an exploratory framework for understanding how AI addresses specific neurodevelopmental deficits. Most notably, this review uncovers the notable imbalance in research distribution, serving as an important observation for researchers to expand AI-based psychosocial studies into secondary and higher education. By exposing these overlooked developmental areas, the

present work provides a preliminary conceptual guide for future scholarly inquiry and helps bridge the gap between emerging technology and pedagogical theory.

Conclusions

In conclusion, AI-based interventions may act as a dynamic cognitive and emotional scaffold for students with ADHD, showing potential to support academic engagement and psychosocial resilience through real-time personalization. Although current evidence remains concentrated in primary education, the synergy between AI and human expertise offers a preliminary data-informed pathway toward more inclusive educational practices. Ultimately, AI serves not as a replacement but as a valuable augmentation of human intervention, providing adaptive support that can assist neurodivergent learners in their developmental trajectories.

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Ethics and Conflict of Interest

Registration and Protocol; this systematic review was not registered in a public database (e.g., PROSPERO), and a formal review protocol was not prepared prior to the commencement of the study. The review was conducted in strict accordance with the PRISMA 2020 statement guidelines to ensure reporting transparency and methodological rigor. The research complied with ethical principles and there are no conflicts of interest among the authors.

Author Contribution

First and second author contributed to the study conception, the data collection, the formal analyses as well as the writing of the first draft and the final version of the manuscript. Third, fourth and fifth author commented on the draft version of the manuscript and contributed to the writing of its final version. All authors read and approved of the final manuscript.

Data Availability

No analytic code was used, as the synthesis was strictly qualitative. The data that support the findings of this study are available on request from the corresponding author.

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JOB SATISFACTION AND LIFE SATISFACTION AMONG PRESCHOOL TEACHERS: THE MEDIATING ROLE OF PSYCHOLOGICAL DISTRESS AND THE MODERATING EFFECT OF CAREER STAGE

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Abstract

This study examined the relationship between job satisfaction and life satisfaction among preschool teachers, focusing on the mediating role of psychological distress and the moderating role of the career stage. Data from preschool teachers were analyzed using structural equation modeling (SEM) with a multiple mediation framework including anxiety, depression, and stress. Job satisfaction showed a significant positive association with life satisfaction both directly and indirectly. Among the mediators, stress emerged as the only significant pathway linking job satisfaction to life satisfaction, whereas anxiety and depression did not independently predict life satisfaction when modeled simultaneously. The model explained 35% of the variance in life satisfaction. Multi-group analyses further revealed that these relationships differed across career stages: the direct effect of job satisfaction on life satisfaction was strongest among early-career teachers, while emotional factors became more salient in later career stages. These findings suggest that occupational satisfaction influences overall well-being through both direct evaluative mechanisms and stress-related pathways, and that these processes evolve across professional development. The study highlights the importance of reducing workplace stress and supporting teachers' psychological health to enhance both professional functioning and life satisfaction.

Keywords: Job satisfaction, life satisfaction, preschool teachers, psychological distress, mediation, structural equation modeling.

INTRODUCTION

Educational institutions constitute a fundamental pillar of social development, and the professionals who work within them play a crucial societal role. Teachers, administrators, and other educational staff contribute directly to the formation of future generations, and their professional well-being helps shape educational quality, student outcomes, and broader societal progress (Klassen & Chiu, 2010; OECD, 2020). Among the determinants of educational effectiveness, the job satisfaction of educational personnel has emerged as a central factor because it is closely linked to motivation, professional engagement, and psychosocial well-being. Employees who experience higher levels of job satisfaction tend to demonstrate greater effectiveness, creativity, and commitment, which in turn enhance instructional quality and learning environments (Judge et al., 2001; Skaalvik & Skaalvik, 2011). Conversely, low satisfaction may reduce enthusiasm for professional duties and negatively affect educational outcomes (Bakker & Demerouti, 2007; Hoy & Hoy, 2001; Schwarzer & Hallum, 2008).

Within the education sector, the quality of preschool education is particularly sensitive to teacher well-being. Preschool teachers operate in emotionally demanding environments, interacting continuously with young children and their families while managing developmental, pedagogical, and relational responsibilities. Such conditions may increase the risk of emotional exhaustion and burnout, which can impair both teacher performance and children's developmental outcomes (Maslach et al., 2001; Skaalvik & Skaalvik, 2017). In early childhood settings, teacher well-being is particularly critical, as it directly influences the quality of teacher–child interactions, classroom climate, and children's socio-emotional and cognitive development (Hamre & Pianta, 2001; Pianta et al., 2012). Moreover, lower levels of job satisfaction and well-being among teachers have been associated with reduced instructional quality, lower engagement, and less effective classroom management (Bakker & Demerouti, 2007; Schwarzer & Hallum, 2008). Consequently, understanding the factors that shape job satisfaction in preschool educators is essential for improving educational systems and supporting early childhood development.

International research indicates that organizational and psychosocial factors play a key role in shaping teacher satisfaction. For example, social support and a psychologically safe work environment have been shown to enhance job satisfaction among teachers across European contexts (Van Droogenbroeck & Spruyt, 2015). Leadership style also appears influential: democratic leadership has been associated with increased satisfaction among teachers in China (Liu & Onwuegbuzie, 2012), while transformational leadership practices in the United States have been linked to professional growth and improved work climate perceptions (Bogler, 2001). Structural factors such as salary and working conditions likewise contribute significantly to teachers' professional well-being, as emphasized in the OECD's report (OECD, 2020). Collectively, these findings suggest that teacher satisfaction is shaped by a multidimensional interplay of individual, organizational, and contextual variables.

From a theoretical perspective, job satisfaction is commonly conceptualized as an individual's subjective evaluation of their work and work environment, reflecting the degree to which expectations and needs are fulfilled (Locke, 1976). Classic motivational frameworks, including Maslow's hierarchy of needs and Herzberg's two-factor theory, remain influential in explaining this construct. Herzberg and colleagues (1959) proposed that motivational factors such as recognition and growth opportunities enhance satisfaction, whereas hygiene factors, including salary and working conditions, primarily prevent dissatisfaction. Empirical research consistently demonstrates that job satisfaction is associated with organizational performance, employee retention, and psychological well-being (Judge et al., 2001). One of the most widely used instruments for measuring this construct is the Minnesota Satisfaction Questionnaire (Weiss et al., 1967), which assesses multiple dimensions of employees' perceptions of their work environment.

Beyond organizational outcomes, job satisfaction is closely linked to broader life satisfaction. One of the dominant theoretical explanations for this relationship is the spillover hypothesis, which proposes that emotional experiences in one life domain transfer into another (Bowling et al., 2010; Heller et al., 2002). Accordingly, positive or negative experiences at work may influence personal well-being, and vice versa. Although numerous studies have examined this association, most empirical evidence stems

from Western contexts and is largely correlational, leaving causal mechanisms insufficiently understood (Diener & Tay, 2012; Rain et al., 1991). Scholars have therefore suggested that psychological factors may mediate the relationship between job and life satisfaction (Judge & Watanabe, 1993; Rode, 2004).

Mental health indicators such as depression, anxiety, and stress represent potential mediating mechanisms in this process. Research shows that low job satisfaction is associated with higher levels of depressive symptoms, occupational stress, and emotional exhaustion, which may undermine both psychological functioning and work performance. Studies conducted in Azerbaijan similarly indicate that job alienation and workplace stress are linked to depressive symptoms and reduced professional satisfaction (Imanova, 2022; Novruzov, 2022). Evidence from broader international literature also demonstrates that work stress, work--family conflict, psychological violence, and negative team relations can significantly reduce job satisfaction and well-being (Modaresnezhad, 2021). Furthermore, anxiety has been shown to function as a mediator between workplace conditions and satisfaction outcomes in various professional groups (Soltani et al., 2024; Rigas et al., 2024).

Despite this growing body of research, several gaps remain. First, relatively little is known about the psychosocial mechanisms linking job satisfaction and life satisfaction in educational contexts within non-Western settings. Second, few studies simultaneously examine depression, anxiety, and stress as potential mediators within a unified model. Addressing these gaps may provide a more comprehensive understanding of how occupational experiences shape overall well-being among educators.

In recent years, Structural Equation Modeling (SEM) has become a widely used analytical approach in social and educational research due to its ability to simultaneously examine complex relationships among multiple variables, including both direct and indirect effects (Almeida, 2024). SEM enables researchers to test theoretically grounded models by integrating measurement and structural components within a single framework.

Compared to traditional regression techniques, SEM allows for the modeling of latent constructs and the estimation of multiple interrelated dependencies, making it particularly suitable for studying psychological processes such as job satisfaction, psychological distress, and life satisfaction. Moreover, recent studies have emphasized the increasing application of SEM in educational contexts to better understand factors influencing teacher performance and well-being (Alamer, 2025).

Accordingly, the present study adopts a structural equation modeling approach to examine both the direct and indirect pathways linking job satisfaction to life satisfaction, as well as the moderating role of career stage.

Accordingly, the present study aims to examine the association between job satisfaction and life satisfaction among preschool teachers, with particular attention to the mediating role of depression, anxiety, and stress, and to test whether these structural relations vary across career stages. By integrating organizational, demographic, and psychological variables within a single analytical framework, this research seeks to contribute both to the literature on teacher well-being and to the development of evidence-based human resource and educational policies.

Literature review and theoretical background

The relationship between job satisfaction and life satisfaction has been extensively examined in the literature, with consistent evidence suggesting a positive association between these constructs (Diener et al., 1999; Judge et al., 2001). The Bottom-Up Spillover Theory posits that satisfaction in specific life domains, such as work, contributes cumulatively to overall life satisfaction (Diener, 1984; Heller et al., 2002). Within this framework, job satisfaction is considered a critical determinant of general well-being.

In occupational contexts, the Job Demands–Resources Model provides a useful explanation for how workplace conditions influence psychological outcomes (Demerouti et al., 2007). According to this model, job resources—such as positive work experiences and satisfaction—can reduce psychological strain, whereas job demands may increase stress and burnout.

Empirical studies have demonstrated that job satisfaction is negatively associated with psychological distress indicators, including stress, anxiety, and depression, which in turn influence life satisfaction (Bakker & Demerouti, 2007; Schwarzer & Hallum, 2008). However, findings regarding the relative contribution of these mediators remain mixed, with some studies highlighting stress as a more proximal predictor of well-being outcomes (Skaalvik & Skaalvik, 2017; Modaresnezhad, 2021).

Additionally, career development perspectives suggest that work-related experiences and their psychological consequences may vary across different stages of professional life (Super, 1980; Zacher & Frese, 2011). Despite this, limited research has examined how the structural relationships among job satisfaction, psychological distress, and life satisfaction differ across career stages.

Contribution of the Study

This study contributes to the educational and psychological literature in several ways. First, it extends existing research by examining the simultaneous effects of multiple psychological distress variables within a unified structural model (Preacher & Hayes, 2008). Second, by employing a structural equation modeling approach, the study provides a more comprehensive understanding of the mechanisms linking job satisfaction to life satisfaction (Kline, 2016). Third, the inclusion of a career stage as a moderator offers novel insights into how these relationships evolve across professional development (Zacher & Frese, 2011).

From a practical perspective, the findings offer important implications for educational systems, highlighting the need for targeted interventions to reduce stress and enhance teacher well-being, particularly at different stages of career development (OECD, 2020). Such insights are critical for improving both teacher effectiveness and early childhood educational outcomes (Hamre & Pianta, 2001).

Aim of the study

The aim of this study is to examine the relationship between job satisfaction and life satisfaction among preschool teachers, focusing on the mediating role of psychological distress (depression, anxiety, and stress) and the moderating role of career stage.

H_1. Job satisfaction will be positively associated with life satisfaction among preschool teachers.

H_2. Job satisfaction will be negatively associated with psychological distress (depression, anxiety, and stress).

H_3. Psychological distress will be negatively associated with life satisfaction.

H_4. Psychological distress will mediate the relationship between job satisfaction and life satisfaction.

H_5. Career stage will moderate the structural relationships among job satisfaction, psychological distress, and life satisfaction, such that the strength of these direct and indirect effects differs across early-, mid-, and late-career teachers.

METHOD

The present study is grounded in a mediation framework examining the relationship between job satisfaction and life satisfaction, with psychological distress variables (anxiety, depression, and stress) as mediators. This conceptualization is informed by well-established theoretical perspectives suggesting that individuals' evaluations of their work domain can extend to broader life evaluations, both directly and through emotional and psychological processes.

From a theoretical standpoint, the model draws on the Bottom-Up Spillover Theory, which posits that satisfaction within specific life domains (e.g., work) contributes to overall life satisfaction through cumulative effects across domains (Diener, 1984; Diener et al., 1999). In addition, the model is consistent with the Job Demands–Resources Model, which suggests that job-related resources (e.g., satisfaction, positive work experiences) can reduce psychological strain and enhance well-being outcomes (Demerouti et al., 2001; Bakker & Demerouti, 2007).

Psychological distress is conceptualized as a key mechanism through which job satisfaction influences life satisfaction. Prior research indicates that lower job satisfaction is associated with higher levels of stress, anxiety, and depression, which in turn negatively affect individuals' global evaluations of life (e.g., Diener et al., 1999; Bakker & Demerouti, 2007). Based on this evidence, it is expected that job satisfaction will exert both a direct effect on life satisfaction and indirect effects through psychological distress.

Furthermore, the study incorporates the career stage as a moderator, recognizing that the strength and nature of these relationships may vary across professional development stages. This assumption aligns with lifespan and career development perspectives, which suggest that individuals' work-related experiences and their psychological consequences evolve over time.

Overall, the proposed model integrates direct and indirect pathways, allowing for a comprehensive examination of how job satisfaction contributes to life satisfaction through both evaluative and emotional mechanisms.

Participants and procedure

Participants were recruited using a non-probability convenience sampling strategy. Specifically, preschool teachers working in various educational institutions across Azerbaijan were invited to participate through professional networks, institutional contacts, and online communication channels (e.g., email and social media groups for educators). Participation was voluntary, and data were collected through an online survey platform. Inclusion criteria required participants to be currently employed as preschool teachers and to provide informed consent prior to participation.

The study included 266 preschool teachers from Azerbaijan who completed the survey. Participants ranged in age from 22 to 67 years (M = 43.89, SD = 10.34). For moderation analyses, participants were categorized into three career stages based on years of work experience: Early career (1–10 years; n = 114), Mid-career (11–30 years; n = 95), and Late career (30+ years; n = 57). Detailed sociodemographic characteristics are presented in Table 1.

Table 1 presents the demographic and occupational characteristics of the sample, including marital status, number of children, health condition, income satisfaction, working hours, and career stage distribution.

Table 1. Participant characteristics (n = 266).

Variable	Category	n	%
Age	Mean (SD)	43.89 (10.34)	Range: 22–67
Marital status	Married	149	56.0
	Single	117	44.0
Children	None	17	6.4
	One	48	18.0
	Two or more	201	75.6
Health problems	Yes	58	21.8
	No	208	78.2
Income satisfaction	Satisfied	207	77.8
	Not satisfied	59	22.2
Working hours/day	3–5 hours	29	10.9
	6–8 hours	229	86.1
	9–10 hours	8	3.0
Career stage	Early (1-10 years)	114	42.9
	Middle (11-30 years)	95	35.7
	Late (30+ years)	57	21.4

As shown in Table 1, the sample consisted predominantly of married participants (56.0%), with the majority reporting having two or more children (75.6%). Most participants indicated no health problems (78.2%) and reported being satisfied with their income (77.8%). In terms of working conditions, the vast majority worked 6–8 hours per day (86.1%), reflecting a relatively standardized workload among preschool teachers. Regarding career stage distribution, the largest group was early-career teachers (42.9%), followed by mid-career (35.7%) and late-career participants (21.4%), ensuring adequate representation across different stages of professional development. Overall, the sample reflects a diverse range of demographic and occupational characteristics relevant to the study aims.

All participants provided informed consent before participation. Responses were anonymous and used solely for research purposes.

Ethics

The study followed the ethical principles of the Declaration of Helsinki and obtained approval from the Ethics Committee of the (blinded for review) (Approval No. T-765). Participants were fully informed about the study procedures and provided written informed consent prior to participation.

Data Collection Tools

The Depression, Anxiety, and Stress Scale (DASS-21) was created by Lovibond and Lovibond (1995). The 21- item scale was broken down into three sub- dimensions: stress, anxiety, and depression. For example, depression might be described as the inability to feel anything positive at all. Using a 4-point Likert scale, the DASS-21 rates negative emotional symptoms (0 = never applied to me, 3 = frequently or heavily applied to me) For the depression subscale, anxiety subscale, and stress subscale, respectively, the Cronbach alpha internal consistency reliability coefficient in the clinical sample is .87, .85, and .81. The Cronbach's Alpha coefficient in this research is .79.

Job Satisfaction Scale (Hackman & Oldham, 1975) is a widely used tool to measure an individual's job satisfaction. The Job Satisfaction Scale consists of 14 items, such as the nature of management in the workplace. Participants respond to each statement on a 5-point Likert-type scale, ranging from 1 ("It does not satisfy me at all") to 5 ("It satisfies me very much"). Cronbach's alpha of this scale is .95. The Cronbach's Alpha coefficient in this research is .87.

Satisfaction with Life Scale (SWLS) was developed by Diener et al. (1985). The SWLS is a brief 5-item questionnaire used to assess overall cognitive judgments of life satisfaction. Respondents often just have to spend one-minute answering questions using a Likert scale. This scale is appropriate for adults from a variety of backgrounds because the questions are open-ended. Use in non-clinical groups is where it is most suitable. A 6-point Likert scale is used by SWLS to evaluate life satisfaction. According to the reliability study of the SWLS, there was .74 Cronbach's alpha internal consistency. The Cronbach's Alpha coefficient in this research is .72.

Data analysis

Data were analyzed in R. Raw data were imported from SPSS (.sav) format using the haven package and screened for missingness. Composite variables (job satisfaction, life satisfaction, anxiety, depression, and stress) were computed as mean scores (MEAN variables). Descriptive statistics (M, SD, skewness, kurtosis) were obtained using the psychpackage. Bivariate associations among study variables were examined using Pearson correlation coefficients.

To test the hypothesized multiple mediation model, structural equation modeling (SEM) was conducted using the lavaanpackage. Job satisfaction was specified as the predictor, life satisfaction as the outcome, and anxiety, depression, and stress as parallel mediators. Covariances among the mediators were freely estimated. Indirect effects (specific and total) and the total effect were evaluated using nonparametric bootstrapping with 2000 resamples, and statistical inference was based on bootstrap percentile 95% confidence intervals (CIs). Because the structural model was just-identified (df = 0), global model fit indices (e.g., CFI, RMSEA, SRMR) were not informative; therefore, interpretation focused on parameter estimates and bootstrap CIs. Standardized estimates (β) and explained variance (R^2) were reported for endogenous variables.

Moderation by work experience was examined via multi-group SEM. Participants were categorized into three career stages (Early, Mid, Late) based on years of work experience. A model allowing regression paths to vary freely across groups was compared with a model constraining all regression paths to equality across groups. Group differences were evaluated using the robust chi-square difference test, with statistical significance set at $p < .05$.

RESULTS

As shown in Table 2, job satisfaction was moderately positively correlated with life satisfaction and negatively correlated with anxiety, depression, and stress. In turn, all three distress indicators were negatively associated with life satisfaction and positively intercorrelated.

Structural model: Multiple mediator model

We tested a multiple mediation model in which job satisfaction predicted life satisfaction both directly and indirectly through anxiety, depression, and stress. Covariances among the three mediators were freely estimated.

Because the structural model was just-identified (df = 0), global fit indices (e.g., CFI, RMSEA, SRMR) were not informative; therefore, interpretation focused on parameter estimates and bootstrap confidence intervals.

Table 2. Descriptive statistics and correlations.

Variable	Mean	Std.Dev.	Skewness	Kurtosis	1	2	3	4	5
Job satisfaction	3.68	.68	-.62	.64	—				
Life satisfaction	4.91	1.20	-.26	-.30	.466	—			
Anxiety	.49	.47	1.38	2.24	−.339	−.253	—		
Depression	.44	.44	1.83	4.75	−.332	−.366	.555	—	
Stress	.86	.63	.88	.29	−.422	−.507	.588	.584	—

Note. Correlations > |.12| are significant at $p < .05$ with this sample size.

Table 2 presents the descriptive statistics and bivariate correlations among the study variables. Job satisfaction (M = 3.68, SD = .68) and life satisfaction (M = 4.91, SD = 1.20) showed moderate variability and approximately normal distributions, with slight negative skewness indicating a tendency toward higher scores. In contrast, anxiety and depression demonstrated positive skewness and elevated kurtosis, suggesting that lower levels of these symptoms were more common in the sample, with a smaller proportion of participants reporting higher levels. Stress showed a moderate positive skew but remained within acceptable distributional limits.

In terms of associations, job satisfaction was positively correlated with life satisfaction ($r = .466$, $p < .05$) and negatively correlated with anxiety ($r = -.339$), depression ($r = -.332$), and stress ($r = -.422$), indicating that higher job satisfaction is linked to better overall well-being and lower psychological distress. Life satisfaction was also negatively associated with anxiety ($r = -.253$), depression ($r = -.366$), and stress ($r = -.507$), with the strongest relationship observed for stress. Additionally, anxiety, depression, and stress were all positively intercorrelated (r range = .555–.588), reflecting the common co-occurrence of psychological distress indicators.

Consistent with the threshold for statistical significance in this sample ($|r| > .12$, $p < .05$), all reported correlations were statistically significant.

Direct effects

Table 3. Structural model standardized path estimates.

Path	β	95% CI	p
Job satisfaction → Anxiety	−.339	[−.463, −.214]	<.001*
Job satisfaction → Depression	−.332	[−.458, −.205]	<.001*
Job satisfaction → Stress	−.422	[−.553, −.290]	<.001*
Job satisfaction → Life satisfaction	.311	[.169, .453]	<.001*
Anxiety → Life satisfaction	.149	[−.012, .313]	.074
Depression → Life satisfaction	−.113	[−.298, .064]	.109
Stress → Life satisfaction	−.396	[−.560, −.247]	<.001*

*p< .05

Table 3 presents the standardized path coefficients from the structural model. Job satisfaction emerged as a significant negative predictor of all three indicators of psychological distress, including anxiety (β = −.339, p < .001), depression (β = −.332, p < .001), and stress (β = −.422, p < .001), indicating that higher job satisfaction is associated with lower levels of distress. When controlling for the mediators, job satisfaction remained a significant positive predictor of life satisfaction (β = .311, p < .001), suggesting a robust direct effect.

Among the mediators, only stress demonstrated a significant association with life satisfaction (β = −.396, p < .001), indicating that higher stress is linked to lower life satisfaction. In contrast, the effects of anxiety (β = .149, p = .074) and depression (β = −.113, p = .109) were not statistically significant when included simultaneously in the model, suggesting that their unique contributions to life satisfaction are limited after accounting for shared variance with stress.

Overall, the model explained a substantial proportion of variance in life satisfaction (R^2 = .350), while explaining smaller but meaningful proportions of variance in anxiety (R^2 = .115), depression (R^2 = .110), and stress (R^2 = .178). These findings highlight stress as the primary pathway linking job satisfaction to life satisfaction within the model.

Table 4 presents the results of the bootstrapped indirect effects analysis (2,000 resamples, percentile confidence intervals). The total indirect effect of job satisfaction on life satisfaction through the three mediators was statistically significant (β = .274, p < .001), indicating that psychological distress variables jointly transmit part of the effect of job satisfaction on life satisfaction.

Indirect effects (bootstrapping)

When examining the specific indirect pathways, only the indirect effect via stress was significant (β = .296, p < .001), suggesting that stress serves as the primary mediating mechanism linking job satisfaction to life satisfaction. In contrast, the indirect effects through anxiety (β = −.089, p = .121) and depression (β = .066, p = .144) were not statistically significant, as their confidence intervals included zero.

Table 4. Results of indirect effects**.**

Effect	Estimate	95% CI	p
Anxiety	−.089	[−.221, .009]	.121
Depression	.066	[−.023, .155]	.144
Stress	.296	[.175, .435]	<.001*
Indirect	.274	[.163, .392]	<.001*
Total effect	.824	[.594, 1.079]	<.001*

*p< .05

Additionally, the total effect of job satisfaction on life satisfaction was significant (β = .824, p < .001), indicating a strong overall association. Taken together, these findings support a **partial mediation model**, in which job satisfaction influences life satisfaction both directly and indirectly, primarily through its effect on stress.

Moderation by work experience (multi-group analysis)

To examine whether work experience moderated the structural relations, participants were classified into three career-stage groups based on years of work experience: Early (n = 114), Mid (n = 95), and Late (n = 57). A multi-group SEM allowing regression paths to vary freely across groups was compared with a model constraining all regression paths to equality across groups. The comparison indicated that constraining the paths significantly worsened model fit: $\Delta\chi^2(14) = 39.008$, p = .00036.

Table 5. Multi-group standardized paths (moderation by work experience).

Path	Early β	Mid β	Late β
Job → Life satisfaction	.457*	.226	.057
Stress → Life satisfaction	−.473*	−.556*	−.136
Depression → Life satisfaction	.023	.016	−.466*

Note. *p < .05, **p < .01, ***p < .001

The freely estimated multi-group model demonstrated a significantly better fit than the constrained model, indicating that at least some structural paths differed across career stages. Inspection of standardized estimates presented in Table 5 showed that the direct association between job satisfaction and life satisfaction was strongest in the Early group (β = .457, p < .001), smaller in the Mid group (β = .226, p = .062), and non-significant in the Late group (β = .057, p = .701).

These findings suggest that the psychological mechanisms linking job satisfaction to life satisfaction may vary across different stages of career development.

Stress was a significant negative predictor of life satisfaction in both the Early (β = −.473, p < .001) and Mid (β = −.556, p < .001) groups, but not in the Late group (β = −.136, p = .436). In contrast, depression showed a significant negative association with life satisfaction in the Late group (β = −.466, p < .001), while this path was not significant in the Early or Mid-groups.

The pattern of coefficients is visually summarized in Figure 1, which illustrates the career-stage differences in both direct and indirect pathways linking job satisfaction to life satisfaction. As shown in the Figure 1, job satisfaction consistently predicted lower psychological distress across all groups; however, the pathways through which job satisfaction translated into life satisfaction differed by career stage.

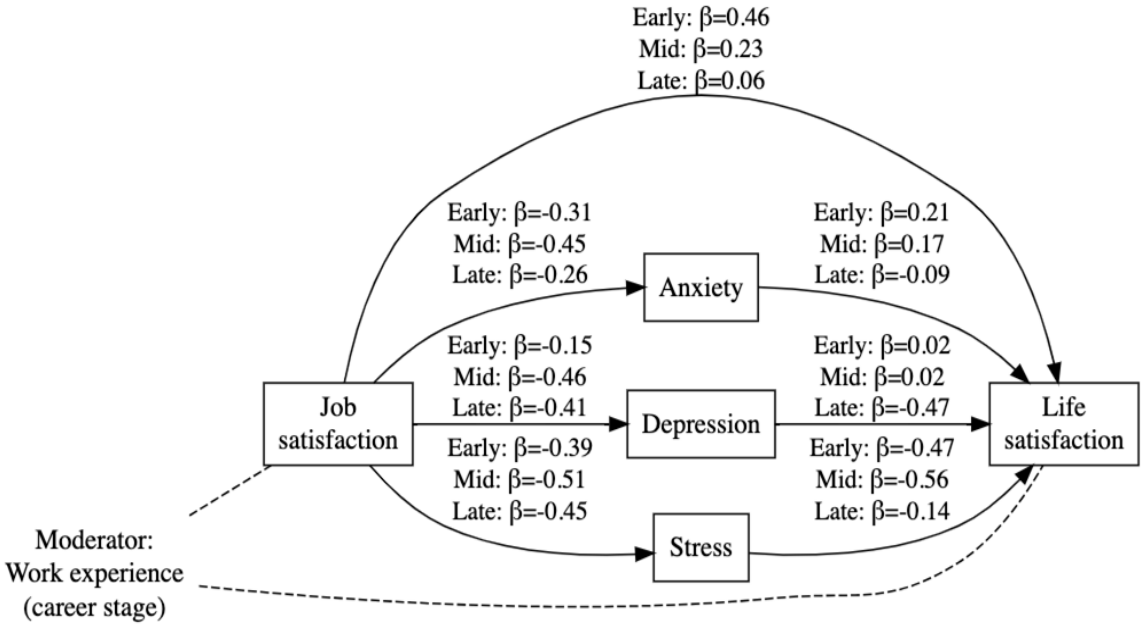

Figure 1. Multi-group structural model of job satisfaction predicting life satisfaction via psychological distress across career stages.

In earlier career phases, job satisfaction contributed to life satisfaction both directly and indirectly through reduced stress, suggesting that work-related experiences may play a more central role in shaping overall well-being at this stage. In mid-career participants, stress remained the dominant mechanism linking job satisfaction to life satisfaction, whereas the direct effect of job satisfaction weakened.

In contrast, in the late-career group, depression emerged as the primary pathway associated with life satisfaction, while the effects of job satisfaction and stress were substantially attenuated. This shift suggests that emotional adjustment processes may become more relevant for overall well-being in later career stages than direct work-related satisfaction.

Taken together, these findings indicate that work experience functions as a meaningful moderator of the psychological processes linking job satisfaction to life satisfaction, with different mechanisms predominating at different career stages.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

The present study investigated the relationship between job satisfaction and life satisfaction among preschool teachers and examined whether psychological distress (anxiety, depression, and stress) mediated this association. In addition, the study explored whether these structural relationships varied across career stages. The findings provide several important insights into the psychological mechanisms linking occupational experiences to broader well-being.

Consistent with previous research, job satisfaction showed a moderate positive association with life satisfaction, indicating that teachers who experience greater fulfillment in their professional roles also tend to evaluate their lives more positively. This supports theoretical perspectives suggesting that work constitutes a central life domain whose emotional consequences extend beyond the workplace (Judge & Watanabe, 1993; Diener & Tay, 2012). The persistence of a significant direct path from job satisfaction to life satisfaction after controlling for psychological distress suggests that occupational

evaluations contribute independently to global well-being judgments, rather than operating solely through mental health pathways.

The results further demonstrated that job satisfaction was negatively associated with all three indicators of psychological distress—anxiety, depression, and stress—indicating that higher occupational satisfaction is linked to lower emotional strain. This finding aligns with occupational well-being frameworks such as the Job Demands–Resources model, which posits that adequate work resources protect employees from psychological exhaustion and emotional difficulties (Bakker & Demerouti, 2007; Warr, 2007). In emotionally demanding professions such as early childhood education, this protective function of job satisfaction may be particularly salient.

However, when examining the mediational pathways, only stress emerged as a significant predictor of life satisfaction and as a statistically significant mediator. Anxiety and depression did not independently predict life satisfaction when included simultaneously in the model. This pattern suggests that, in the present sample, stress may represent the most proximal psychological mechanism through which occupational experiences translate into broader well-being outcomes. One possible interpretation is that stress reflects the immediate cognitive and physiological burden of professional demands, whereas anxiety and depressive symptoms may represent more distal or generalized emotional states. Similar findings have been reported in studies showing that perceived stress is often more strongly linked to daily functioning and subjective well-being than broader affective symptoms (Lovibond & Lovibond, 1995; Wang & Hall, 2019).

The significant total indirect effect indicates that psychological distress collectively contributes to the relationship between job satisfaction and life satisfaction, yet the decomposition of effects highlights that this process is primarily driven by stress. Thus, the present findings point toward a partial mediation model, in which job satisfaction influences life satisfaction both directly and indirectly through reduced stress. This dual pathway is consistent with integrative well-being models proposing that occupational satisfaction affects both evaluative judgments and emotional functioning.

A major contribution of this study lies in the multi-group analyses examining career-stage differences. The results indicated that the structural pathways linking job satisfaction, psychological distress, and life satisfaction were not invariant across career stages. Specifically, the direct association between job satisfaction and life satisfaction was strongest among early-career teachers, weaker in mid-career participants, and non-significant among late-career teachers. This pattern suggests that work experiences may play a particularly central role in shaping overall well-being during the early stages of professional development, when occupational identity, career expectations, and future prospects are still forming.

The mediational mechanisms also varied across career stages. Stress was a strong predictor of life satisfaction in early and mid-career groups but not among late-career teachers, whereas depression became the dominant predictor of life satisfaction in the late-career group. This shift may reflect developmental changes in the psychological meaning of work. Early in a career, well-being may be strongly tied to workload management, role adaptation, and daily professional pressures, making stress a key explanatory factor. In contrast, in later career stages, broader emotional evaluations and cumulative experiences may become more relevant for overall well-being, increasing the importance of depressive symptoms. These findings align with lifespan perspectives suggesting that the determinants of well-being evolve across career trajectories as individuals' priorities and coping resources change.

Taken together, the findings suggest that job satisfaction is an important but not uniform predictor of life satisfaction among preschool teachers. Its effects appear to operate through both direct evaluative pathways and stress-related emotional mechanisms, while the relative importance of these processes varies across career stages. From a practical perspective, these results imply that interventions aimed at improving teacher well-being may need to be tailored to career phase. For early-career teachers, strategies that reduce occupational stress and enhance role clarity may be particularly effective, whereas

for more experienced teachers, attention to emotional support and psychological health may be more critical.

Overall, the present study contributes to the literature by demonstrating that the link between job satisfaction and life satisfaction is both psychologically mediated and developmentally contingent. By integrating mediation and moderation within a single analytical framework, the findings provide a more nuanced understanding of how occupational experiences shape overall well-being among educators.

Conclusion

This study demonstrated that job satisfaction is positively associated with life satisfaction among preschool teachers, with this relationship operating both directly and indirectly through psychological distress. Among the examined mediators, stress emerged as the primary pathway linking occupational experiences to overall well-being. Moreover, the multi-group analyses indicated that these relationships vary across career stages, suggesting that the psychological mechanisms connecting work and life satisfaction are developmentally contingent. Overall, the findings highlight the importance of reducing workplace stress and supporting teachers' psychological well-being as key strategies for enhancing both professional functioning and life satisfaction.

From a research perspective, future studies should further investigate the dynamic interplay between job satisfaction and well-being using longitudinal and dyadic designs, as well as explore additional contextual and organizational factors (e.g., institutional climate, leadership styles, and social support) that may strengthen or buffer these relationships. From a practical standpoint, educational institutions should prioritize interventions aimed at stress reduction, such as workload management, psychological support programs, and professional development initiatives tailored to different career stages. Such evidence-based strategies may not only improve teachers' well-being but also contribute to more sustainable and effective educational environments.

Limitations and recommendations

Despite its contributions, the present study has several limitations that should be considered when interpreting the findings. First, the cross-sectional design limits the ability to draw causal conclusions regarding the directionality of relationships among job satisfaction, psychological distress, and life satisfaction. Longitudinal studies are needed to determine whether changes in job satisfaction lead to subsequent changes in well-being over time.

Second, all variables were measured using self-report instruments, which may introduce common method bias and shared variance among constructs. Third, the sample consisted exclusively of preschool teachers, which may limit the generalizability of the findings to other educational levels or occupational groups. Future research should examine whether similar mediational mechanisms operate among primary, secondary, or higher education teachers, as well as in non-educational professions.

Future studies may also consider expanding the model by including additional organizational variables, such as leadership style, organizational climate, or perceived support, as well as personal resources such as resilience or coping strategies. Such extensions could provide a more comprehensive understanding of how workplace conditions interact with individual psychological processes to shape teachers' well-being across their careers.

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Ethics and Conflict of Interest

The study followed the ethical principles of the Declaration of Helsinki and obtained approval from the Ethics Committee of the (blinded for review) (Approval No. T-765). Participants were fully informed about the study procedures and provided written informed consent prior to participation. The authors declare that there are no conflicts of interest regarding the publication of this paper.

Author Contribution

Ulkar Zalova-Nuriyeva contributed to conceptualization, methodology, supervision, writing—original draft, and project administration. Sevil Abbasova contributed to data curation and writing—review & editing. Nigar Asgerova contributed to validation and writing—review & editing. Zhala Babazade contributed to visualization and writing—review & editing. Vusala Maharova contributed to data collection, literature review, and writing—review & editing. Chinara Kazimzade contributed to resources and validation. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data Availability

The data that support the findings of this study are available on request from the corresponding author.

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MEDIATING ROLE OF PRIMARY SCHOOL STUDENTS' RESEARCH SKILLS BETWEEN CAREER CURIOSITY AND WELL-BEING

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Abstract

The career-related curiosity of elementary school students before transitioning to high school may substantially affect their emotional and psychological well-being. Research skills developed during this period can fulfill curiosity and enhance overall well-being. This study investigated how research skills mediate the relationship between career-related curiosity and the emotional-psychological well-being of elementary school students. This study was conducted using a quantitative correlational research design to examine the relationships between career curiosity, research skills, and emotional-psychological well-being among elementary school students. The sample consisted of 286 students aged 9 to 14 from a district in Istanbul, Türkiye. Data were gathered using the Personal Information Form, the Stirling Children's Emotional-Psychological Well-being Scale, and the Career Development Scale for Children. Descriptive statistics and correlation analyses were used to inform structural equation modeling, which was used to evaluate the proposed mediation model. The results indicated that career-related curiosity (independent variable) directly influenced emotional-psychological well-being (dependent variable), with an indirect effect fully mediated by research skills (mediator variable). However, when research skills were included in the model, this direct effect became statistically no significant, demonstrating a full mediation effect. In other words, research skills entirely mediated the relationship between career-related curiosity and emotional-psychological well-being. The study's findings are analyzed in the context of current literature, with suggestions for educational practices and implications for school counselling and career guidance.

Keywords: Career curiosity, research skills, well-being, primary school student.

INTRODUCTION

Research skills play a crucial role in fostering cognitive and emotional growth; however, their development in childhood is mainly stimulated by curiosity. Career-related curiosity, in particular, can enhance elementary school students' motivation to learn, promoting the acquisition of research skills and contributing to emotional and psychological well-being. This connection highlights the necessity of integrating career curiosity into educational curricula, with research skills supporting students' intellectual, emotional, and social development, promoting autonomy, academic performance, and stronger peer relationships (Belfi & Borghans, 2025; Schultheiss, 2008; Schultheiss et al., 2005; Watson & McMahon, 2005). Early career planning is becoming increasingly essential in the modern world, driven by rapid technological advances and a dynamic global labor market. Career development is not merely about job selection but a lifelong learning process involving cognitive and emotional growth (Dilmaç & Bakır, 2022). Curiosity—a core trait in early career development—shapes children's learning behavior, academic involvement, and motivation to explore (Dilmaç & Gökalp-Şimşir, 2022; Kırkıç, 2022). Inquisitive behavior also supports emotional well-being by providing a sense of purpose and engagement. Well-being is more than the absence of distress; it represents flourishing across mental, emotional, and spiritual domains. Seligman's (2012) PERMA model and Ryff's psychological

well-being framework (Gündoğan, 2022; Ryff, 1989) emphasize positive emotions, engagement, meaning, accomplishment, personal growth, and autonomy. When curiosity leads children to explore, it drives the development of research skills, such as information-seeking, self-reflection, and goal-setting, all of which contribute to career development and overall well-being. Although these constructs are conceptually related, they represent distinct psychological processes. Career curiosity refers to a motivational and exploratory tendency that encourages children to ask questions about future roles, interests, and learning opportunities (Schultheiss, 2008; Stead et al., 2016). In contrast, research skills represent the cognitive and behavioral competencies used to investigate information, evaluate alternatives, and solve problems within learning contexts. Thus, curiosity functions primarily as a motivational driver of exploration, whereas research skills represent the applied abilities that enable children to transform exploratory motivation into structured learning and problem-solving activities. Students who develop these skills are more academically successful and better equipped to face future challenges. Despite growing academic interest in the topic, few empirical studies explore the intersection of career curiosity, research skills, and well-being during childhood (Stead et al., 2016). Although research on children's career development has expanded internationally, studies examining the relationship between career curiosity, research skills, and psychological well-being within different cultural and educational contexts remain limited. Investigating these relationships in the Turkish educational context provides an opportunity to contribute to global discussions on early career development and socio-emotional learning during childhood. This study examined how research skills mediate the relationship between career-related curiosity and emotional-psychological well-being in elementary school students, with the goal of informing educational strategies that foster holistic development.

Career Curiosity in Childhood

Career development is a lifelong process that encompasses not only job selection, self-awareness, goal formulation, and the pursuit of meaning, but also the continuous interaction between individuals' values, interests, and abilities with social, cultural, and economic contexts (Brown, 2002; Herr et al., 2004; Savickas, 2005; Super, 1990). Early childhood, generally defined as the period from birth to approximately age 8, is a critical stage for building foundational traits such as curiosity, self-concept, and time perspective, which significantly influence career identity and life satisfaction in later stages (Berk, 2018; Papalia & Martorell, 2021). However, the age range examined in the present study (9–14 years) represents a transitional developmental period spanning late childhood and early adolescence. During this transition, children gradually move from concrete operational thinking toward more advanced cognitive processes associated with early adolescence, which enables more structured exploration of interests, future roles, and personal identity. Career curiosity refers to an individual's tendency to explore career-related information, seek alternatives, and actively investigate possible life paths (Savickas, 2002; 2013). Rooted in Super's developmental theory and further expanded within Career Construction Theory, career curiosity is considered one of the four key dimensions of career adaptability, concern, control, and confidence (Savickas & Porfeli, 2012). In childhood, it manifests as asking questions about occupations, exploring the environment, and developing an early awareness of potential future roles. However, as students move toward early adolescence, this curiosity may evolve from general inquisitiveness into more systematic career exploration and identity-related reflection, particularly as they approach important educational transitions such as the move to secondary education. Super's career development model highlights nine dimensions—curiosity, research orientation, self-concept, locus of control, interests, planning, time perspective, career information, and significant others—all of which should be cultivated early to support favorable career outcomes. Research consistently shows that curiosity drives children to seek information and develop research orientation, enhancing self-awareness and intrinsic motivation (Schultheiss, 2008; Schultheiss et al., 2005). This increases vocational engagement and subjective well-being (Gamboa et al., 2023). Within this developmental transition from late childhood to early adolescence, research skills may play a particularly important role by helping students transform their natural curiosity into structured inquiry, critical thinking, and goal-oriented exploration. Recent experimental studies support these claims. For example, Alan and Mumcu (2024) demonstrated that fostering curiosity in elementary school students

enhanced academic performance and knowledge retention. While not directly focused on career-related curiosity, these findings highlight the foundational role of curiosity in promoting adaptive learning skills, which aligns with the present study's focus on research skills as a mediator between curiosity and well-being. Similarly, Abdelghani et al. (2024) improved curiosity-driven and metacognitive skills through workshops, while Valikhani et al. (2023) demonstrated gains in career planning and exploration among children. Despite this, the mediating role of research skills in the link between early career curiosity and emotional-psychological well-being remains underexplored. Most existing literature focuses on adolescence or academic outcomes, overlooking emotional growth in primary years. This study addressed this gap by examining how research skills mediate the relationship between career-related curiosity and emotional well-being in elementary school students, promoting a more integrated and socioemotionally informed model of early career development.

Emotional–Psychological Well-Being of Children

Well-being is a multidimensional construct that encompasses both objective living conditions and individuals' cognitive and emotional evaluations of their experiences (Schulte et al., 2015). Emotional well-being reflects life satisfaction and the ability to sustain positive emotional states (Keyes, 2002). Emotional–Psychological Well-Being (EPW) has been conceptualized within both hedonic and eudaimonic traditions. Hedonic well-being emphasizes life satisfaction and the balance of positive over negative affect (Diener, 1984; Keyes, 2002), whereas eudaimonic well-being emphasizes realizing one's potential, personal growth, and meaning in life (Ryff, 1989). Integrative models, such as Keyes' (2002) mental health continuum, combine these perspectives by framing well-being as a state of flourishing that includes emotional vitality, psychological functioning, and social connectedness. In childhood, EPW is closely linked to self-regulation, resilience, and school adjustment, reflecting both individual traits (e.g., optimism, self-efficacy) and contextual supports (e.g., family and classroom climate) (Deci & Ryan, 2000; Suldo et al., 2011). Positive emotions, such as enthusiasm, joy, and attentiveness, enhance awareness and adaptability, fostering resilience and broadening cognitive resources. In contrast, the lack of such emotions may lead to emotional stagnation (Fredrickson & Branigan, 2005). While negative emotions like anxiety and anger may hinder well-being, moments of serenity signal emotional regulation competence (Watson et al., 1988). Psychological well-being goes beyond mood states, encompassing autonomy, purpose, environmental mastery, and relationships (Obrenović et al., 2020; Ryff & Keyes, 1995). Ryff's (1989) model comprises six dimensions: self-acceptance, personal growth, life purpose, positive relations, autonomy, and mastery, all of which are essential for meaning, identity, and self-efficacy. Psychological well-being supports children's academic success, stress resilience, and social competence (Söner & Yılmaz, 2020). Ecclestone (2012) highlights the value of emotional intelligence, mindfulness, empathy, and resilience in child development. These capacities aid emotional regulation and identity formation, promoting long-term well-being. Recent studies emphasize the importance of integrated models, which include intrapersonal factors (e.g., optimism, self-awareness) and environmental support (e.g., family and school climate). Enhancing reflective thinking and inquiry skills through research-oriented activities can improve emotional and psychological well-being. Therefore, elementary school students' EPW should be viewed holistically—cognitively, affectively, and behaviorally. Promoting emotional well-being through research skill development fosters a nurturing school environment that boosts academic achievement and social flourishing, preparing students for future success.

Research Skills in Childhood

In today's knowledge-driven society, early development of research skills is essential for fostering cognitive growth, scientific literacy, and lifelong learning. These skills involve formulating questions, gathering and analyzing information, drawing evidence-based conclusions, and applying knowledge across contexts (Booth et al., 2008; Creswell, 2014; Leavy, 2017). Research literacy also includes transferable competencies relevant to education, health, business, and the social sciences, emphasizing critical thinking, ethical reasoning, and information evaluation (Fink, 2013; Healey & Jenkins, 2009). Research literacy refers to an individual's ability to understand, interpret, and critically evaluate research processes and findings, and to apply this knowledge across various contexts (Mertens, 2019;

Zawacki-Richter et al., 2020). In childhood education, these skills do not emerge spontaneously; instead, they are stimulated by curiosity-driven exploration. Naturally inquisitive children begin to ask meaningful questions, assess the credibility of information, and use evidence-based reasoning to solve problems (Bapanova et al., 2023). Structured learning environments encouraging curiosity can significantly improve hypothesis generation, evidence evaluation, and question formulation (Jirout, 2020; Spektor-Levy et al., 2013). Thus, curiosity serves as a foundation upon which research skills develop, and these competencies in turn support children's autonomy, self-regulation, and emotional resilience. Research skills empower children to navigate uncertainty, manage stress, and engage meaningfully with their surroundings (Corbí et al., 2024). Moreover, they contribute to self-efficacy and emotional well-being by enabling students to explore their interests and cope with academic and social demands (Gamboa et al., 2023). Such empowerment promotes self-esteem, psychological flexibility, and career exploration (Kashdan & Rottenberg, 2010). Despite their importance, limited research directly addresses the role of research skills in shaping childhood emotional health. Therefore, this study examined how curiosity leads to the development of research skills, which foster integrated cognitive and emotional development in elementary school learners.

The Interrelationship between Career Curiosity, Emotional–Psychological Well-Being, and Research Skills

Within educational frameworks, this interaction underscores the importance of fostering curiosity as a catalyst for developing research skills, which in turn supports children's emotional and psychological well-being. Students are not only prepared for academic achievement through this holistic approach, but they are also equipped with the critical life skills necessary for future objectives. Fostering curiosity and teaching research skills are two of the most effective ways for teachers to improve the emotional resilience of their students. As a result, students can tackle the complexities of academic and personal difficulties with greater ease. According to Banerjee et al. (2016), this underscores the importance of schools embracing comprehensive programs that integrate emotional and social development with academic courses. These programs should be implemented without exception. In this way, an environment conducive to all students will be fostered.

Significance of the Study

This inquiry into elementary school children's research skills, career-related curiosity, and EPW is crucial, as foundational competencies acquired in early education have a significant impact on career exploration and mental health. Research skills foster autonomy, accountability, and innovation, laying the groundwork for personal and professional success (Martínez Mora et al., 2018). Curiosity, a vital socio-emotional skill, enhances vocational interest and facilitates identity development (Gamboa et al., 2023). Interpersonal curiosity is correlated with social-emotional competence and well-being, with gender serving as a moderator of these effects, suggesting that curiosity operates differently across groups (Han et al., 2023). These findings highlight the complex role of curiosity in developmental outcomes. Furthermore, research competence and professional inquisitiveness help students adapt to future challenges (Gamboa et al., 2023), especially within supportive educational environments that nurture cognitive and emotional growth (Zhang & Yuen, 2022). Importantly, the age range examined in this study (9–14 years) represents a developmental transition between late childhood and early adolescence (Berk, 2018; Papalia & Martorell, 2021). This period is not merely an extension of childhood but a critical developmental window in which curiosity gradually evolves from general inquisitiveness and playful exploration into more structured academic and career-related inquiry. Developmental theory suggests that students during this stage begin to move from concrete operational thinking toward more advanced reasoning abilities that support systematic information seeking, reflection, and goal-oriented exploration (Berk, 2018; Piaget, 1972). While curiosity and career guidance are often studied during adolescence or higher education, limited research investigates the mediating role of research skills in the relationship between early vocational curiosity and EPW in elementary school contexts. In rapidly evolving, technology-driven societies, preparing children early for career development is increasingly important. Studies indicate that metacognition and self-regulation, activated through curiosity, support inquiry-based learning and engagement (Abdelghani et

al., 2024). Understanding this developmental transition is particularly important for several reasons. First, the cognitive changes occurring during late childhood and early adolescence allow students to transform natural curiosity into more systematic research behaviors and information-seeking strategies (Schultheiss, 2008). Second, this stage represents a critical psychological preparation period for significant educational transitions, such as the move to secondary education, where students are expected to make increasingly complex academic and future-oriented decisions. Third, fostering career curiosity during this developmental phase may support early identity exploration and reduce uncertainty related to educational and career pathways, thereby contributing directly to students' emotional and psychological well-being (Savickas, 2013). Therefore, integrating career curiosity, research skills, and emotional well-being into early education is essential. This study fills a critical gap by examining how research skills mediate the relationship between career-related curiosity and EPW in elementary students. It contributes theoretically and practically to educational psychology, career education, and socio-emotional learning at the foundational developmental stage.

The Present Study and Hypotheses

This study examined the relationship between career curiosity and elementary school children's EPW, and how research skills mediate this relationship. Numerous studies indicate that curiosity indirectly affects students' mental health by enhancing skills that support learning. Research by Sağlam and Topsumer (2019), Roslan and Cho (2022), and Lydon-Staley et al. (2022) demonstrates that curiosity enhances psychological well-being and facilitates the achievement of key life events. In this study, students' career curiosity is expected to improve their mental health indirectly by fostering the acquisition of research skills. For example, Spektor-Levy et al. (2013) noted that curiosity fosters children's question-asking and scientific reasoning, which contribute to the development of research skills. Similarly, Wagner (2020) and Eising and Philbin (2022) showed how curiosity improves academic research competencies. The findings indicate that career curiosity enhances research skills, positively impacting emotional and psychological well-being. EPW promotes life, pleasure, positivity, and meaning (Ryff, 1989; Seligman, 2012). Fredrickson and Branigan (2005) found that pleasant feelings increase consciousness and improve emotional well-being. Therefore, cultivating research skills is essential for elementary school students, as it promotes active engagement in learning and enhances their capacity to manage intricate emotional and social contexts. These skills enable students to interact with their environment, promoting autonomy and self-efficacy, which are essential for emotional and psychological well-being. Developing research skills can enhance coping mechanisms, allowing students to manage academic pressures and personal challenges more effectively, promoting a healthier emotional state. This supports the idea that research skills mediate the positive effects of career curiosity on mental health. Schultheiss (2008) and Schultheiss, Palma, and Manzi (2005) further note that curiosity helps children develop career awareness and that research promotes self-discovery and environmental understanding. The results suggest that research skills serve as a mechanism that transmits the effects of job curiosity to children's emotional and psychological outcomes. Based on the literature, the following hypotheses were tested.

H_1. A significant relationship exists between career curiosity, research skills, and emotional and psychological well-being.

H_2. Research skills play a mediating role in the relationship between career curiosity and emotional and psychological well-being.

METHOD

Research Design

This study was conducted using a quantitative correlational research design to examine the relationships between career-related curiosity, research skills, and emotional-psychological well-being among elementary school students. Correlational research designs are widely used to investigate the direction and strength of relationships between variables without manipulating them (Creswell & Creswell, 2018). Within this framework, the present study aimed to explore whether research skills function as a

mediating mechanism in the relationship between career-related curiosity and emotional-psychological well-being. To test the proposed mediation model, structural equation modeling (SEM) was employed as the primary statistical analysis technique. SEM enables researchers to simultaneously examine complex relationships between latent and observed variables and to evaluate both direct and indirect effects within a single model (Kline, 2011; Byrne, 2016). In the proposed model, career-related curiosity was treated as the independent variable, emotional-psychological well-being as the dependent variable, and research skills as the mediating variable.

Participants

The study was conducted in the Arnavutköy district of Istanbul, Türkiye. A convenience sampling method was employed, and schools that were accessible to the researchers were included in the study. This district was selected because it represents the socioeconomic and demographic characteristics commonly observed in large metropolitan educational contexts in Türkiye, making it suitable for examining psychological and educational variables among school-aged students. The selected schools were accessible and reflected the urban socioeconomic characteristics of the region. The final sample consisted of 286 students aged between 9 and 14 years. More than half of the participants (58.7%) were female, while 41.3% were male. The highest participation was observed among 7th-grade students. Detailed demographic information regarding participants' gender, grade level, and age distribution is presented in Table 1.

Table 1. Demographic characteristics of participants.

Variable	Category	Number	Percentage (%)
Gender	Female	168	58.7
	Male	118	41.3
Grade	4th grade	61	21.3
	5th grade	51	17.8
	6th grade	37	12.9
	7th grade	104	36.4
	8th grade	33	11.5
Age	9 years	31	10.8
	10 years	56	19.6
	11 years	39	13.6
	12 years	88	30.8
	13 years	37	12.9
	14 years	35	12.2

According to developmental psychology classifications (Berk, 2018; Papalia & Martorell, 2021), the participants fall within the middle childhood (ages 6–11) and early adolescence (ages 12–14) developmental periods. This classification served as the developmental framework for the present study.

Data Collection Tools

Four tools were used to collect data: the Personal Information Form, the Stirling Emotional-Psychological Well-being Scale for Children (SCWBS), the Self-Directed Learning Implementation Skills Scale for Elementary School Students, and the Career Development Scale for Children.

Personal Information Form: This form, developed by the researchers, contains questions about students' demographic information, including gender, grade level, and age.

Stirling Emotional and Psychological Well-being Scale for Children: This scale, developed by Liddle and Carter (2015), assesses children's emotional and psychological well-being levels. The scale was adapted into Turkish by Akın et al. (2016). It consists of 12 items rated on a five-point Likert scale (1 = Never, 2 = Not much of the time, 3 = Some of the time, 4 = Quite a lot of the time, 5 = All of the time). There are no reverse-coded items in the scale, and higher scores indicate higher levels of emotional and psychological well-being. The Turkish adaptation study reported satisfactory psychometric properties, with item–total correlations ranging between .57 and .73 and a Cronbach's

alpha reliability coefficient of .90 (Akın et al., 2016). In the present study, internal consistency reliability was assessed using Cronbach's α and McDonald's ω coefficients. Before testing the structural model, the measurement model was examined through confirmatory factor analysis (CFA), and the fit indices indicated acceptable model fit (CFI = .936, TLI = .901, SRMR = .061, RMSEA = .075).

The Self-Directed Learning Implementation Skills Scale for Elementary School Student: This scale was developed by Gündüz and Selvi (2016) to assess elementary school students' self-directed learning skills. The theoretical basis of the scale is the Self-Directed Learning (SDL) theory (Knowles, 1975; Guglielmino, 1978), which emphasizes learners' autonomy, responsibility, and ability to plan, implement, and evaluate their learning processes. The scale consists of five sub-dimensions: research skills, thinking skills, strategy use skills, evaluation skills, and peer collaborative learning. The scale consists of 45 items and employs a five-point Likert scale (1 - Not suitable for me, 2 - Minimal ideal for me, 3 - Somewhat ideal for me, 4 - Fairly suitable for me, 5 - Completely suitable for me). As the score obtained from the scale increases, the ability to conduct self-learning also increases. In the development study of the scale, item factor load values were found to be between .41 and .74. In the confirmatory factor analysis of the scale, it was seen that the model had a good fit (x^2/df= 1.38, RMSEA= .047, SRMR= .060, RMR= .074, NFI= .92, NNFI= .97, CFI= .97, GFI= .75, AGFI= .72). The current study used Cronbach's α and McDonald's ω values to check for dependability. The Cronbach's alpha reliability coefficients for the scale were found to be .90 for research skills, .86 for thinking skills, .79 for strategy use skills, .81 for evaluation skills, and .73 for collaborative learning skills with peers. Before proceeding to the SEM, the measurement model was examined using confirmatory factor analysis (CFA), and the fit indices were acceptable [CFI = .927, TLI = .916, SRMR = .046, RMSEA = .0526].

The Childhood Career Development Scale: This scale was developed by Schultheiss and Stead (2004) to assess children's career development levels. Bacanlı et al. (2007) adapted the scale into Turkish, and written permission to use this adaptation in the present study was obtained from the authors. The scale was developed according to Super's (1990) career development model, originally designed for children. Following the models, the scale consists of eight sub-dimensions: curiosity, interest, information, locus of control, key figures, time perspective, planning, and self-concept, comprising a total of 52 items. The scale is a three-point Likert scale (1 - Not suitable for me, 2 - I am undecided, 3 - Suitable for me). As the score obtained from the scale increases, the level of career development also increases. In analyses to adapt the scale to Turkish, the Cronbach's alpha coefficient for the overall scale was .78. To assess scale reliability, the scale was administered to students twice, with an interval of 21 days, to estimate the test-retest stability coefficient. In the Turkish adaptation study (Bacanlı et al., 2007), the stability coefficients were reported as: information sub-dimension (r=.51), curiosity sub-dimension (r=.54), interests sub-dimension (r=.57), locus of control sub-dimension (r=.53), key figures sub-dimension (r=.49), time perspective sub-dimension (r=.51), planning sub-dimension (r=.55), self-concept sub-dimension (r=.57), and the whole scale (r=.71). In the present study, reliability analysis for the curiosity subscale yielded Cronbach's α = .64 and McDonald's ω = .66, which are considered acceptable for research purposes (Taber, 2018). Before proceeding to the SEM, the measurement model was examined through confirmatory factor analysis (CFA), and the fit indices were found to be at acceptable levels [CFI = .983, TLI = .996, SRMR = .066, RMSEA = .0778].

Data Collection and Analysis

Data were collected during the 2024–2025 academic year from students attending public schools in the Arnavutköy district of Istanbul. After obtaining the necessary permissions from school administrations and educational authorities, the data collection instruments were administered to students in classroom settings under the supervision of the researchers and school counselors. Participation was voluntary, and students were informed about the purpose of the study before completing the questionnaires. The completion of the survey instruments took approximately 15–20 minutes. Before conducting the structural equation modeling analysis, key statistical assumptions were evaluated to ensure the suitability of the data for multivariate analysis. These procedures included the examination of missing values, identification of outliers, and assessment of the normality of the data distribution. Prior to the

main analyses, the dataset was screened for missing values, outliers, and assumptions of normality. Multivariate outliers were assessed using Mahalanobis distance, and outliers were identified based on the chi-square threshold ($p < .001$, df = number of variables). Accordingly, 25 cases were removed from the dataset. Skewness and kurtosis values ranged between −1 and +1, indicating that the data approximated a normal distribution (Morgan, 2004). Subsequently, descriptive statistics and Pearson correlation analyses were first conducted to examine relationships among the variables. Subsequently, structural equation modeling (SEM) was employed to test the proposed mediation model. The analyses were conducted using SPSS 25.0 for descriptive and correlation analyses and AMOS 20.0 for structural equation modeling. Model fit was evaluated using commonly recommended goodness-of-fit indices, including CFI, TLI, SRMR, and RMSEA. In addition, bootstrap analyses with 5000 resamples were conducted to estimate the indirect effects and their confidence intervals (Preacher & Hayes, 2008).

FINDINGS

The descriptive statistical values of curiosity, research skills, and EPW variables used in the study, along with the findings of the Pearson Correlation Analysis conducted to examine the relationship between these variables, are presented in Table 2.

Table 2. Descriptive statistics and correlations among study variables.

	1. Emotional and psychological well-being	2. Research skills	3. Curiosity	Confidence Intervals 95% CI Lower	95% CI Upper
1. Emotional and psychological well-being	1			-	-
2. Research skills	.571 **	1		.487	.644
3. Curiosity	.322 **	.509 **	1	.214	.423
Arithmetic mean	46.60	65.76	17.50	-	-
Standard deviation	6.19	8.39	2.49	-	-
Kurtosis	-.086	-.714	-.773	-	-
Skewness	-.112	.577	.180	-	-

Note. CI = confidence interval; α = Cronbach's alpha; ω = McDonald's omega. **p < .01.

When Table 2 is examined, the relationship between EPW and research skills was calculated as $r = .571$ and found to be statistically significant ($p < .01$, 95% CI [.487, .644]). According to Cohen's (1988) guidelines, this correlation represents a large effect size. The relationship between EPW and Curiosity was $r = .322$ and significant ($p < .01$, 95% CI [.214, .423]). Based on Cohen's classification, this indicates a medium effect size. Finally, the relationship between Curiosity and Research Skills was calculated as $r = .509$ and was statistically significant ($p < .01$). This correlation corresponds to a large effect size according to Cohen's (1988) criteria. When the arithmetic variables of EPW ($M = 46.60$, $SD = 6.19$), research skills ($M = 65.76$, $SD = 8.39$), and curiosity ($M = 17.50$, $SD = 2.49$) are examined, it is found that the participants generally had values above the average. Based on these findings, H1, which states that there is a significant relationship between career curiosity, research skills, and emotional–psychological well-being, was supported.

Network analysis was conducted to depict the correlational relationship between elementary school students' curiosity, research skills, and EPW levels, as shown in Figure 1.

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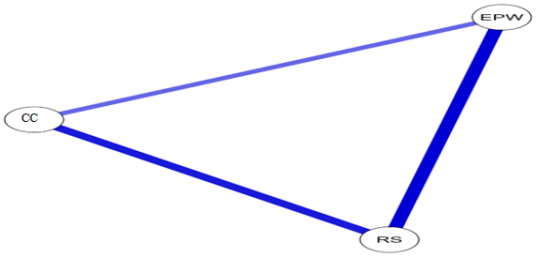

Figure 1. Network analysis. Blue lines represent positive correlations.
Note. CC = Curiosity, RS= Research Skills, EPW = Emotional and Psychological Well-Being.

This network analysis illustrates the relationships between Curiosity, Research Skills, and Emotional-Psychological Well-being. The thickness of the blue lines, representing positive correlations, indicates the strength of the relationship between the variables. The strongest link was between Research Skills and Emotional-psychological well-being, indicating that individuals' research competencies are directly related to their emotional and psychological well-being. The link between Curiosity and Research Skills is also quite strong, supporting that curious individuals are more likely to develop research skills and acquire information. The relationship between curiosity and emotional-psychological well-being was weaker but still positive, suggesting that curiosity may affect psychological well-being through research skills rather than directly. This analysis suggests that research skills can influence psychological well-being, while curiosity has an indirect effect on this process.

Structural Equation Modeling Analyses

The mediating role of research skills in the relationship between career-related curiosity and psychological well-being was examined using the mediation model proposed by Baron and Kenny (1986). The tested model is presented below.

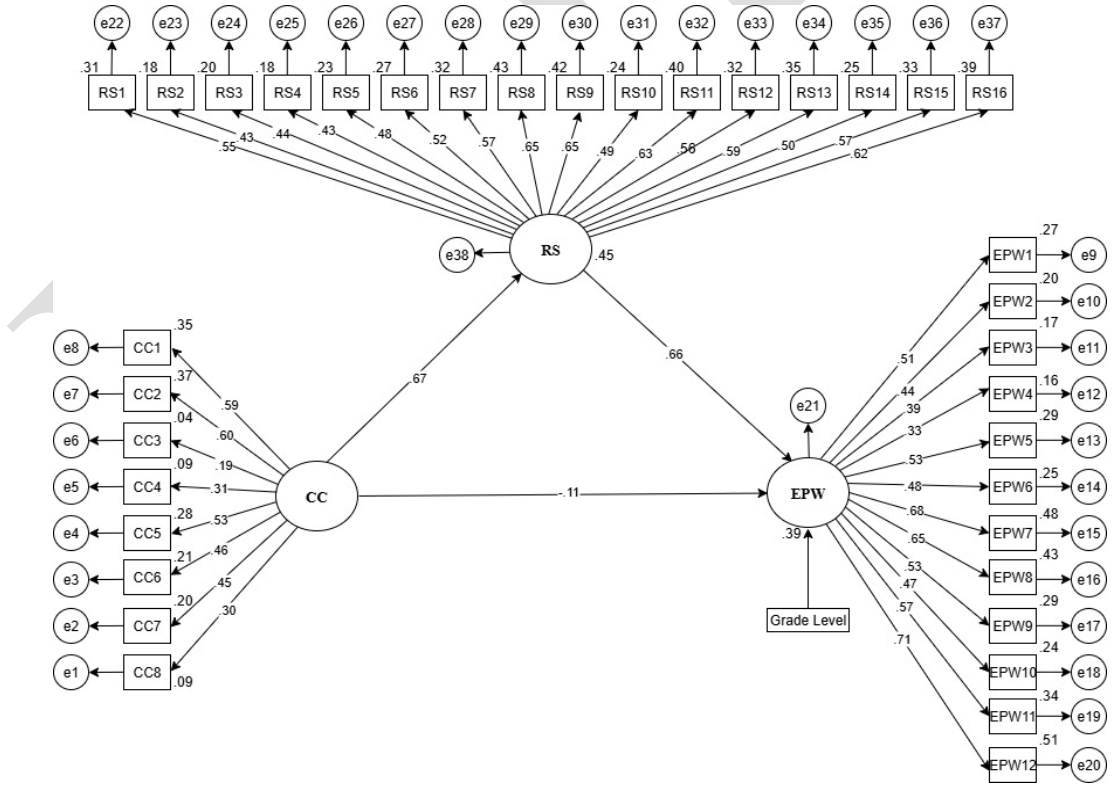

Figure 2. Model: The mediating role of research skills in the relationship between career-related curiosity and emotional and psychological well-being.
Note. CC = Career Curiosity, EPW= Emotional and Psychological Well-Being, RS= Research Skills

In the Model, it was observed that career-related curiosity significantly predicted research skills (β = .67, p < .001), and research skills significantly predicted EPW (β = .68, p < .001). Regression and bias values are given in the table below.

Table 3. Regression and bias values of the Model.

Regression Values					Standard			Bias (%95)	
				Estimate	S.E.	C.R.		Lower Limit	Upper Limit
Research Skills	<---		Career Curiosity	1.749	.454	3.853	p < .001	1.047	3.357
Emotional and psychological well-being	<---		Research Skills	.664	.128	5.179	p < .001	.447	.914
Emotional and psychological well-being	<---		Curiosity	-.187	.261	-.717	p > .05	-.811	.431
Emotional and psychological well-being	<---	Research Skills	<--- Curiosity	1.161	.005		p < .001	.634	2.286

Note. β = standardized regression coefficient; S.E. = standard error; C.R. = critical ratio; CI = confidence interval. Bootstrap estimates are based on 5000 resamples.

The structural equation modeling results reported in Table 3 revealed that career curiosity significantly predicted research skills (Estimate = 1.749, S.E. = .454, C.R. = 3.853, p < .001, 95% CI [1.047, 3.357]). In addition, research skills significantly predicted emotional and psychological well-being (Estimate = .664, S.E. = .128, C.R. = 5.179, p < .001, 95% CI [.447, .914]). However, the direct effect of career curiosity on emotional and psychological well-being was not statistically significant (Estimate = −.187, S.E. = .261, C.R. = −.717, p > .05, 95% CI [−.811, .431]). When the indirect pathway was examined, the bootstrap results indicated that the indirect effect of career curiosity on emotional and psychological well-being through research skills was statistically significant (β = 1.161, S.E. = .005, p < .001, 95% CI [.634, 2.286]). These results suggest that research skills mediate the relationship between career curiosity and emotional and psychological well-being.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

The present study investigated the mediating role of research skills in the relationship between career-related curiosity and the emotional and psychological well-being of primary school students. The results revealed that career-related curiosity did not have a significant direct effect on students' emotional and psychological well-being once research skills were included in the model. Instead, research skills fully mediated this relationship, indicating that curiosity contributes to students' well-being indirectly through the development of research-related competencies. This finding highlights an important conceptual point: while curiosity represents a valuable personal trait during childhood, its psychological benefits may emerge when it is translated into concrete competencies such as problem-solving, information literacy, and critical thinking. In other words, curiosity alone may not be sufficient to enhance emotional well-being unless it is supported by the development of research-related skills.

The results revealed that career-related curiosity alone did not have a significant direct effect on students' emotional–psychological well-being once research skills were included in the model. Instead, research skills fully mediated this relationship, meaning that curiosity contributes to students' well-being indirectly through its impact on research-related competencies. This finding clarifies an important conceptual point: while curiosity is a natural and valuable trait in childhood, it must be translated into concrete skills such as problem-solving, information literacy, and critical thinking in order to yield psychological benefits. In other words, curiosity without the development of research competencies may not be sufficient to foster emotional resilience or life satisfaction. This interpretation is consistent with previous findings, which show that curiosity plays a role in initiating exploratory behaviors but

relies on intermediary mechanisms to support well-being (Eising & Philbin, 2022; Wagner, 2020). The mediating role of research skills may also be interpreted through the lens of Self-Determination Theory (SDT), which emphasizes the fundamental psychological need for competence in promoting well-being (Deci & Ryan, 2000; Ryan & Deci, 2017). According to SDT, individuals experience higher levels of psychological well-being when they feel capable of effectively interacting with their environment and successfully mastering challenges. In the context of the present study, research skills such as problem-solving, information evaluation, and inquiry-based thinking may represent concrete expressions of competence development in children. Thus, curiosity alone may initiate exploratory tendencies, but the development of research-related competencies enables children to transform curiosity into successful learning experiences, which in turn supports emotional and psychological well-being during the transition from late childhood to early adolescence.

The strong positive relationship observed between research skills and emotional–psychological well-being reinforces the notion that cognitive and academic proficiencies contribute substantially to children's mental health. Wardani (2020) found that academic skills are important predictors of psychological well-being, while Kart and Gelbal (2014) reported that scientific research skills significantly predict individuals' self-efficacy, which in turn has been consistently associated with well-being (Çiçek & Almalı, 2020; Hampton, 2004; Kılınç, 2017). The present findings align with this line of research, indicating that the ability to ask questions, evaluate evidence, and apply knowledge helps students cope with academic and social challenges more effectively. Kaya (2017) also noted that problem-solving capability is a significant predictor of mental health, and Frisch (2000) emphasized that effective problem-solving is central to maintain high levels of subjective well-being. By linking curiosity to these skills, the current study underscores that research competencies serve as a bridge between natural exploratory tendencies and meaningful psychological outcomes.

From a theoretical perspective, these results expand upon Super's life-span, life-space career development theory (Super, 1990), which acknowledges the significance of age-related stages in vocational growth. In early and middle childhood, curiosity is considered as a critical dimension of exploration. At the same time, the development of competencies such as planning, self-concept, and career information consolidates this trait into more stable identity structures. Savickas (2002) and Savickas and Porfeli (2012) identified curiosity as one of the four core dimensions of career adaptability, alongside concern, control, and confidence. However, the current study suggests that in order for curiosity to influence well-being outcomes in childhood, it must operate in conjunction with concrete research skills. Thus, this work highlights the interplay between socio-emotional factors and cognitive-developmental competencies in shaping children's well-being.

The findings also carry practical implications for schools, guidance programs, and families. Educators should create learning environments that not only stimulate curiosity but also systematically cultivate research skills through inquiry-based projects, workshops, and problem-based learning. By embedding such approaches into curricula, schools can enhance both academic performance and socio-emotional development. Guidance services may integrate modules on emotional intelligence, stress management, and resilience training, thereby ensuring that students can translate their curiosity-driven explorations into emotional growth. Families can further support this process by encouraging children's questioning behaviors and by providing opportunities for independent research at home. Caregiver education programs may also be beneficial in equipping parents with strategies to nurture children's vocational interests alongside their emotional well-being. In an increasingly digital world, e-learning platforms and digital tools offer additional opportunities for fostering curiosity and independent inquiry. However, these must be paired with adult guidance to ensure that children's engagement is developmentally appropriate and emotionally supportive.

Although this study makes a unique contribution by focusing on the mediating role of research skills in childhood, several limitations must be acknowledged. The research was conducted with a sample drawn exclusively from primary school students in a specific district of Istanbul, which restricts the generalizability of the findings. The cross-sectional design also prevents firm conclusions about

causality, and it is possible that well-being itself may enhance curiosity or research skill development over time. Additionally, although CFA results confirmed that the measurement model demonstrated acceptable fit indices, further replication with larger and more diverse samples is recommended to consolidate the validity of the findings. Longitudinal or experimental studies would be particularly valuable in clarifying the temporal order of the observed relationships. Qualitative approaches, such as interviews or observations, may provide further insights into how children subjectively perceive the links between curiosity, research skills, and well-being in everyday educational contexts.

Conclusion

This study examined the mediating role of research skills in the relationship between career-related curiosity and the EPW of primary school students. *Results* revealed significant associations contributing to understanding early career development and its psychosocial aspects. A moderate, positive correlation between research skills and EPW suggests that fostering these skills may enhance students' mental health. This finding aligns with prior research indicating that academic competencies, such as self-directed learning, cognitive engagement, and problem-solving, improve self-efficacy and psychological well-being. Although few studies have directly examined this link, emerging evidence suggests that curiosity reduces research anxiety and encourages deeper learning. These findings underscore the interconnection between curiosity, research skills, and well-being in elementary education. Promoting inquiry-based and curiosity-driven learning can boost academic success and emotional resilience. The study emphasizes the integration of such activities into early curricula. Future research should employ longitudinal or experimental approaches to investigate how these variables interact over time and across diverse educational settings, thereby informing evidence-based educational policy and practice.

Recommendations

This study suggests that enhancing research skills and career-related curiosity, grounded in career counselling theory, can improve the emotional and psychological well-being of primary school students. Career curiosity, originally conceptualized within vocational psychology and career counselling, emphasizes children's early exploration of interests, self-concept, and future possibilities (Super, 1990; Savickas, 2005). Therefore, the findings of this study contribute not only to educational practices but also to the theoretical understanding of career development processes in childhood. The results showed that research skills fully mediated the relationship between career curiosity and well-being. This suggests that while curiosity motivates exploration, it is through research skills that children can transform this motivation into meaningful learning and psychological benefits. Accordingly, the practical recommendations presented here are directly linked to the study's empirical findings. For educators, introducing age-appropriate career education early can foster curiosity and promote self-discovery. Developing research skills through workshops, project-based learning, and inquiry-based curricula is consistent with the observed mediation effect, as these methods strengthen the skills that connect curiosity to well-being. For policymakers, designing curricula that integrate socio-emotional learning with career exploration will ensure that the structural links demonstrated in the model are addressed in practice. Families also play a vital role; caregiver education can reinforce children's curiosity and support their research practices at home, enhancing well-being. Finally, digital tools and supportive school climates can extend these opportunities, further validating the mediating process revealed by the study. Future research should adopt longitudinal and cross-cultural designs to investigate how career curiosity influences well-being across diverse educational settings when combined with research skills. Including additional variables such as academic motivation and cognitive engagement may deepen the model's explanatory power, addressing both the career counselling framework and the broader educational context. In addition, future studies should focus on developing more robust and developmentally appropriate measurement instruments for assessing career curiosity in children. Considering that the internal consistency of the scale used in the present study was relatively modest ($\alpha = .64$), improved measurement tools may provide more reliable assessments of curiosity-related constructs in early educational contexts.

Limitations of the Research

Several limitations should be considered when interpreting the findings of this study. First, the cross-sectional design limits causal inferences regarding the relationships among career-related curiosity, research skills, and emotional and psychological well-being. Second, all data were collected through self-report measures completed by primary school students, which may have introduced response biases such as social desirability and inaccuracies related to children's developmental characteristics. Third, the study was conducted within a specific cultural and educational context, limiting the generalizability of the findings to different populations and settings. Finally, although research skills were identified as a significant mediator, other potentially influential variables, such as academic motivation, self-efficacy, family support, and school climate, were not included in the model. Future longitudinal, experimental, and cross-cultural studies are needed to validate and extend the present findings.

Funding

No funding was received from any individual or institution for this research.

Ethics and Conflict of Interest

This study was conducted in accordance with the principles of ethical research and the Declaration of Helsinki. Ethical approval was obtained from the İstanbul Sabahattin Zaim Üniversitesi Ethics Committee (Approval Date: 28/07/2023, Decision No: 2023/07). In addition, the necessary permissions to conduct the study in schools were obtained from the relevant educational authorities affiliated with the Ministry of National Education. Since all participants were under the age of 16, written informed consent was obtained from their parents or legal guardians, and voluntary assent was obtained from the students themselves. Participants were informed about the purpose of the study and their right to withdraw from the study at any time without penalty. All collected data were kept confidential, anonymized during analysis, and used solely for scientific research purposes in accordance with data protection and privacy regulations. The authors declare that they have no conflicts of interest.

Author Contribution

All authors contributed equally to the conception and design of the study, data collection, data analysis and interpretation, manuscript writing, and revision processes. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data Availability

The data that support the findings of this study are available on request from the corresponding author.

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CHALLENGES FACED BY CHILDREN WITH AUTISM SPECTRUM DISORDER IN PARTICIPATING IN PHYSICAL ACTIVITIES

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Abstract

Children diagnosed with Autism Spectrum Disorder (ASD) encounter numerous individual, environmental, and social challenges in participating in physical activities. Despite the developmental benefits of physical activity, such as improvements in motor skills, social interaction, sensory regulation, and emotional balance children with ASD often experience limited participation. This limitation not only affects their development but also impacts their families quality of life of. The purpose of this study is to explore the barriers faced by children with ASD in engaging in physical activities, as perceived by parents and professionals working who closely with them. This research employed a qualitative design. Participants included teachers, parents, speech therapists, physiotherapists, and occupational therapists who provide care or educational services to children with ASD. Data were gathered through semi-structured interviews and analyzed using content analysis techniques. Analysis of the data revealed four main themes: individual behavioral characteristics, intensity of environmental stimuli, socio-emotional challenges, and educational/structural deficiencies. Participants emphasized that these factors significantly hinder active participation in physical activities. Additionally, there was a strong consensus on the necessity for individually tailored environments and professional support in physical activity programs. The study concludes that improving physical activity participation among children with ASD requires the implementation of structured, individualized programs that are professionally supported and carefully balanced in terms of environmental stimuli.

Keywords: Autism spectrum disorder, physical activity, participation barriers, environmental factors, social factors.

INTRODUCTION

The participation in physical activities is a crucial factor supporting the social, emotional, and motor development of children diagnosed with Autism Spectrum Disorder (ASD). However, the challenges encountered in this process are considerable. ASD is a neurodevelopmental disorder that typically emerges before the age of three and persists throughout life. It is characterized by difficulties in social communication and interaction, along with repetitive, restricted, and stereotyped behaviors, activities, and interests (Boyd & Shaw, 2010). Motor skill impairments, in combination with low physical fitness levels and developmental delays, substantially limit the ability of individuals with ASD to

engage in physical activities (Rinehart et al., 2001). Moreover, the social and behavioral difficulties associated with ASD further hinder participation in such activities, often leading to sedentary lifestyles (Pan, 2009). This restriction is also reflected in findings that children with ASD are less likely to participate in physical activities compared to their typically developing peers (McCoy et al., 2016).

Both individual and environmental factors are influential in limiting participation in physical activities. For example, lack of motivation for physical activity (Stanish et al., 2015), low motor skill competence (Loprinzi et al., 2015), and not enjoying physical activity negatively affect the participation of individuals with ASD (Eversole et al., 2016). Similarly, limited access to physical activity resources, lack of parental encouragement, and the absence of trained instructors for organized activities are also among the important barriers (Must et al., 2015; Gregor et al., 2018). Features such as delays in motor development and sensory sensitivities further increase the difficulties in participation (Nichols et al., 2019; Scharoun et al., 2017).

Physical activity programs offer various benefits for children with ASD. Research has shown that these programs reduce stereotypical and self-stimulatory behaviors, improve social skills, and enhance physical functioning and cognitive performance (Lytle & Todd, 2009; Suárez-Manzano, 2024). Especially activities that support social interactions may increase time-on-task and enhance the effectiveness of inclusive environments (Shahane et al., 2024). However, despite the positive effects of physical activity, the activity levels of children with ASD are generally low, and the increased time spent on screens exacerbates this problem (Must et al., 2015).

Evaluating barriers to physical activity requires a multifaceted process. According to the socio-ecological model, the analysis should extend from child-level behavioral problems to factors at the family, community, and public policy levels (Must et al., 2015). Such an evaluation may help develop comprehensive strategies to increase the participation of individuals with ASD in physical activity. Therefore, obtaining the views of parents and teachers is of great importance in understanding the barriers to participation in physical activity more comprehensively and identifying possible solutions. The role of parents is vital in increasing their children's participation in physical activity (Arnell et al., 2020). Social barriers such as lack of parental support or the absence of partners in organized activities make it even more difficult for these individuals to engage in leisure activities (Nichols et al., 2019). The perspectives of parents who play a critical role in the daily lives and physical activity participation of children with ASD and teachers who provide education to these children are considered important in identifying barriers and developing effective strategies. In this context, the purpose of this study is to examine the challenges faced by children with ASD in participating in physical activities from the perspectives of parents and teachers.

METHOD

Research Design

To investigate the challenges faced by children with autism spectrum disorder (ASD) in participating in physical activities, a qualitative research method was employed. Qualitative research involves the use of data collection techniques such as observation, interviews, and document analysis to explore perspectives, perceptions, and events in a realistic and holistic manner within their natural contexts (Mertens, 2014; Yıldırım & Şimşek, 2018). The research design adopted in this study was a phenomenological approach. Phenomenology is a qualitative research approach that aims to describe how individuals perceive and interpret a phenomenon, event, or situation about which knowledge is limited (Smith & Fowler, 2009; Creswell et al., 2013; Chigbu, 2019). In this study, the phenomenological design was utilized to understand and explain the challenges experienced by children with ASD in participating in physical activities, as interpreted through the perspectives, experiences, and perceptions of their parents and teachers.

Participants

Participants were selected through criterion sampling, one of the purposeful sampling strategies. Criterion sampling involves including all cases that meet specific, predetermined conditions, thereby ensuring access to the most relevant data sources for the purpose of the research (Patton, 2014). Within this framework, the study aimed to collect data from parents of children with ASD and professionals responsible for their education and care, to evaluate the challenges these children face in participating in physical activities. The children of the families participating in the study are preschool and primary school students. The inclusion criteria were defined as follows: for parents, having a child diagnosed with ASD who was receiving rehabilitation services; and for professionals, working in a rehabilitation setting and having experience with children with ASD. Following the necessary approvals obtained from a private rehabilitation center in Kırşehir, both parents of children with ASD and field experts were informed about the research. Written informed consent was collected from all participants prior to data collection. Information regarding the participating parents is presented in Table 1, and details concerning the professionals are provided in Table 2.

Table 1. Demographic information of parents.

Participant Code	Gender	Age	Education Level	Occupation
P1	Female	28	Secondary School	Unemployed
P2	Female	30	Secondary School	Unemployed
P3	Erkek	42	University	Teacher
P4	Female	32	High School	Unemployed
P5	Female	29	High School	Unemployed
P6	Female	38	University	Officer
P7	Female	41	High School	Unemployed
P8	Female	33	High School	Unemployed
P9	Female	26	High School	Unemployed
P10	Female	35	Secondary School	Unemployed
P11	Female	36	High School	Cook
P12	Female	38	Secondary School	Unemployed
P13	Female	28	High School	Unemployed
P14	Female	31	High School	Worker
P15	Female	27	University	Unemployed
P16	Female	32	High School	Unemployed

The majority of the participants were mothers in their young to middle adulthood. Most had completed secondary or high school education. A large proportion of them were not employed, while those who were working were engaged in various professions.

Table 2. Demographic information of field experts.

Participant Code	Gender	Age	Field / Profession
T1	Male	28	Preschool Teacher
T2	Male	25	Guidance Counselor
T3	Female	31	Classroom Teacher
T4	Female	30	Classroom Teacher
T5	Female	35	Preschool Teacher
T6	Female	28	Classroom Teacher
T7	Female	37	Preschool Teacher
OT1	Male	29	Occupational Therapist
OT2	Female	25	Occupational Therapist
PT1	Female	29	Physiotherapist
SLT1	Female	26	Speech and Language Therapist
SLT2	Female	33	Speech and Language Therapist

The field experts consisted of participants from various disciplines, including preschool, classroom, and guidance teachers, as well as occupational therapists, physiotherapists, and speech and language therapists. The majority of the participants were women and within the young adult age range.

Within the research process, preliminary individual interviews were conducted with parents and experts who agreed to participate in the study. An interview schedule was prepared to ensure that the interviews were carried out in a planned and systematic manner. Schedules were structured independently for each participant group to accommodate their unique requirements and availability. Interviews with parents were scheduled in accordance with their daily routines and comfort. Accordingly, the interviews were held at times when parents brought their children to the rehabilitation center for special education sessions, ensuring that the children were in a safe environment. This approach was adopted to facilitate parents' participation in the interviews and to encourage their meaningful contribution to the research process. The interview schedule for parents is presented in Table 3. To ensure the protection of personal data, the parents' names were anonymized and replaced with code identifiers.

Table 3. Parent interview schedule.

Participant	Date	Day	Time	Interview Duration
P1	January 28, 2025	Tuesday	15:00	20 minutes
P2	January 28, 2025	Tuesday	16:00	30 minutes
P3	January 29, 2025	Wednesday	15:00	20 minutes
P4	January 29, 2025	Wednesday	17:00	25 minutes
P5	January 30, 2025	Thursday	12:00	25 minutes
P6	January 30, 2025	Thursday	14:00	25 minutes
P7	January 30, 2025	Thursday	17:00	20 minutes
P8	January 31, 2025	Friday	11:00	25 minutes
P9	February 6, 2025	Thursday	16:00	30 minutes
P10	February 12, 2025	Wednesday	16:00	25 minutes
P11	February 20, 2025	Thursday	17:00	30 minutes
P12	February 21, 2025	Friday	12:00	25 minutes
P13	February 21, 2025	Friday	14:00	30 minutes
P14	February 22, 2025	Saturday	11:00	20 minutes
P15	February 22, 2025	Saturday	12:00	25 minutes
P16	February 27, 2025	Thursday	12:00	25 minutes

The interviews with parents were conducted over a specific period, scheduled on different days and times during both weekdays and weekends. The duration of the interviews was generally similar across participants, and the sessions were flexibly organized according to their availability. In the study, interviews with experts were arranged based on their available times during working hours. The interviews were scheduled for the time slots previously identified by the experts as free according to their teaching schedules. Accordingly, the workload and time management constraints of the experts were carefully considered, thereby ensuring that the interviews were conducted in an effective and efficient manner.

The interview schedule for the experts is presented in Table 4. To ensure the protection of personal data, the experts' names were anonymized and replaced with code identifiers.

Table 4. Interview schedule with experts.

Participant	Date	Day	Time	Interview Duration
T1	January 28, 2025	Tuesday	12:00	35 minutes
T2	January 29, 2025	Wednesday	11:00	20 minutes
T3	January 31, 2025	Friday	12:00	30 minutes
T4	February 1, 2025	Saturday	13:00	30 minutes
T5	February 7, 2025	Friday	14:00	25 minutes
T6	February 8, 2025	Saturday	15:00	20 minutes
T7	February 11, 2025	Tuesday	12:00	25 minutes
OT1	February 13, 2025	Thursday	12:00	30 minutes
OT2	February 13, 2025	Thursday	13:00	30 minutes
PT1	February 15, 2025	Saturday	12:00	20 minutes
SLT1	February 18, 2025	Tuesday	12:00	25 minutes
SLT2	February 18, 2025	Tuesday	13:00	25 minutes

The interviews conducted with expert participants were scheduled within a specific timeline, covering both weekdays and weekends. The sessions were organized at different days and times, taking into account each participant's individual availability, and the duration of the interviews was generally consistent across participants

Setting

During the research process, interviews with parents and experts were conducted in a meeting room of a rehabilitation center in Kırşehir that provides special education services. The physical features of this room met specific standards to ensure that the interview process could be carried out efficiently. The interview room covered an area of approximately 16 square meters and had a rectangular layout. It was designed to receive natural light through a large window overlooking the institution's garden. This bright environment allowed participants to feel more comfortable and at ease during the interviews. In addition, the room's furniture was arranged to ensure participants' comfort. The layout included single and double armchairs, a table, chairs, and a bookshelf, creating a warm, organized, and inviting atmosphere conducive to effective communication and meaningful interaction throughout the interviews.

Data Collection Tools

This study aimed to examine the challenges faced by children diagnosed with ASD in participating in physical activities. In this context, semi-structured interview questions were developed to be used in interviews with parents and teachers. The interview questions were carefully prepared based on the purpose of the research and the relevant literature. The prepared interview form addressed key issues such as the difficulties experienced by children with ASD in participating in physical activities, the reasons underlying these difficulties, and the effects of physical activities on their development. Accordingly, the questions were designed to allow participants to reflect their experiences in detail. The initial draft of the interview form was evaluated by four academic experts in the field, and necessary revisions were made based on the feedback received. In light of the experts' opinions, the final set of questions was determined, and the form was reviewed for content and structural appropriateness. Following the feedback process, the interview form was finalized to include four main questions, each designed to serve the purpose of the study and to explore participants' experiences and observations in depth. Within the scope of the research, the questions to be addressed during the interviews with parents and teachers were determined as follows:

What are the biggest challenges you face regarding your child's/student's participation in physical activities?

What do you think about the influence of the environment (e.g., playgrounds, sports facilities) on your child's/student's participation in physical activities?

Do you think there are physical, social, or emotional factors preventing your child/student from participating in physical activities? Please explain.

What types of resources or training do you think are needed for your child/student to become more active in physical activities?

The interviews were both audio- and video-recorded to ensure the accurate documentation of participants' responses. These recordings allowed the interview process to be properly archived and enabled meticulous analysis of the conversations. Additionally, the use of both audio and video recordings provided researchers with the opportunity to revisit observations made during the interviews, thereby enhancing the accuracy and reliability of the data. During this process, participants' consent was obtained prior to recording, and their privacy and confidentiality were strictly protected. To support the qualitative data collection process, a researcher's reflective journal was also utilized. The journal systematically documented observations, experiences, notable events, and personal reflections related to the research process (Mills, 2007). It included pre- and post-interview impressions, the physical and emotional conditions of the interview setting, participants' reactions and body language, noteworthy situations that emerged during the interviews,

and the researcher's self-awareness regarding their role in the process. This reflective practice contributed to maintaining transparency, reflexivity, and depth in the qualitative inquiry.

Data Collection Process

In this study, the challenges experienced by children with ASD in participating in physical activities were examined through data collected from interviews conducted with parents and experts. The interviews were semi-structured in format and lasted between 20 and 35 minutes. The data collection process was designed in accordance with the aim of the research and carried out following established ethical principles. The participants consisted of parents and educators of children with ASD who were receiving education at rehabilitation centers. The selection of these participants was based on their direct experience and relevance to the research questions. Participation in the interviews was entirely voluntary, and each participant was provided with an informed consent form to ensure their explicit approval to take part in the study. Additionally, the researcher kept a reflective journal to record both personal experiences during the data collection process and immediate observations regarding participants' reactions. This journal served as an important tool for documenting the research process and ensuring reflexivity and transparency in qualitative inquiry.

Credibility and Trustworthiness of the Study

The credibility of this research was strengthened through various methods and procedures implemented throughout the study. The reliability and validity of the research were ensured by employing multiple strategies such as triangulation of data sources, use of multiple researchers, expert review, participant confirmation, and inter-researcher consistency in data analysis (Creswell, 1998). Ethical principles and the control of researcher bias were also taken into consideration. The study was conducted with parents and teachers of children with autism who were receiving education in rehabilitation centers. Participant selection was carried out carefully to ensure the accuracy and validity of the research topic. Parents and teachers were considered appropriate participants since they possessed firsthand knowledge of the children's physical activities and the challenges encountered during these activities. Including participants directly related to the research topic was regarded as essential for ensuring content validity. The research was based on the principle of data triangulation. Data were collected from different stakeholders, including parents and teachers of children with ASD enrolled in rehabilitation centers. This approach enhanced the external validity of the study and provided a more comprehensive understanding of the phenomenon from multiple perspectives. Moreover, the study was conducted by a team of three researchers, incorporating the principle of investigator triangulation. Collaboration among researchers ensured that different aspects of the data collection process were meticulously managed and contributed to maintaining researcher neutrality. Each researcher took responsibility at different stages, enabling the study to progress in a coherent and reliable manner. To ensure validity, peer debriefing and expert consultation were employed. The interview questions were initially drafted by one researcher and subsequently reviewed by two others.

The questions were subsequently submitted to field experts, and necessary revisions were carried out in line with their feedback. Obtaining expert opinions was a crucial step in ensuring content validity and the alignment of questions with the research objectives. This process strengthened the scientific validity of the research questions and facilitated the collection of accurate and reliable data.

Researcher bias was carefully monitored throughout the study. During data analysis, continuous communication and discussion were maintained among the researchers to minimize the impact of bias. The use of double coding where each piece of data was independently analyzed by two researchers helped ensure internal consistency. Discrepancies in coding were discussed and resolved through consensus, and a common coding scheme was established. This approach minimized the influence of personal interpretations and biases on the analysis process.

Participants' perspectives were accurately and ethically represented in the study. The member checking process was conducted in accordance with ethical research principles. Preliminary meetings were held with the parents and teachers participating in the study, during which the research purpose was explained in detail and informed consent forms were obtained. Participants were assured that

their statements would remain confidential and used solely for research purposes. In addition, the interview transcripts could be shared with participants for feedback to ensure accuracy of representation. However, the text does not indicate that the draft report was shared with participants, which remains a limitation. Nevertheless, attention was given to protecting participants' rights and ensuring that their views were represented accurately.

To enhance the validity and reliability of the interviews conducted with parents of children with ASD, pilot interviews were carried out. The pilot interviews aimed to test the effectiveness of the main research questions and the interview form, assess the clarity of the questions, and observe the overall flow of the interview process. The pilot study was conducted with two parents who had similar characteristics to the target population. During these sessions, the questions were clearly communicated, and potential issues encountered during the interviews were noted. The duration of the interviews, parents' reactions, and their response patterns were also observed. Based on the feedback obtained, necessary adjustments were made to the interview questions, and the final version of the form was prepared for the main study. The pilot interviews played a crucial role in ensuring the reliability and validity of the research.

The data collection and analysis processes were described in rich and detailed narrative form. Participants' views were presented comprehensively in line with the research context, enabling readers to gain a clear understanding of the research process. Transparency was maintained by providing detailed information about the findings and methods used, which strengthened the credibility of the study's results.

In this research, an external auditor, an academician specialized in special education, was assigned to oversee and evaluate the entire process. The interview sessions, which constituted one of the most critical stages of the research, were video recorded to ensure external auditing. The recordings were used to accurately document and later analyze the interviews. This method served as an important tool to enhance both the validity and reliability of the study. The external auditing process allowed the auditor to observe the research without intervention, providing an objective evaluation of the procedures. The video recordings also enabled the auditor to review each stage in detail and allowed the researchers to assess and analyze the interviews more reliably.

Data Analysis

During the qualitative research process, both audio and video recordings were collected during the interviews. The obtained data were transcribed into Word format using the Notebook LM program. After transcription, the written texts were compared with the audio recordings to verify content accuracy, and necessary corrections were made. After these procedures, the data were prepared for the coding process. The research data were analyzed through content analysis. In qualitative research, content analysis is an analytical method that enables the systematic examination of written, verbal, or visual data to transform them into meaningful themes (Yıldırım & Şimşek, 2018). This method is particularly common in studies that aim to understand individuals' experiences, attitudes, perceptions, and perspectives on social phenomena in depth (Krippendorff, 2019). Content analysis involves several stages, including dividing the data into meaningful units, coding, categorizing, and developing themes. Throughout this process, the researcher aims to reveal the underlying meanings while preserving the integrity of the data. According to Yıldırım and Şimşek (2018, p. 242), unlike descriptive analysis, content analysis includes a deeper level of interpretation and seeks to uncover the latent meanings embedded in the data. Consistent with the purpose of this study, content analysis was employed to interpret, in depth, the perspectives of participants special education teachers, speech and language therapists, occupational therapists, and physiotherapists regarding the challenges experienced by children with ASD in participating in physical activities. The interview data were transcribed and transferred into the MAXQDA 2020 software for analysis. Independent coding was conducted by the researchers, and the similarities and differences between the codes were examined collaboratively. To ensure the reliability of the data, the agreement/disagreement principle proposed by Miles and Huberman (1994) was applied. The inter-coder reliability coefficient was calculated

using the following formula: Reliability = (Agreement / (Agreement + Disagreement)) × 100 the overall reliability of the analysis was calculated as 84%. A high level of similarity was observed between the coders, while differing codes were re-evaluated and recoded through consensus. As a result of the coding process, categories and themes were derived, corresponding to the interview questions. In qualitative research, data analysis is conducted in four main stages: (1) coding the data, (2) identifying themes, (3) organizing codes and themes, and (4) defining and interpreting the findings (Yıldırım & Şimşek, 2018).

In accordance with these stages, the data were analyzed, and four overarching themes were identified: challenges in participation in physical activities and the influence of the environment on participation.

Physical, social, and emotional factors preventing participation, Resources and training required to increase active participation. Under these themes, similar data were grouped, and a meaningful structure was established among the codes, categories, and themes to comprehensively describe the findings.

RESULTS

"As a result of the analysis of the participants' responses to the questions related to physical activity, the findings were presented under four themes and supported with direct quotations. These themes are illustrated in Figure 1."

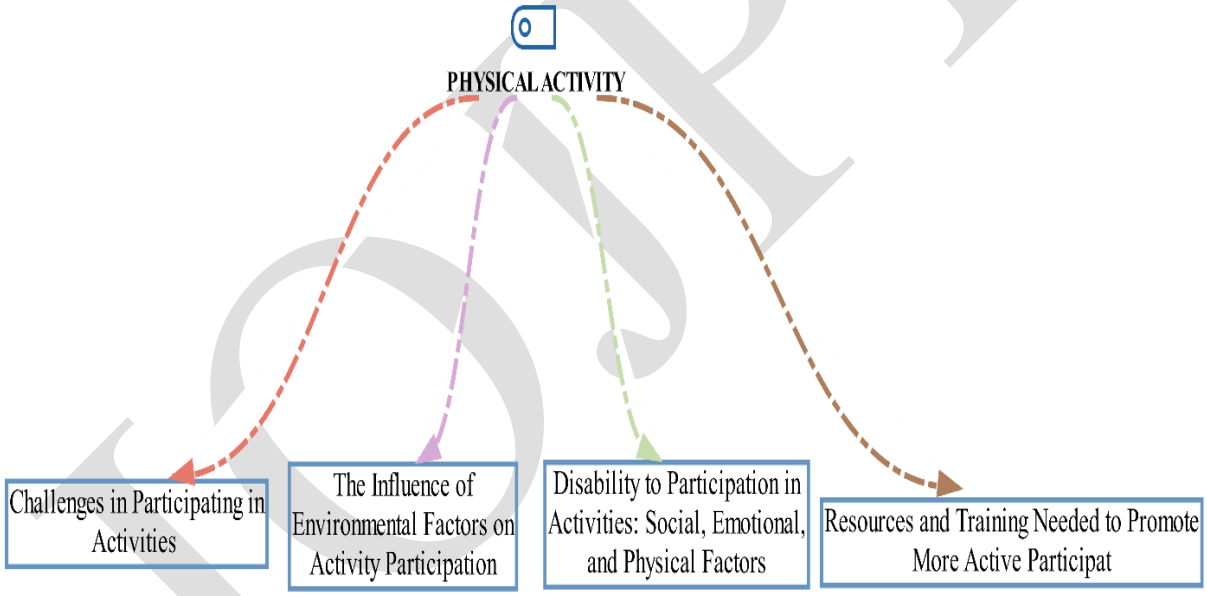

Figure 1. Hierarchical code–subcode model of the themes.

Findings on Challenges in Participation in Physical Activities

The participants were first asked: "What are the biggest challenges you face regarding your child's/student's participation in physical activities?" This question aimed to identify the difficulties encountered by participants in ensuring students' engagement in physical activities. The findings related to challenges in participation were grouped under four categories and are presented in Figure 2.

As shown in Figure 2, the theme "Challenges in participation in physical activities" consists of four categories: child-related challenges, activity-related challenges, special education-related challenges, and parent-related challenges. Participants reported that the most frequently encountered difficulties within the child-related challenges category included: displaying obsessive or repetitive behaviors (e.g., arranging objects in a specific order or reacting intensely to minor changes in daily routines) (f=14), restricted movement (f=12), hyperactivity (f=7), attention and concentration problems (f=3),

noncompliance with instructions (f=3), poor self-control (f=2), focus on a single game or toy (f=2), possessive behaviors and believing that everything belongs to them (f=1), lack of physical strength (f=1), and limited self-expression skills (f=1).

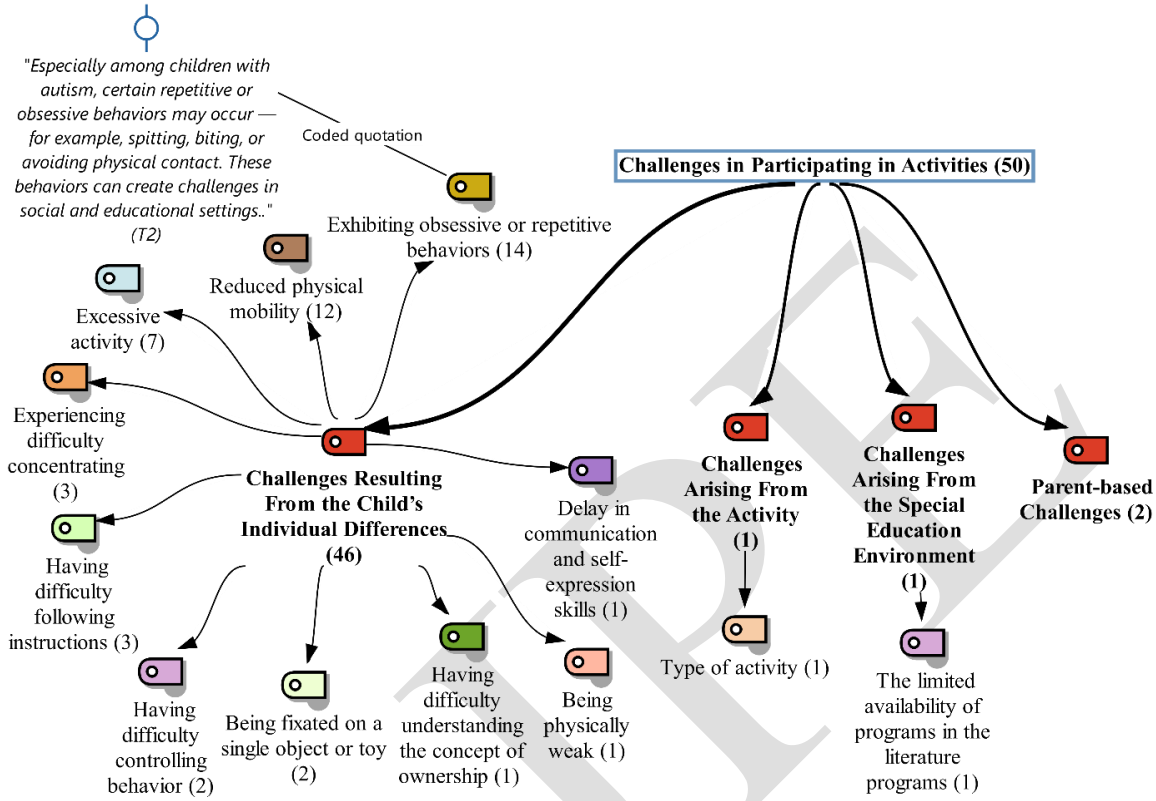

Figure 2. Hierarchical code–subcode model of the theme challenges in participation in physical activity.

A parent coded as P9 described their child's obsessive behaviors as follows: "He seems unwilling to move. When we go outside, he throws himself on the ground and refuses to get up." Similarly, a speech and language therapist (SLT1) stated: "Obsessive behaviors can significantly hinder participation in physical activities. Students who are strongly attached to certain objects or routines often experience intense anxiety when faced with environmental or procedural changes during activities." These findings indicate that obsessive and repetitive behaviors commonly observed in children with ASD act as barriers to active participation in physical activities. Within the activity-related challenges category, participants noted that the most common problem was the inappropriateness of activities for children (f=1). A parent (P1) commented: "Most physical activities are too demanding for my child, so he is often reluctant to participate and struggles to adapt to the activity." A teacher (T6) further explained: "When physical activities are not aligned with the child's interests, sensory needs, or motor skill level, it becomes difficult for them to adapt to the process. This often leads to withdrawal or lack of motivation." These results suggest that when physical activities are not tailored to individual needs, children with ASD experience adaptation difficulties and display low motivation toward participation. Under the special education-related challenges category, participants emphasized the inadequacy of existing programs (f=1). A parent (P3) expressed: "My child has been receiving special education for a long time, but I think the programs do not include enough physical activity. Although my child really needs to move, this need is not reflected in the educational plans." A teacher (T4) similarly noted: "In the special education programs we implement, content related to physical activity is quite limited. I observe that many students particularly need movement-based activities. However, since programs mainly focus on academic goals, physical and motor development often remain in the background." This finding highlights that current special

education programs insufficiently address the physical activity dimension, failing to adequately meet students' motor development needs. In the parent-related challenges category, participants pointed out issues such as parents' lack of awareness of the importance of physical activity (f=1) and limited parental support or involvement (f=1). A teacher (T1) remarked: "Parents do not consider physical activity as an academic subject, so they do not take it seriously. They often complain about their child's hyperactivity, but they make no effort to provide opportunities for physical movement." Similarly, the researcher noted in the reflective journal: "The mother explained that her child displayed problem behaviors during physical activity sessions. However, as the interview progressed, it became evident that these behaviors stemmed more from family attitudes than from autism itself." These findings reveal that parental attitudes play a decisive role in shaping children's overall developmental processes and participation behaviors in physical activities. Findings on the Influence of the Environment on Participation in Physical Activities The second question addressed to the participants was: "What do you think about the influence of the environment (e.g., playgrounds, sports facilities) on your child's/student's participation in physical activities?"

This question aimed to identify participants' views on how environmental factors affect children's participation in physical activities. The findings related to this topic were gathered under the theme "The Influence of the Environment on Participation" and organized into two categories, as illustrated in Figure 3.

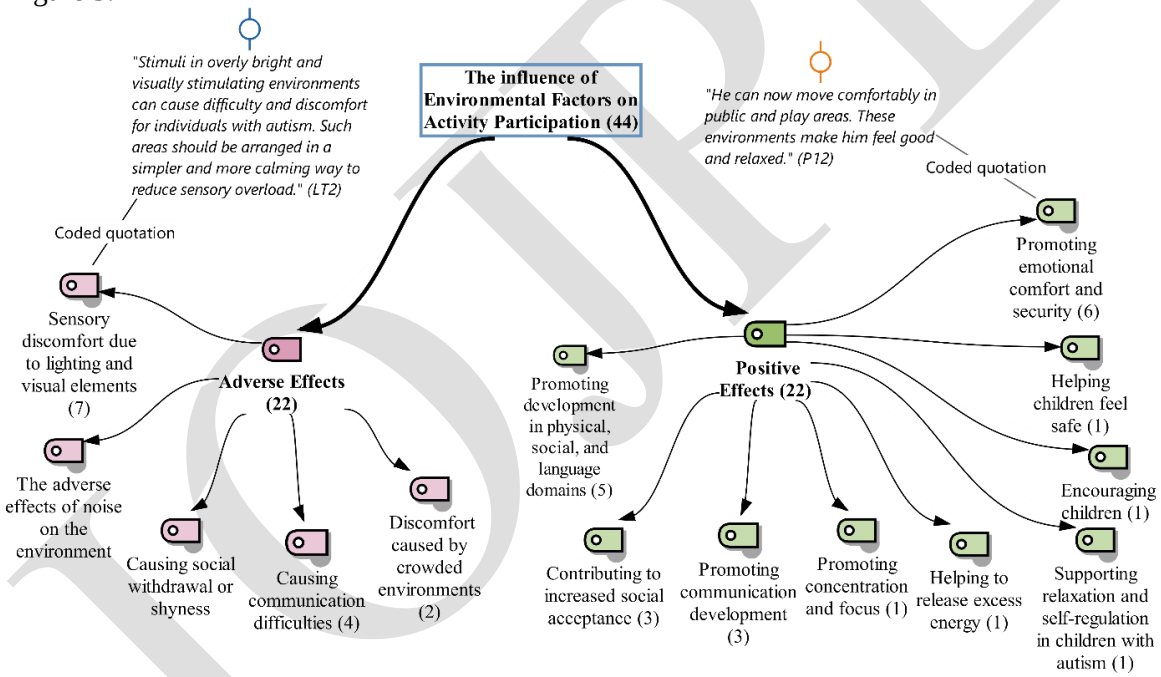

Figure 3. Hierarchical code–subcode model of the theme "Environmental factors affecting challenges in participation in physical activity"

As illustrated in Figure 3, the theme "The Influence of the Environment on Participation" was examined under two main categories: positive effects and negative effects. In the negative effects category, participants reported that excessive light and visual stimulation in the environment (f = 7), noisy surroundings (f = 5), and crowded settings (f = 2) caused discomfort in children, leading them to display withdrawn behaviors (f = 4) and experience communication difficulties (f = 4). As seen in Figure 3, the most frequently emphasized environmental barrier was the excessive presence of light and visual stimuli, which negatively affected the child's engagement in physical activity. One participant, an occupational therapist (ER1), expressed the following view regarding this issue: "Playgrounds that are overly bright and visually overwhelming can make children uncomfortable. The simultaneous presence of different lights and sounds can negatively affect their participation in physical activities." Similarly, the researcher's diary included the following observation: "During the

interview, I observed how the child's problem behaviors complicated daily life and how these behaviors became even more challenging due to environmental factors." These findings indicate that the intensity of environmental stimuli interacts with problem behaviors, creating a significant environmental barrier that hinders participation in physical activities. In the positive effects category, participants noted that the environment played a supportive role in various aspects of the child's development. They emphasized that the environment helped children feel comfortable and relaxed (f = 6), contributed to their physical, social, and language development (f = 5), facilitated social acceptance (f = 3), improved communication skills (f = 3), enhanced attention (f = 1), provided an outlet for excess energy (f = 1), promoted calmness (f = 1), increased courage (f = 1), and supported a sense of safety (f = 1). As shown in Figure 3, the most frequently mentioned positive environmental effect was the sense of comfort and relaxation that children experienced in supportive environments. For instance, a parent (P4) stated: "When my child spends time in play areas involving physical activity, I observe that he both relaxes and behaves more harmoniously; such environments really make him feel good." Similarly, a teacher (T2) explained: "Playgrounds and sports facilities help children release their energy. For example, activities such as playing in a ball pit or sliding down a slide promote physical movement and contribute to sensory integration therapy. These areas are highly beneficial for helping children expend their energy."

Overall, these findings demonstrate that physical activity environments play a positive role in children's relaxation and adaptation processes. It can be concluded that physical activity contributes to the development of behavioral regulation and sensory integration skills by helping balance children's energy levels.

Findings on Physical, Social, and Emotional Factors Preventing Participation in Physical Activities

The third question addressed to the participants was: "Do you think there are any physical, social, or emotional factors that prevent your child/student from participating in physical activities? Could you please explain?" This question aimed to identify the participants' perspectives regarding the physical, social, and emotional factors that may hinder children's participation in physical activities. The findings related to this question were organized under the theme "Physical, Social, and Emotional Factors Preventing Participation in Physical Activities" and categorized into three subcategories, as illustrated in Figure 4.

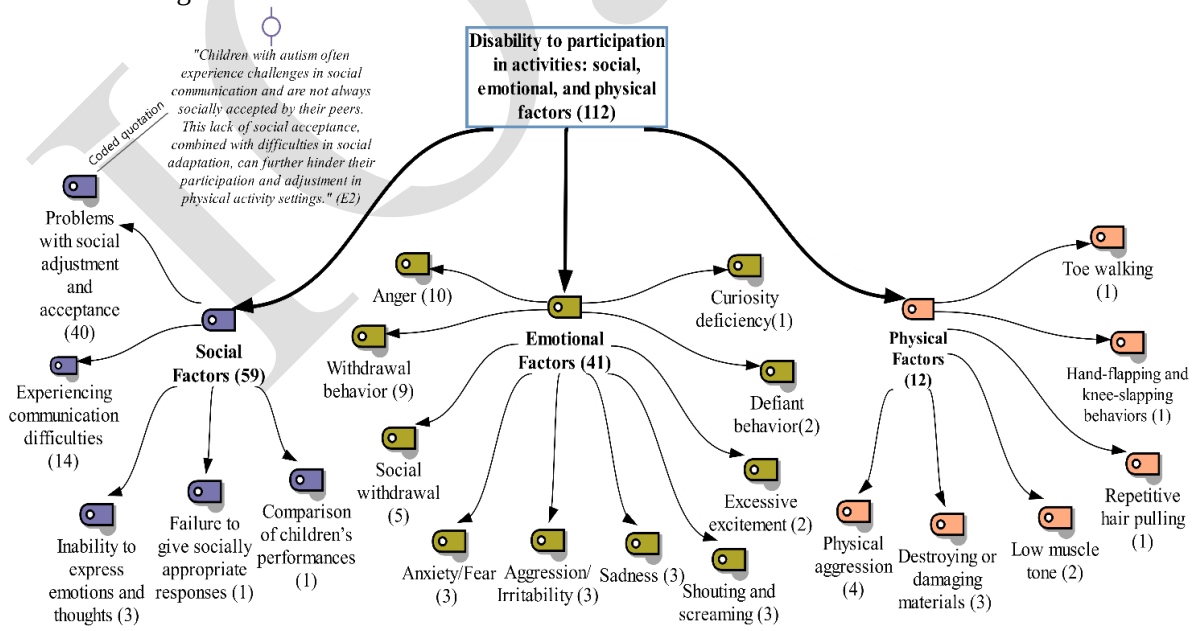

Figure 4. Hierarchical code–subcode model of the theme social, emotional, and physical factors hindering participation in physical activity.

As illustrated in Figure 4, the theme "Physical, Social, and Emotional Factors Preventing Participation in Physical Activities" consists of three categories: social factors, emotional factors, and physical factors. In the social factors category, participants most frequently mentioned social adaptation/acceptance problems (f = 40), followed by communication difficulties (f = 14), inability to express oneself (f = 3), inappropriate responses (f = 1), and comparison with other children (f = 1). As seen in Figure 4, the most emphasized social factor was difficulty with social adaptation and acceptance. One parent (P5) expressed this as follows: "When playing a game, it was sometimes difficult for him to get along with other children." In addition, the researcher's diary included the following observation: "During the interviews, I noticed that parents believed societal awareness toward children with special needs was quite low. This lack of awareness seemed to make both parents and children more withdrawn in social settings." These findings suggest that social adaptation and acceptance problems negatively affect the participation of children with special needs in physical activities. Moreover, parents' hesitancy in social contexts stemming from low societal awareness appears to limit children's opportunities to join group activities and reduces their access to physical activity experiences. In the emotional factors category, participants identified anger problems (f = 10) as the most common issue, followed by introversion (f = 9), withdrawal (f = 5), anxiety/fear (f = 3), aggression/irritability (f = 3), sadness (f = 3), shouting/screaming (f = 3), excitement (f = 2), stubbornness (f = 2), and lack of curiosity (f = 1). As shown in Figure 4, anger problems were the most frequently mentioned emotional barrier. A parent (P8) described this as follows: "Sometimes he gets angry and has difficulty expressing himself. For instance, when he can't do something, he may throw his toys or start shouting, whereas other children may try to find a solution." In the researcher's diary, this was reflected as: "According to the mothers' responses, children's emotional anxieties make it difficult for them to participate in group-based learning, which in turn negatively affects their engagement in physical activities." These findings indicate that anger and behavioral problems lead to challenges in social interaction processes, acting as a significant emotional barrier to participation in physical activities. In the physical factors category, participants most frequently mentioned hitting others (f = 4), followed by throwing or breaking objects (f = 3), muscle weakness (f = 2), hair pulling (f = 1), hand flapping or knee slapping (f = 1), and toe walking (f = 1). As illustrated in Figure 4, the most frequently emphasized physical factor was hitting others. A parent (P11) expressed this as follows: "My son struggles in social interactions; when he gets excited and cannot express himself, he sometimes shows behaviors such as hitting or biting." Similarly, a teacher (T3) stated: "Children sometimes struggle with social integration when they go to a park, school, or family gathering. Especially during physical activities, they may hit other children. The other children may react in the same way or withdraw, and in both cases, the physical activity ends."

These findings reveal that children with autism spectrum disorder (ASD) may display physical aggression as a response to intense emotions or overstimulation in social environments, which in turn hinders their healthy participation in physical activities.

Findings on Social, Emotional, and Physical Factors Preventing Participation

As shown in Figure 4, the theme of barriers to participation consisted of three categories: social, emotional, and physical factors. In the social factors category, participants most frequently reported problems of social adaptation/acceptance (f=40), followed by communication problems (f=14), inability to express oneself (f=3), inappropriate responses (f=1), and being compared with other children (f=1). As seen in Figure 4, the most emphasized social factor was social adaptation/acceptance problems. Parent P5 stated: "While playing a game, sometimes it was difficult to adapt to other children." The researcher's journal reflected: "During the interview, I realized that families believed societal awareness of children with special needs was quite low. This caused them to keep both themselves and their children in the background in social environments." These findings show that social adaptation and acceptance problems negatively affect the participation of children with special needs in physical activities. Moreover, families' shy behavior in social contexts, due to a lack of awareness, restricts children's participation in group activities and reduces opportunities for physical activity. In the emotional factors category, the most frequently reported issue was anger

problems (f=10), followed by introversion (f=9), withdrawal (f=5), anxiety/fear (f=3), aggression/irritability (f=3), sadness (f=3), shouting/screaming (f=3), excitement (f=2), stubbornness (f=2), and lack of curiosity (f=1). As reflected in Figure 4, the most emphasized emotional factor was anger. Parent P8 explained: "Sometimes he gets angry and has difficulty expressing himself. For example, when he cannot do something, he may throw the toys in his hand or shout, while other children can find solutions in such situations." The researcher's journal also noted: "From the mothers' responses, it became evident that children's emotional concerns made it difficult for them to participate in group education, and this also negatively affected their participation in physical activities." These findings suggest that anger and behavioral problems cause difficulties in children's social interaction processes and constitute an important barrier that negatively affects participation in physical activities. In the physical factors category, participants most frequently reported hitting others (f=4), followed by throwing/breaking objects (f=3), lack of muscle strength (f=2), hair pulling (f=1), hand flapping/knee slapping (f=1), and tiptoe walking (f=1). As seen in Figure 4, the most emphasized physical factor was hitting others. Parent P11 shared: "My son struggles with social interaction. Especially when he gets excited and has difficulty expressing himself, he sometimes shows behaviors such as hitting or biting." Teacher T3 explained: "When children go to a park, school, or family gathering, they may struggle with social integration. Especially during physical activities, they may display hitting behaviors toward other children. Other children either respond similarly or avoid them. In both cases, the physical activity ends."

These findings indicate that children with ASD, when unable to express themselves in response to intense emotions and stimuli in social environments, sometimes resort to physical aggression, which complicates healthy participation in physical activities.

Findings on Education and Resources Needed for More Active Participation in Physical Activities

The fourth question asked to the participants was: "In your opinion, what kind of resources or training are needed for your child/student to be more active in physical activities?" This question aimed to identify the participants' perspectives regarding the resources and educational supports necessary to enhance students' active participation in physical activities. The findings related to this question were organized under the theme "Resources and Training Required to Increase Active Participation" and categorized into two subcategories, as illustrated in Figure 5.

Findings on Education and Resources Needed for More Active Participation

As illustrated in Figure 5, the theme "Resources and Training Required to Increase Active Participation" consists of two main categories: Required Trainings and Required Resources. In the Required Trainings category, participants most frequently emphasized the need for movement/physical development training (f = 7). Other areas mentioned included training that supports children's socialization (f = 5), training on attention deficit and hyperactivity (f = 3), training conducted by educators specialized in individual differences (f = 2), multidisciplinary training approaches (f = 2), early-age intervention programs (f = 2), training for special education teachers (f = 2), group training (f = 1), community-based awareness training (f = 1), and training that supports child development through various modalities (f = 1). A physiotherapist (PT1) highlighted the importance of movement-based training by stating: "Physical activity programs should take a greater place in the curriculum and not be limited to physical education classes. In preschool and early childhood, activities involving movement are essential. Especially for children with attention deficit or hyperactivity, these are far more beneficial than desk-based learning. Therefore, physical activities should be planned according to each child's interests and needs." Similarly, a teacher (T5) emphasized the professional development of educators: "First, special education teachers need training in physical activity. It is important to expand initiatives run by the Ministry of National Education and the Ministry of Youth and Sports. Moreover, physical activities tailored for children with autism should be demonstrated to teachers and parents with concrete examples. This would increase children's participation in physical activities." These findings underline the necessity of integrating systematic and comprehensive physical activity education into early curricula and

enhancing educators' competencies. Expanding adapted physical activity programs for children with autism spectrum disorder (ASD) is expected to have a positive impact on both participation and development. In the Required Resources category, participants most frequently pointed to the need for special education schools, parks, and areas designed for individuals with special needs (f = 21). Other needs included quiet and comfortable spaces (f = 1), special facilities in every city (f = 1), and socially engaging environments (f = 1).

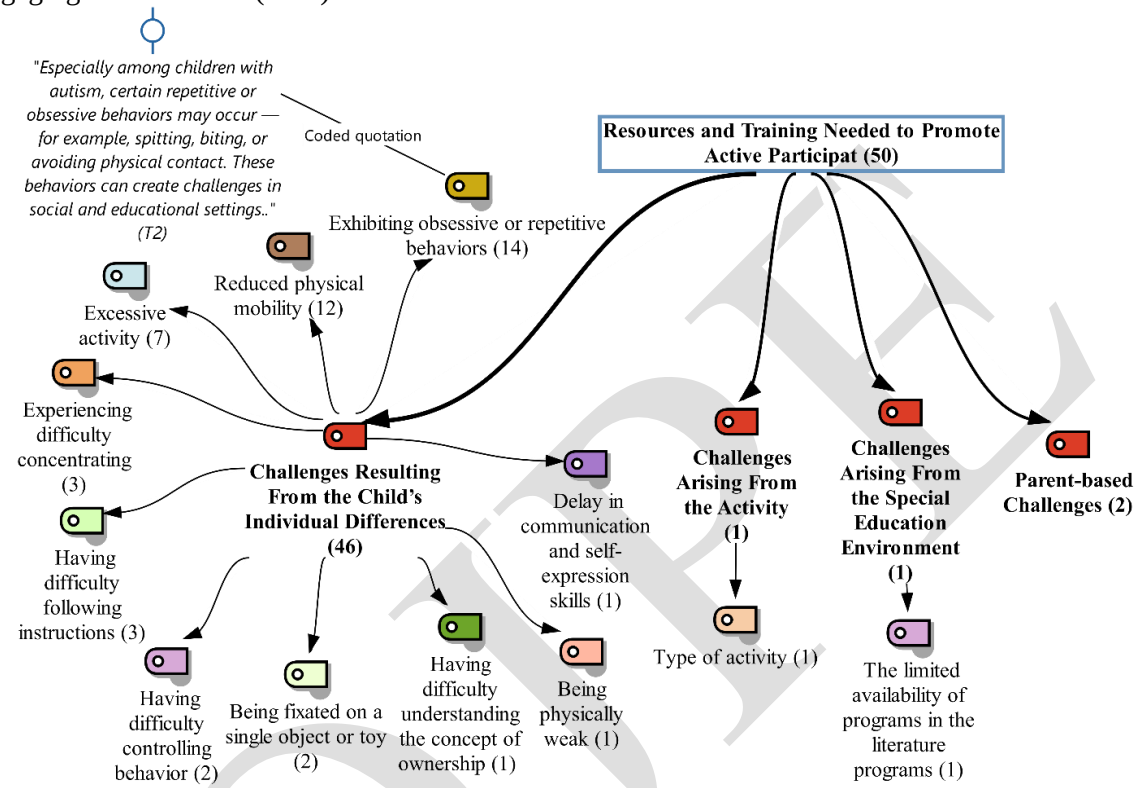

Figure 5. Hierarchical code–subcode model of the theme resources and education needed to promote more active participation in physical activities.

As seen in Figure 5, the most frequently emphasized resource requirement was the availability of inclusive and accessible spaces for individuals with special needs. A parent (P14) expressed this as follows: "Facilities that meet the needs of children with autism should be built first. Currently, I don't think there are enough of these in our country. There should be special centers designed with consideration for what these children can and cannot do, both physically and psychologically. However, this cannot be achieved through individual efforts alone it requires collaboration between the Ministry of National Education and other relevant institutions." Similarly, an occupational therapist (OT2) noted: "Parks should include more diverse and developmentally supportive materials. Right now, most parks only have slides and swings. Designing more comprehensive playgrounds could help children improve their motor skills." Additionally, the researcher's diary included the following reflection: "Lack of resources frequently emerged in almost every interview. Based on my observations, the existing facilities do not adequately meet the interests and needs of children with ASD." Overall, these findings indicate that the shortage of suitable physical spaces and resources to support the development of children with special needs limits the effectiveness of related interventions. This represents a systemic issue that calls for institutional collaboration and infrastructure improvements.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

Difficulties Arising from the Nature of the Activity

One of the challenges faced by children with autism spectrum disorder (ASD) in participating in physical activities stems from the structural characteristics of the activities themselves. Research findings indicate that activities which are poorly structured in content or not aligned with the child's developmental level and interests often result in loss of motivation and unwillingness to participate. This, in turn, negatively affects the continuity of participation and makes it more difficult for children to adapt to the process. The need for planning activities that are sensitive to individual differences was also emphasized by teachers in their interviews. Arnel et al. (2018) noted that when children's individual needs are met, participation becomes more sustainable. This finding is also consistent with the Family of Participation-Related Constructs (fPRC) model proposed by Imms et al. (2017), which suggests that individual, social, and environmental factors collectively and directly shape participation levels. Therefore, physical activity should not be viewed solely as a means of developing motor skills but rather as a personalized and structured intervention domain. For children with ASD to engage in physical activities effectively and consistently, the content, duration, and implementation methods of programs should be adapted to their unique developmental and behavioral needs.

Difficulties Arising from the Special Education System

Structural limitations within the special education system represent a significant barrier to the participation of children with autism spectrum disorder (ASD) in physical activities. The findings of this study indicate that current special education programs primarily emphasize cognitive and academic development, while goals related to physical development remain secondary. This imbalance restricts the improvement of children's motor skills and physical competence, consequently limiting their participation in physical activities. Implementation-related issues were also noteworthy. Parental reports revealed that programs focusing on physical activity are limited in number and that staff members working in these programs often lack sufficient knowledge and expertise regarding the specific needs of children with ASD (Ayvazoğlu et al., 2015). The shortage of qualified professionals poses a major obstacle, particularly for interventions that must be sensitive to behavioral and sensory differences. Similarly, Gregor et al. (2018) found that a majority of teachers had little to no experience conducting physical activity sessions with individuals with ASD. Moreover, when learning environments are not adequately adapted, the use of physical activity as a supportive and therapeutic tool within special education becomes highly limited. These findings highlight the need for the special education system to regard physical activity not as a secondary component, but as a developmental necessity. The establishment of individualized, high-quality physical activity programs tailored to the unique needs of children with ASD is essential for promoting both motor and social development.

Child-Related Challenges

One of the most fundamental barriers to the participation of children with autism spectrum disorder (ASD) in physical activities arises from individual developmental limitations. The findings of this study indicate that these children experience a range of personal challenges, including attention deficits, hyperactivity, difficulty following instructions, deficiencies in social skills, and motor impairments. In particular, obsessive behavior patterns, reluctance to share, and difficulty in following directions were observed to directly hinder adaptation to physical activity settings. These findings are consistent with a broad body of literature. For instance, Schenkelberg et al. (2015) reported that children with ASD often struggle with peer interactions in unstructured activities and tend to prefer individual participation. Similarly, Must et al. (2015) demonstrated that motor skill deficits, coupled with behavioral difficulties such as distractibility, limit participation in physical activities. Hughes et al. (2006) also emphasized that poor motor competence and low motivation are direct determinants of engagement. Sowa and Meulenbroek (2012) identified social exclusion and coordination difficulties as major barriers, while Emck et al. (2009) highlighted that children with attention problems often have a low perception of their own motor abilities, negatively influencing motivation. Eaves and Ho (2008) found that social inadequacies may lead individuals with ASD to withdraw from social environments, and Bandini et al. (2013) described social exclusion as one of the most significant

psychosocial barriers to participation. Within this framework, increasing the participation of children with ASD in physical activities requires more than merely structural or environmental adjustments. It is equally essential to acknowledge individual differences, design targeted programs for motor skill development, and support social interaction skills within structured and guided contexts. The behavioral characteristics of children with ASD directly influence the pedagogical design of physical activities, suggesting that interventions aimed at enhancing participation should adopt an individualized, flexible, and multidimensional approach.

Parent-Related Challenges

Parental attitudes play a critical role in shaping the participation of children with autism spectrum disorder (ASD) in physical activities. The findings of this study indicate that some parents lack sufficient understanding of the developmental benefits of physical activity, which results in limited encouragement and support for their children's engagement. Insufficient knowledge, lack of guidance, and low awareness levels among parents indirectly restrict children's participation in physical activities. Salar et al. (2024) found that although parents recognize the benefits of physical activity, low child motivation, sedentary lifestyles, and a lack of regular routines serve as barriers to consistent participation. Moreover, families often experience a lack of knowledge regarding appropriate guidance strategies for their children. Observations recorded in the researcher's diary revealed that some behavioral difficulties may stem not only from ASD itself but also from parental attitudes. Edwards et al. (2024) similarly emphasized that family attitudes play a decisive role in children's emotional, social, and behavioral development, indirectly influencing their participation in physical activities. Additionally, environmental stressors such as limited time, energy, and financial resources further reduce the parents' capacity to support their children and hinder their active involvement in the process. In this context, it is necessary to develop awareness and support programs that include not only children but also their parents. Enhancing parental awareness regarding the developmental role of physical activity is a critical prerequisite for ensuring the sustainability of children's participation and development.

The Impact of the Environment on Participation in Physical Activity

One of the most significant factors influencing the participation of children with autism spectrum disorder (ASD) in physical activities is the physical environment. The findings of this study revealed that environmental stimuli directly affect children's attention, behavior, and level of social participation. In particular, environments with intense lighting, high noise levels, or excessive visual stimuli were observed to heighten sensory sensitivities in children, resulting in discomfort, distractibility, and problem behaviors. Such conditions make it difficult for children to adapt to physical activity settings and hinder the continuity of participation. Moreover, crowded and socially complex environments were found to trigger shyness and social withdrawal behaviors among children. These settings tend to lower social motivation and cause children to associate physical activity with negative experiences. Carson et al. (2010) noted that institutional structures and societal norms can restrict participation among individuals with ASD by offering inflexible physical activity programs. On the other hand, environments that are designed with sensitivity to individual needs help children feel safe and comfortable, thus facilitating participation. Such settings support behavioral regulation, enhance attention span, and positively influence emotional regulation. Furthermore, safe and structured physical environments promote social interaction, thereby supporting language development, peer relationships, and social acceptance. In conclusion, for children with ASD to engage in physical activities actively and sustainably, environmental factors must be systematically addressed. Designing appropriate physical environments that consider sensory sensitivities and individual developmental needs not only facilitates accessibility but also enhances the developmental benefits of physical activity.

Physical, Social, and Emotional Factors Preventing Participation

The barriers to participation in physical activities among children with autism spectrum disorder (ASD) are multidimensional, encompassing social, emotional, and physical domains. The findings of this study reveal that communication difficulties, inability to express oneself, and insufficient social

responsiveness limit children's interactions with peers and, consequently, hinder their participation in physical activities. Low social awareness and experiences of social exclusion lead families to withdraw from social environments, thereby reducing children's opportunities for social participation (Salar et al., 2024). From an emotional perspective, factors such as anxiety, stress, low motivation, and poor anger regulation pose major obstacles to participation, particularly in group-based activities. These emotional regulation challenges exacerbate difficulties in adaptation during physical activities and make it harder for children to engage in the process (Edwards et al., 2024; Grosprêtre et al., 2024). Physical difficulties often coexist with behavioral problems, such as throwing objects, hitting, muscle weakness, or repetitive movements. Such behaviors reduce the effectiveness of activities and negatively affect social interaction. According to parents, as children grow older, differences in motor competence become more pronounced, further restricting participation in physical activities. Increased peer exclusion with age also leads children to withdraw from physical engagement. The cumulative impact of these negative experiences may shape individuals' attitudes toward physical activity later in life (Shields & Synnot, 2016; Hillier et al., 2020). These findings underscore the necessity of adopting a holistic approach that simultaneously addresses the social, emotional, and physical needs of individuals with ASD. Enhancing participation requires not only interventions targeting physical skills but also the development of supportive programs aimed at strengthening social environments, emotional resilience, and behavioral regulation capacities.

Recommendations for Enhancing Participation Through Educational and Resource Support

Increasing the participation of children with autism spectrum disorder (ASD) in physical activities requires comprehensive educational programs and accessible resources. Based on the views of parents and experts, movement-based and physical development-oriented programs are identified as the most essential forms of training. Moreover, the importance of programs that promote socialization, address attention and hyperactivity challenges, accommodate individual differences, and integrate multidisciplinary approaches was strongly emphasized. Early intervention programs and group training practices, along with teachers equipped with sufficient knowledge and practical skills, are considered critical components for effective implementation. Additionally, community-based awareness and education programs are necessary to promote a more inclusive understanding of physical activity for children with ASD. In terms of resources, the creation of special education schools, parks, and physical environments adapted for individuals with special needs emerges as a fundamental requirement. These spaces should be quiet, comfortable, and provide opportunities for social interaction, while also supporting children's motor development. However, infrastructure limitations and the lack of inter-institutional collaboration make it difficult to meet these needs effectively. Existing literature highlights the scarcity of adequate and effective programs that address the physical activity requirements of children with ASD (Dwyer et al., 2008). Although schools have the potential to promote physical activity, parents frequently report that their children's needs are not fully met (Pan & Frey, 2006). Therefore, teachers in special education must possess expertise in adaptive physical activity and develop strategies tailored to children's motor and sensory needs (Healy et al., 2019). Clearly defined program goals and training sessions designed to enhance participation are key to increasing children's interest and engagement in physical activity (Nichols et al., 2019; Bremer et al., 2020). Both parents and professionals identified accessibility and the provision of appropriate environments as top priorities. It is also recommended that physical education teachers expand their efforts to keep children active through developmentally appropriate practices (Obrusnikova & Miccinello, 2012). Accessible facilities, opportunities for social interaction, and peer support were identified as structural factors that facilitate participation (Shields et al., 2012; Buchanan et al., 2017). However, the intensity of after-school therapy sessions and limited leisure time restrict families' ability to encourage physical activity (Tobing, 2010). In Turkey, there are notable deficiencies in access to sports facilities, participation in organized events, and financial support for individuals with disabilities, all of which negatively affect participation (Çınarlı & Ersöz, 2010). Financial constraints are particularly evident among individuals with ASD, who often face high healthcare expenses and higher unemployment rates (Martin Ginis et al., 2016; Shields & Synnot, 2016). Broader economic difficulties and insufficient public policies in Turkey further

exacerbate barriers to participation (Aydın & Sarol, 2020). To enhance participation in physical activities among children with ASD, it is essential to: Strengthen teachers' knowledge and skills in special and adapted physical education, develop multidisciplinary programs tailored to individual needs, and establish accessible and safe physical activity environments. In addition, implementing parent-focused support programs, increasing public awareness, and ensuring the efficient use of financial resources are critical for sustainability. A multifaceted and holistic approach one that integrates educational, environmental, social, and policy dimensions will ensure lasting improvements in the participation of children with ASD in physical activities.

Researcher's Diary

An examination of the researcher's diary revealed that limited resources, parental attitudes, deficits in social and communication skills, as well as environmental and emotional factors, constitute major barriers to the participation of children with autism spectrum disorder (ASD) in physical activities. The lack of resources, insufficient individualized educational programs, and absence of consistent policies were observed to negatively influence both children's development and their engagement in physical activities. Additionally, low levels of parental awareness and the fact that many behavioral problems stem from family attitudes were identified as factors restricting participation in physical activity. Deficiencies in social skills and emotional anxieties were also found to make participation in group activities more difficult, consequently increasing the risk of social exclusion. In light of these observations, it is essential to implement individualized and multidimensional approaches tailored to the specific needs of children with ASD. Such efforts should be supported through parental education, environmental adaptations, and the development of comprehensive policies aimed at promoting inclusive participation and sustainable engagement in physical activities.

Conclusion

This study comprehensively examined the multifaceted challenges and proposed solutions influencing the participation of children with autism spectrum disorder (ASD) in physical activities. The findings revealed that participation is affected by a complex interaction of individual, familial, educational, and environmental factors. Under the theme of child-related challenges, it was found that motor skill deficiencies, attention problems, and behavioral difficulties significantly limit participation in physical activities. To overcome these barriers, individualized support programs that address developmental and behavioral needs are essential. Activity-related challenges showed that standardized and inflexible programs fail to meet the unique needs of children, thereby reducing participation. This finding highlights the necessity of developing adaptable and child-centered activity designs that accommodate individual differences. Challenges stemming from the special education system were associated with teachers' lack of knowledge and competence regarding adapted physical activity, as well as insufficient material and infrastructural support. Therefore, capacity-building training programs in special education and adaptive physical activity should be expanded to ensure effective implementation. Parent-related challenges indicated that low parental awareness, limited support, and financial constraints directly affect children's participation in physical activities. The implementation of parent education programs and the establishment of financial support mechanisms are therefore crucial to sustain engagement. The findings regarding the impact of the environment on participation showed that unsuitable environmental conditions that do not accommodate sensory sensitivities hinder participation, while appropriately adapted and structured environments enhance engagement. Environmental arrangements must therefore be planned in accordance with individual needs to promote comfort, safety, and motivation. Physical, social, and emotional factors preventing participation were also identified as critical barriers. Communication difficulties, emotional regulation problems, and physical limitations were found to jointly restrict children's participation in physical activities. Multidisciplinary interventions that integrate physical, psychological, and social support are required to effectively address these challenges. Finally, recommendations for enhancing participation through educational and resource support emphasized the importance of strengthening teachers' knowledge and skills in special and adapted physical education, developing accessible and safe physical activity environments, increasing family and community awareness, and providing financial

and structural support to ensure sustainability. Overall, the findings of this study highlight the necessity of adopting a multidimensional and holistic approach to increase the participation of children with ASD in physical activities. Addressing both individual and environmental factors in a coordinated and systematic manner will promote active and sustained engagement in physical activity, contributing to children's developmental progress, emotional well-being, and social adaptation.

Limitations and Recommendations

This study aims to examine the challenges experienced by children diagnosed with Autism Spectrum Disorder (ASD) in participating in physical activities, based on the views of parents and professionals. However, considering the research conditions and the characteristics of the study group, certain limitations should be acknowledged. These limitations stem from the nature of the study and should be taken into account when interpreting the results.

First, the study was conducted in a single private rehabilitation center located in the province of Kırşehir. This setting caused the data to be collected within a specific socio-cultural context. Nevertheless, this limitation arose from practical challenges such as the difficulty of accessing institutions that provide education for children with ASD and the lengthy administrative procedures required to obtain research permissions in these settings. Therefore, the principle of accessibility was adopted, and the institution that could be reached was selected as the study site. In this respect, the findings are not intended for broad generalization but rather aim to provide a deep understanding that can shed light on practices in similar educational environments.

Second, the number of parents and professionals who constituted the study group was limited. Reaching families of children with ASD is often a sensitive process—both ethically and emotionally—which made it difficult to find parents willing to participate in the interviews. Similarly, the heavy workload of professionals working in the field of special education restricted the number of available participants. Despite this limitation, the selected participants offered rich and in-depth insights, which aligns with the exploratory nature of qualitative research.

Third, the study was conducted using a qualitative research design, and the data were based on the subjective views and experiences of participants. This is a natural characteristic of qualitative inquiry, which aims to understand individuals' lived experiences and perceptions. Therefore, the findings are not intended to achieve statistical generalization but to present participants' experiences in a comprehensive and meaningful way.

Fourth, the study included only parents and professionals, and the direct views of children with ASD were not obtained. Conducting direct interviews with children diagnosed with ASD was not feasible due to communication challenges, limited attention spans, and the complexity of ethical approval processes. However, information gathered from parents and professionals—those who are most closely involved in the children's developmental and behavioral processes—provided indirect yet reliable representations of the children's experiences.

Fifth, the research was carried out within a specific time frame (January–February 2025). The participants' responses reflect the conditions and experiences of that particular period. This limitation arises from the cross-sectional nature of the study and the lack of resources necessary for conducting long-term longitudinal research. Nevertheless, the data obtained offer a comprehensive snapshot of the current situation regarding the participation of children with ASD in physical activities.

In light of these limitations, the following recommendations are proposed for future studies:

- ✓ Conduct multi-center studies involving special education institutions in different provinces to examine regional variations in the experiences of children with ASD.
- ✓ Employ mixed-method research designs (qualitative + quantitative) to integrate statistical data with in-depth qualitative findings.

- ✓ Incorporate child-centered approaches, such as play-based observations, video analyses, or structured interaction sessions, to collect more multidimensional data.
- ✓ Implement longitudinal research designs to monitor changes in participation levels and developmental outcomes over time.
- ✓ Evaluate the effectiveness of parent education programs, interdisciplinary collaboration models, and environmental interventions across different samples to strengthen participation outcomes.

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Ethics and Conflict of Interest
This study was conducted in accordance with the principles of ethical research and the Declaration of Helsinki. Ethical approval was obtained from the Kirşehir Ahi Evran Üniversitesi Ethics Committee (Approval Date: 20.11.2024, Decision No: 2024/13/05). All procedures were conducted in accordance with research ethics principles and the guidelines. The authors declare that they have no conflicts of interest.

Author Contribution
Aslıhan Nergiz (35%) contributed to the design and planning of the research and data collection processes. Assoc. Prof. Dr. Durdane Öztürk (30%) contributed to data analysis, interpretation of findings, and reporting of the results. Öner Soykan (20%) contributed to the design and planning of the research and to the literature review process. Assoc. Prof. Dr. Deniz Akdal (15%) contributed to ensuring implementation fidelity, manuscript review, and final editing of the text. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data Availability
The data that support the findings of this study are available on request from the corresponding author.

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INVESTIGATION OF PRIMARY SCHOOL TEACHERS' VIEWS ON ETHNOMATHEMATICS-BASED MATHEMATICS INSTRUCTION

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Abstract

The study aims to examine primary school teachers' awareness, views, classroom practices, and challenges regarding ethnomathematics-based mathematics instruction. The research was carried out with 15 primary school teachers working in the Aegean Region using maximum variation sampling and was designed as a case study, one of the qualitative research methods. Qualitative content analysis was performed on the data collected through the semi-structured interview form. The research data showed that most participants had never heard of the term “ethnomathematics.” Most of them, however, used carpet/rug patterns, local dishes, historical sites, etc. as cultural codes in mathematics lessons. Most of the teachers involved in the research stated that the implementation of ethnomathematics-based practices could enhance children’s interest in and motivation for the lesson. Moreover, based on the interviews about the textbooks used by the teachers, the teachers stated that the existing textbooks were not sufficient to reflect local culture. In addition, according to the teachers, systemic factors such as curriculum density, time constraints, and a lack of materials were the main impediments to implementation. The study found that although the teachers lacked theoretical knowledge of ethnomathematics, they incorporated cultural elements through their pedagogical intuition. In this context, the study suggests that practical workshops should be organized for teachers and that digital and printed materials specific to local culture should be provided.

Keywords: Ethnomathematics, primary school teachers, mathematics education, teacher views.

INTRODUCTION

Throughout history, mathematics has often been considered a universal and abstract system of logic, free from culture and human values; nonetheless, as a human activity, mathematics is essentially shaped by the values of individuals and their cultures (Bishop, 1994; D’Ambrosio, 2001; Ergene, Çaylan-Ergene, & Yazıcı, 2020). The fact that traditional mathematics teaching is trapped in theoretical patterns and disconnected from concrete life experiences causes students to struggle with making sense of mathematical concepts (Abiam et al., 2016; Permatasari, 2021; Pound, 2014; Zhang & Zhang, 2010). In this context, the "ethnomathematics" approach, which argues that culture plays a vital role in the emergence and development of mathematics, offers a significant shift in perspective for mathematics education (Kabuye Batiibwe, 2024). Budiarto et al. (2019) state that ethnomathematics not only helps in understanding local cultures but also serves as an important bridge between these cultural practices and school mathematics.

Ethnomathematics, first conceptualized by D'Ambrosio (1985), is defined as the methods and techniques (tics) used by different natural, social, political, or cultural (ethno) environments to learn, understand, explain, and manage reality (mathema). Drawing parallels with Vygotsky's socio-cultural learning theory, this approach is based on relating learning environments to the values, norms, and practices of the culture to which students belong (Hariastuti et al., 2022). A review of the literature

reveals that ethnomathematics-based practices provide multi-dimensional contributions to educational processes. Studies have shown that this approach increases students' mathematical achievement and is particularly effective in concretizing subjects such as geometry and fractions (Ninawati et al., 2025; Sulistyowati, 2023; Wulandari et al., 2024).

The integration of cultural elements into mathematics supports students' motivation and cognitive processes. For instance, the use of traditional games such as "Endog-endogan" and "Engklek" (hopscotch) has been found to develop students' creative and algebraic thinking skills (Ariani & Suswandari, 2024; Supriadi & Arisetyawan, 2020). Furthermore, a recent systematic review by Batiibwe (2025) indicates that utilizing the ethnomathematics program as a learning tool provides significant opportunities to augment students' conceptual understanding and enhance their overall mathematics achievement. Similarly, cultural elements such as local arts or local weaving patterns have been found to enhance geometric thinking (Motseki et al., 2026; Kusuma & Stanley, 2017). Additionally, relating local culture to mathematical problems has been found to positively affect students' critical thinking skills (Lidinillah et al., 2022; Mulyasari et al., 2021).

The current vision of mathematics education in Türkiye supports the inclusion of cultural elements in lessons. The "Century of Türkiye Education Model" (TYMM) curricula, in line with the "From Roots to the Future" vision and the principle of "Temporal Integrity," emphasize that the educational process should encompass the historical experience of society (MEB, 2024a). The objective of relating "Mathematical Representation" skills to daily life and culture within the Primary School Mathematics Curriculum is of critical importance for students to realize that mathematics is a part of life (MEB, 2024b). Accordingly, "Culture and Mathematics" courses have begun to be included in primary school mathematics teacher training programs at universities in Türkiye. Despite all this theoretical grounding and curricular support, the success of the ethnomathematics approach in classroom practices largely depends on the competence, awareness, and beliefs of the teachers who act as implementers (Astuti et al., 2024; Mania & Alam, 2021). However, many teachers struggle to reflect the relationship between culture and mathematics in the classroom environment due to a lack of materials, inexperience, or insufficient pedagogical content knowledge (Ergene et al., 2020; Khalil, 2023).

A large portion of the national and international literature on ethnomathematics (Adam, 2004; Aktekin, 2017; Bahadır, 2021; Baştürk, 2025; Budiarto et al., 2019; Dumlu & Ulusoy, 2025; Günay & Takunyacı, 2023; Kara, 2009; Kaya & Yavuz, 2025; Nuraini et al., 2022; Özbebek, 2024; Yazıcı, 2021) focuses directly on student outcomes, material development, or literature reviews. There are international studies revealing the views of students and teachers—the main elements of the process—regarding ethnomathematics (Khalil, 2023; Mania & Alam, 2021; Mosimege & Egara, 2022; Sunzuma & Maharaj, 2021a; Sunzuma & Maharaj, 2021b; Thakur, 2019). While there are studies in the specific context of Türkiye addressing the views of mathematics teachers and preservice teachers (Çenberci & Horzum, 2023; Mutlu, 2025; Özcan & Bahadır, 2023), there is no study examining the views of primary school teachers at the elementary level, where basic mathematical concepts are constructed. Given this importance, this study examines primary school teachers' views, awareness, and status of integrating cultural elements into mathematics lessons. The findings obtained from the study are aimed at contributing to the determination of teachers' professional development needs and the strengthening of mathematics teaching with cultural foundations. Increasing primary school teachers' awareness of ethnomathematics may help students realize that mathematics is not just a lesson learned at school, but a functional tool used in their families and surroundings. This will provide a concrete answer to the question "How will these topics be useful in real life?"—a question frequently asked by primary school children. Furthermore, it is thought that through mathematics course content carrying traces of their own culture, students will be supported in recognizing their cultural heritage, engaging in an interdisciplinary learning process (Mathematics and Life Studies/Social Studies), increasing their learning motivation, and reducing their anxiety about the lesson. In this direction, the study sought answers to the following questions:

1. What are the awareness levels and conceptual definitions of primary school teachers regarding the concept of "ethnomathematics"?

2. What is the status of primary school teachers' use of local cultural codes (motifs, games, architecture, etc.) in mathematics lessons?

3. According to primary school teachers, what is the effect of the ethnomathematics approach on making sense of the functionality of mathematics in daily life (the answer to the "What will this math be useful for?" question)?

4. What are the views of primary school teachers regarding the adequacy of the "From Roots to the Future" vision of the Century of Türkiye Education Model and the current mathematics curriculum in supporting ethnomathematics practices?

5. To what extent are current mathematics textbooks sufficient in reflecting the local cultural fabric and regional differences, according to primary school teachers?

6. Which specific local cultural elements (e.g., for Uşak province: tarhana, kilim, jereed) do primary school teachers utilize in their mathematics teaching processes?

7. According to primary school teachers, what are the effects of ethnomathematics-based practices on students' interest, motivation, and affective development?

8. How do primary school teachers evaluate the applicability of the ethnomathematics approach in classroom environments with students from different cultural backgrounds (multicultural settings)?

9. What are the systemic, pedagogical, and material-related difficulties encountered by primary school teachers during ethnomathematics-based teaching practices?

METHOD

Research Design

In this study, which aims to examine primary school teachers' views on ethnomathematics-based mathematics instruction, the case study design—one of the qualitative research approaches—was utilized. A case study is a research design that investigates a phenomenon within its real-life context, especially when there are multiple sources of evidence or data (Yin, 2013). This design was selected to present the teachers' current practices regarding ethnomathematics in a holistic manner.

Participants

The study included 15 primary school teachers working in the Aegean Region, selected through maximum variation sampling, one of the purposeful sampling methods. The primary goal of choosing this sampling method is to reflect the diversity of the population and to reveal the common or divergent views of teachers with different characteristics, such as gender, professional seniority, and the socio-economic environment of the school (Grix, 2010). In the study, primary school teachers were included by considering variables that might show diversity, such as gender, school location, grade level taught, years of service, graduation status, and the presence of students from different cultures in their classrooms. Furthermore, in qualitative research, 12 to 15 interviews are generally considered sufficient for data saturation (Guest et al., 2006). Data collection was concluded after interviewing 15 teachers, as it was observed that the data had become repetitive. Personal information regarding the participants is presented in Table 1.

Table 1. Personal information of primary school teachers.

Participant	Gender	School Location	Grade Level Taught	Years of Service	Graduation Status	Students from Different Cultures
P1	Female	Town/Village	3rd grade	30	Undergraduate	Yes
P2	Female	Town/Village	3rd grade	25	Undergraduate	Yes

Table 1 (Continued). Personal information of primary school teachers.

Participant	Gender	School Location	Grade Level Taught	Years of Service	Graduation Status	Students from Different Cultures
P3	Male	District center	4th grade	15	Graduate (MA/PhD)	No
P4	Male	Town/Village	1st grade	15	Graduate (MA/PhD)	No
P5	Male	District center	2nd grade	14	Undergraduate	Yes
P6	Female	Provincial center	2nd grade	23	Undergraduate	Yes
P7	Female	Provincial center	3rd grade	8	Undergraduate	Yes
P8	Female	Provincial center	2nd grade	18	Undergraduate	No
P9	Male	Provincial center	4th grade	23	Undergraduate	No
P10	Female	Provincial center	4th grade	13	Graduate (MA/PhD)	Yes
P11	Female	District center	1st grade	8	Undergraduate	No
P12	Female	Provincial center	3rd grade	13	Graduate (MA/PhD)	Yes
P13	Male	Town/Village	4th grade	12	Graduate (MA/PhD)	Yes
P14	Male	District center	4th grade	20	Undergraduate	No
P15	Female	Provincial center	4th grade	31	Undergraduate	Yes

As shown in Table 1, the participants consisted of 9 female and 6 male teachers. The years of service ranged from 8 to 31 years, reflecting a broad range of professional experience. In terms of educational background, 10 teachers held undergraduate degrees and 5 held postgraduate degrees. Teachers worked in diverse school settings, including provincial centers, district centers, and town/village schools, ensuring maximum variation in the sample. Eight of the 15 teachers reported having students from different cultural backgrounds in their classrooms.

Data Collection Tools

A semi-structured interview tool developed by the researchers was used as the data collection instrument. During the preparation of the tool, draft questions were first created by reviewing the relevant literature. To ensure the content validity and clarity of the draft questions, the opinions of three experts in the fields of primary education and primary mathematics education were sought. The interview tool was finalized based on expert feedback. Finally, a pilot interview was conducted with three primary school teachers not included in the study to check the functionality of the questions. The tool consists of a personal information form (gender, school location, grade level, seniority, graduation status, and presence of multicultural students) and 10 open-ended questions focusing on ethnomathematics perceptions, classroom practices, and challenges.

The questions in the semi-structured interview tool are as follows:

• Have you heard of the concept of "ethnomathematics" before? What does it mean to you? (If the teacher is unfamiliar, it is explained as: "The reflection of mathematics in different cultures, daily life practices, and local traditions.")

• Do you utilize students' daily lives or cultural codes (local games, rug patterns, recipes, etc.) in mathematics lessons? What is your general opinion on this?

• Do you think ethnomathematics practices are an effective tool for answering students' questions, "How will math be useful for me?" Why?

• The Century of Türkiye Education Model (TYMM) adopts the "From Roots to the Future" philosophy. Do you find the curriculum sufficient in this context? Why? Do you think more space should be given to this subject in the curriculum? (If yes, what; if no, why?)

• Do you think the examples in textbooks are compatible with the cultural fabric of the region where your students live? Should they be? Why?

• Do you use local elements (e.g., rug patterns, local folk dances, regional recipes, or historical structures) while teaching a math topic? Why? Can you give examples?

• When you relate mathematics topics to cultural contexts (ethnomathematics), what do you observe in students' behavior during the lesson?

• If you have students from different cultural backgrounds (different provinces, refugees, or different native languages), do you include these differences in math problems? (If yes, how; if no, why?)

• In your opinion, are there obstacles that make it difficult to conduct mathematics lessons based on ethnomathematics? What are they?

• Are there any other views or suggestions you would like to add?

Data Collection and Analysis

The study data were collected in the second semester of the 2025–2026 academic year. Prior to the study, ethics committee approval was obtained. Subsequently, semi-structured interviews were held with volunteer teachers working in various schools. Interviews were held in quiet spaces during lesson breaks, lunch hours, or after school. The sessions were recorded using an audio recording device, with each interview lasting an average of 8–10 minutes. The total time taken for data collection was approximately 120–150 minutes. Qualitative data analysis software was used to transcribe the audio recordings. In case of software errors, each transcript was checked manually. Once the errors were corrected, the transcripts were returned to the teachers for member checking, allowing them to add or remove statements.

Once the transcripts were approved by the teachers, the data were analyzed through content analysis aided by qualitative data analysis software. Content analysis is a systematic analytical procedure in which data are examined in depth to develop codes, and similar codes are grouped under categories and themes (Ekiz, 2009). The analysis occurred in four stages. First, the researchers became familiar with the data by reading the interview transcripts repeatedly. Second, meaningful units were open-coded. Third, these codes were grouped into categories. Finally, these categories were used to identify themes. All codes, categories, and themes were recorded in the qualitative data analysis software. This helped ensure systematic management and increased the traceability of the data analysis process.

The data were analyzed independently by each researcher, and inter-rater reliability was calculated using the formula proposed by Miles and Huberman (1994): Reliability = Agreement / (Agreement + Disagreement) × 100. Data analysis can be considered reliable if the agreement rate is at least 70%. The study's inter-rater agreement was 95%, indicating a high level of agreement between the two coders. Discrepancies were discussed until agreement was reached.

To enhance the credibility of the findings, direct quotations from participant interviews were included below each figure in the findings section to support the identified themes and codes. Thick description of the study context, participants, and data collection procedures supported transferability. To ensure dependability, an audit trail of analytical decisions was maintained during coding. The credibility of the research was also supported through member checking, whereby participants reviewed and confirmed the accuracy of their transcripts.

RESULTS

In this section, primary school teachers' views on ethnomathematics-based mathematics instruction are analyzed in line with the nine research questions. It should be noted that the frequencies may exceed the total number of participants, as a single teacher could express multiple views or provide more than one response for a specific category.

Primary School Teachers' Awareness of the Concept of Ethnomathematics

Teachers' views on the concept of ethnomathematics are presented in Figure 1.

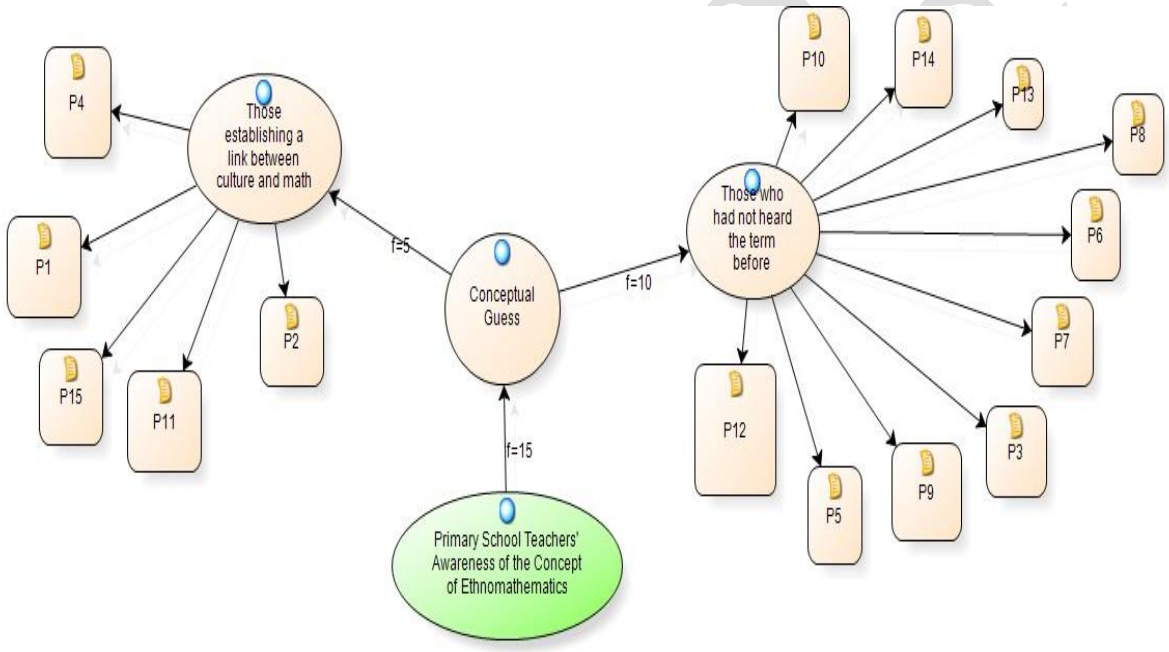

Figure 1. Awareness and definitions of the concept of ethnomathematics.

It was determined that 10 participants had not heard the term "ethnomathematics" before, while five believed it was related to ethnicity and culture. Regarding this:

P4: "I haven't heard it before, but I think it's something related to mathematics and cultural artifacts."

P12: "Ethno already means cultural. Then ethnomathematics must be the combination of 'ethno' and 'math'—an approach that utilizes these codes."

P3: "I have never heard this concept before, so I don't know."

Use of Daily Life and Cultural Codes in Mathematics Lessons

The views of primary school teachers regarding the effectiveness of ethnomathematics-based instruction in relating mathematics to students' daily lives are presented in Figure 2.

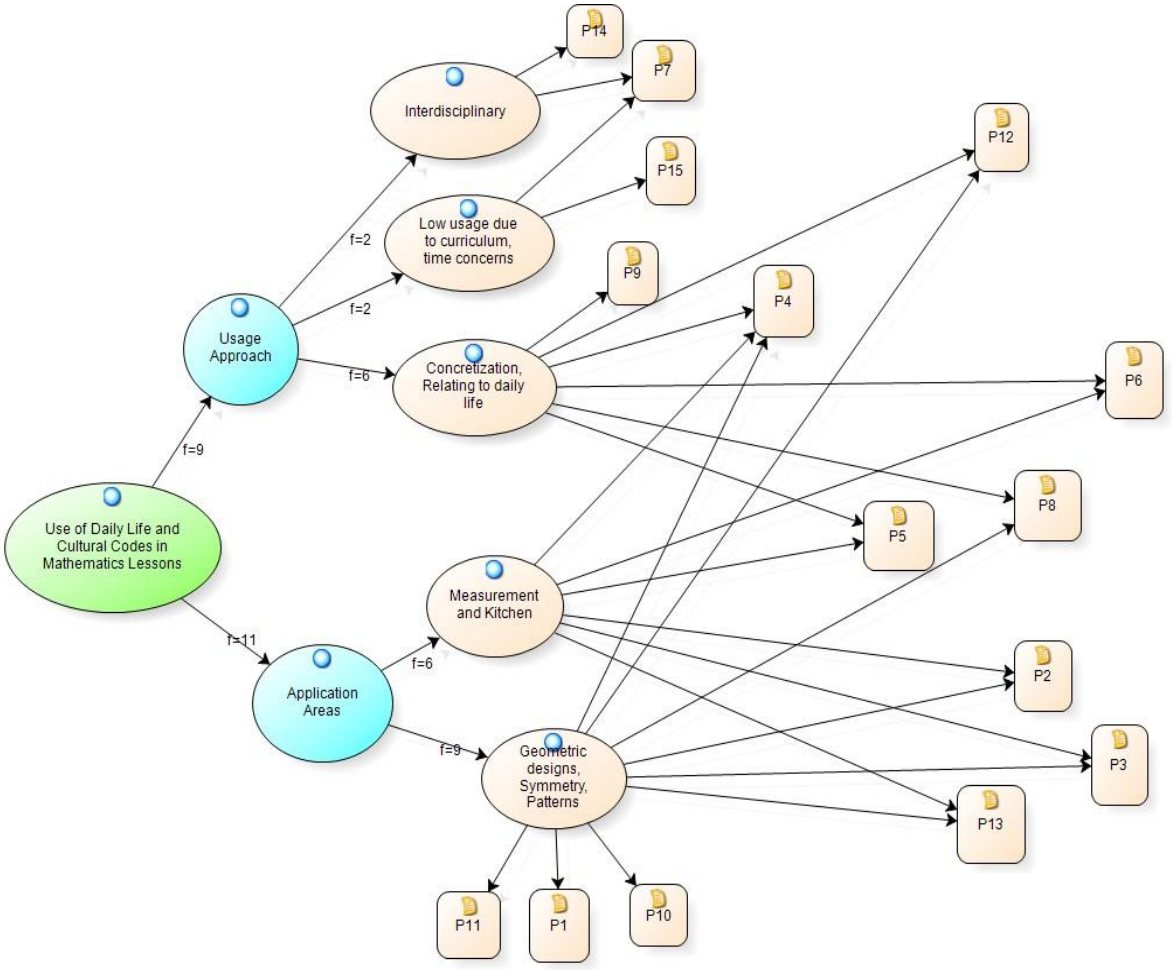

Figure 2. Views on the use of cultural codes.

Eleven teachers stated that they utilize ethnomathematics-based teaching to relate mathematics to daily life. Carpet and rug patterns were emphasized as indispensable tools for teaching patterns and symmetry.

P10: "Yes. For instance, this year we had a unit on patterns. The kilim pattern—Uşak's kilim and carpet weaving is very important and renowned. We touched on that; I don't know the academic term for it, but I can see that I actually incorporate it in my lessons. We created kilim patterns and emphasized how significant Uşak is in this regard."

P6: "First, you give examples from the market, or you start with liquids. You give examples from the liquids in our home—cooking oil, cough syrup. Then you connect that to mass. This is how we teach standard and non-standard measurements. Of course, we always start with examples from our immediate surroundings."

P15: "We use cakes and pizzas a lot when teaching fractions... I don't use elements specifically belonging to our culture."

Impact on Answering the Question: "What Will Math Be Useful For?"

Views on the role of ethnomathematics in explaining the functionality of mathematics are presented in Figure 3.

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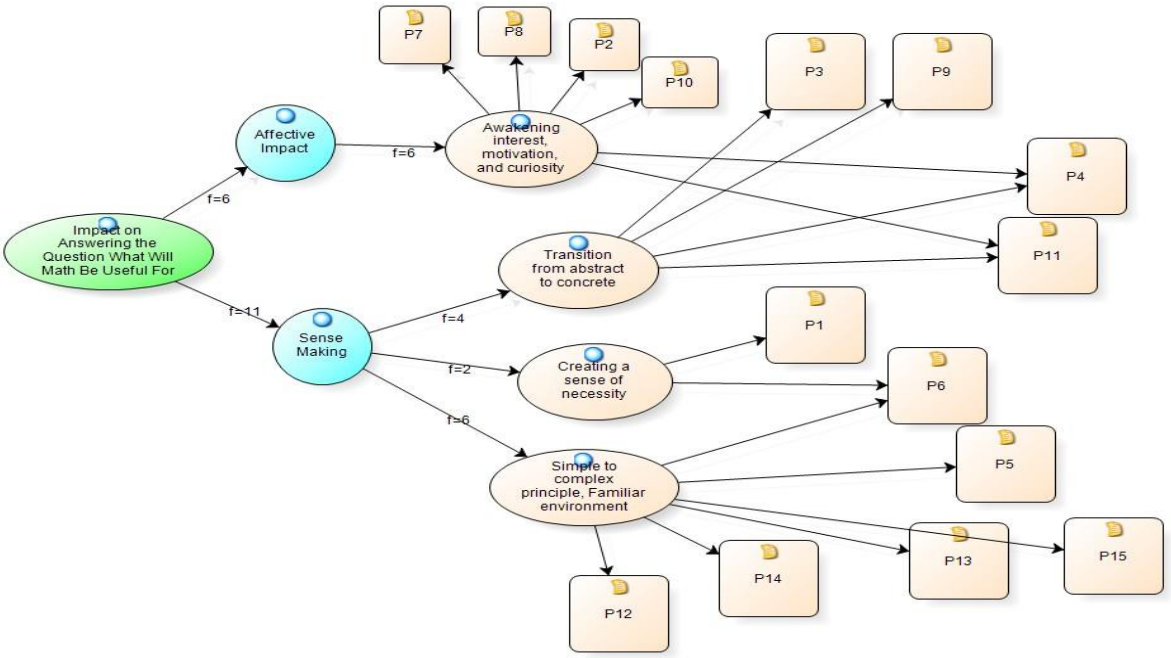

Figure 3. Impact of ethnomathematics on the functionality of mathematics.

Most teachers (f = 11) stated that ethnomathematics helps students make sense of math by moving from abstract to concrete and following the "near-to-far" principle. Six teachers emphasized its role in supporting affective development.

P13: "Since the child starts from what is familiar, they will be more successful in making sense of it."

P4: "It brings math from abstract to concrete. When the child asks, 'Where will I use this?' you give a natural answer."

Reflection of the "Maarif Model" and the "From Roots to the Future" Philosophy

Teachers' views on how well the curriculum reflects this philosophy are presented in Figure 4.

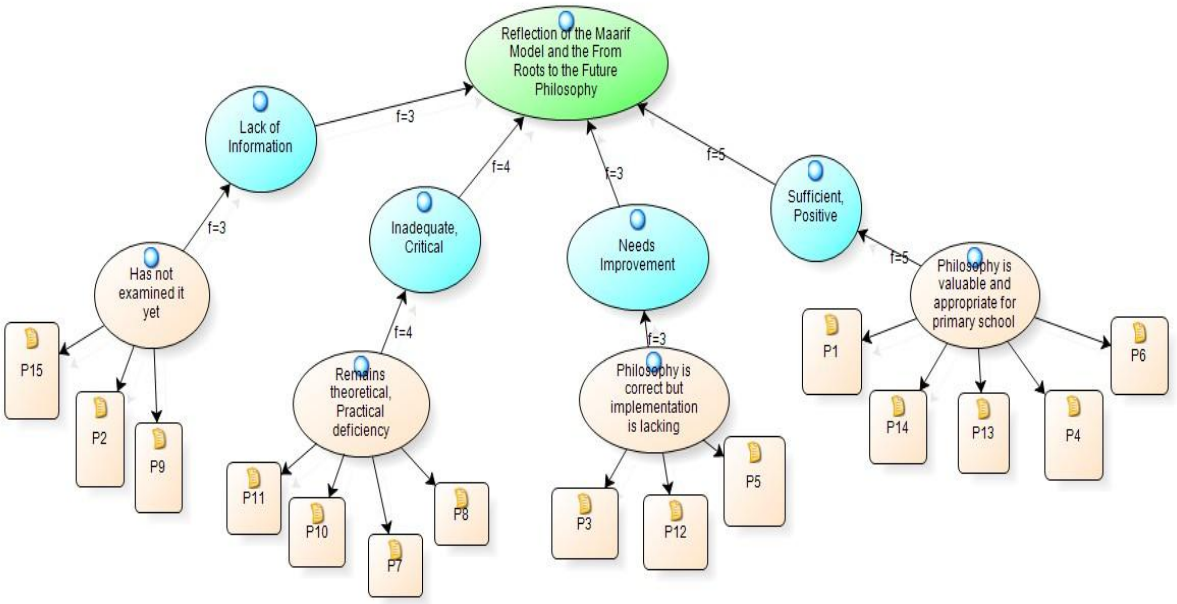

Figure 4. Views on curriculum adequacy.

An analysis of the primary school teachers' views showed that 5 teachers found the curriculum sufficient and positive, while 4 teachers found the program too theoretical and insufficient in practice, and 3 teachers believed that the implementation needed to be improved. While some teachers found the TYMM (Century of Türkiye Education Model) mathematics curriculum simplified and fit for purpose, others argued that the implementation remained theoretical.

P1: "I started with the curriculum this year—I am one of the teachers who began last year. I was honestly prejudiced at first. But as I worked through it, I now think the topics are very well prepared, and the purpose is exactly right. I find the curriculum very well designed. If it is implemented fully and completely, it works well."

P11: "Honestly, I don't find it sufficient at the moment. Because when we say 'from roots to the future,' the child needs to be able to put what they've learned into practice a bit more. They need to be able to conduct experiments. They need to be able to do more research. But since the Maarif Model is new and perhaps still being developed, there may not be enough time for that. I don't think it's sufficient because they haven't yet been able to reduce the theoretical components enough."

Suitability of Textbooks to Cultural Fabric

The views of primary school teachers regarding the compatibility of textbook examples with the cultural fabric of the region where students live are presented in Figure 5.

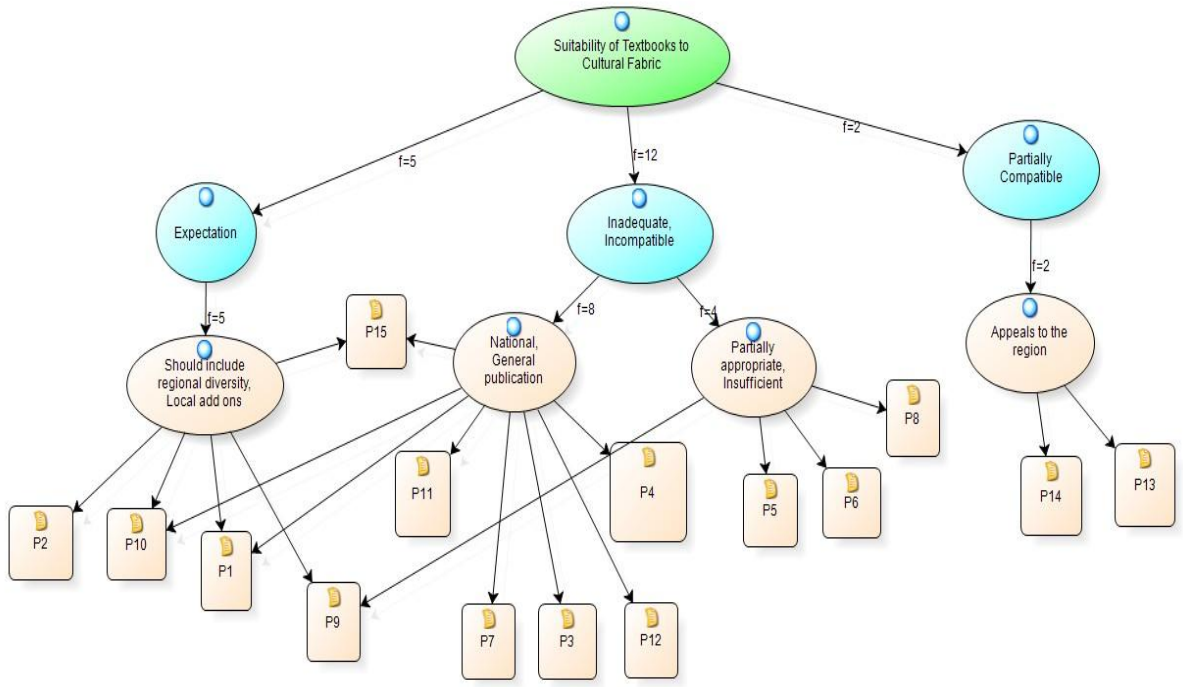

Figure 5. Cultural compatibility of textbooks.

While 12 of the primary school teachers found the textbooks insufficient in reflecting the local cultural fabric because they are published nationally and are general in scope, only 2 teachers stated that the books were partially compatible. A significant portion of the primary school teachers (6 teachers) expected greater regional diversity in the books.

P11: "Since textbooks are printed to be sent nationwide... they may not be prepared to suit the culture of every student in the region."

P14: "It absolutely, definitely should be. [The student] must know their own environment first. After all, one of the principles we apply is the 'near-to-far' principle. In this sense, the textbooks are only partially compatible with the region."

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Local Elements and Examples Used

The distribution of local elements used by primary school teachers in mathematics instruction is presented in Figure 6.

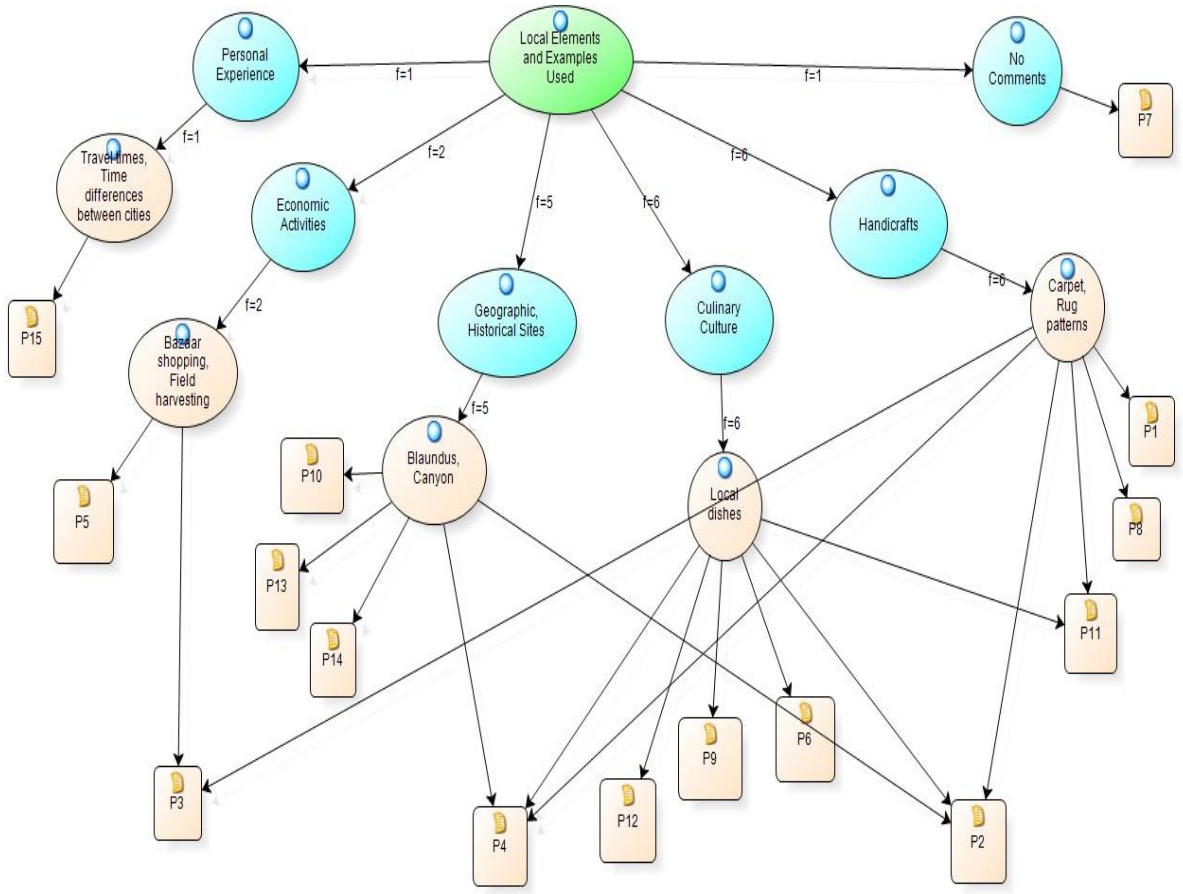

Figure 6. Local elements used in mathematics lessons.

The most commonly used local elements were handicrafts (carpets/kilims), culinary culture (tarhana, local dishes), and geographic/historical sites. While 11 of the primary school teachers used local cultural elements with some frequency, only 2 teachers stated that their use was limited.

P5: "Of course, I use them frequently. For instance, in geometry, I teach symmetry and patterns using kilim and carpet designs. When students see the motifs from their own region, they grasp geometric transformations more easily."

P6: "When posing problems, for example, we ask, 'What is Uşak famous for?' It's tarhana soup, or Ulubey's döndürme (a local pastry). When teaching geometric solids, we might say, 'Imagine a tray of döndürme has arrived—let's divide it into equal parts.' The child knows it; they see it at home."

P10: "For instance, there is the Blaundus Ancient City. We work on it with the children."

Reflections on Student Behavior

Teachers' views on how relating mathematics to cultural contexts affects student behavior are presented in Figure 7.

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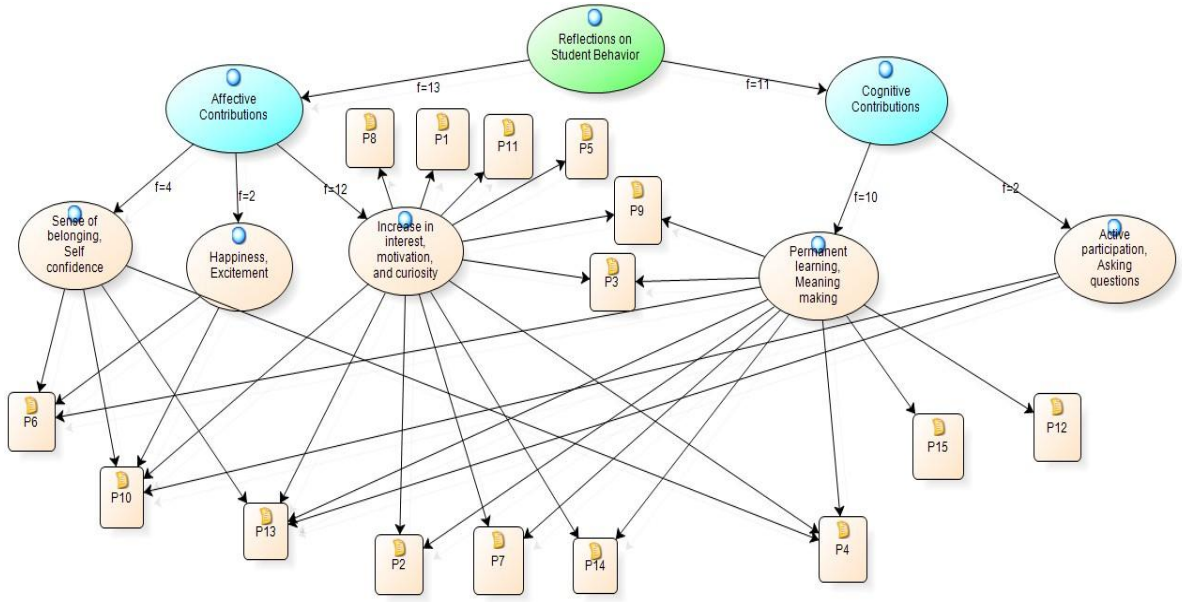

Figure 7. Changes in student behavior.

Nearly all of the primary school teachers stated that ethnomathematics-based instruction creates positive effects on students. While 13 teachers pointed out the affective contributions of ethnomathematics-based teaching, such as interest, motivation, and a sense of belonging, 11 teachers emphasized its cognitive contributions, such as lasting learning and active participation in the lesson.

P10: "I can see their eyes light up like glass. They listen to the lesson so carefully that it really captures the child's attention."

P4: "When they see a piece of their own culture, a feeling of 'I am also part of this lesson' arises in the child."

Inclusion of Students from Different Cultural Backgrounds

Practices for integrating students from diverse backgrounds into mathematics instruction are presented in Figure 8.

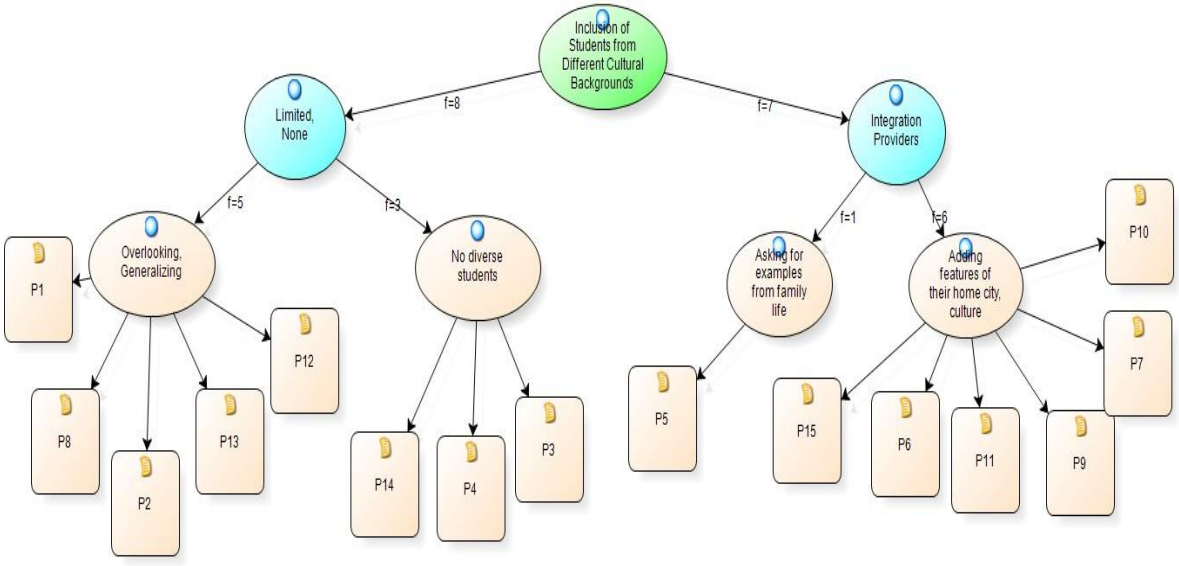

Figure 8. Practices in multicultural classroom environments.

While 7 of the primary school teachers stated that they try to integrate elements from the cities or cultures of students from different backgrounds into their lessons, 8 teachers expressed that they either do not have students from diverse cultural backgrounds in their classrooms or overlook those who are present due to time or language constraints.

P10: "I have a student from Van... I mentioned Akdamar Church. When I said that I loved that place very much, the children began to view it more warmly."

P13: "Seasonal workers come. To be honest, it doesn't happen very often, teacher. Well, rarely, sometimes we overlook them. We act as if the majority is from Uşak."

Obstacles to Ethnomathematics-Oriented Instruction

Barriers to implementing ethnomathematics-oriented lessons are presented in Figure 9.

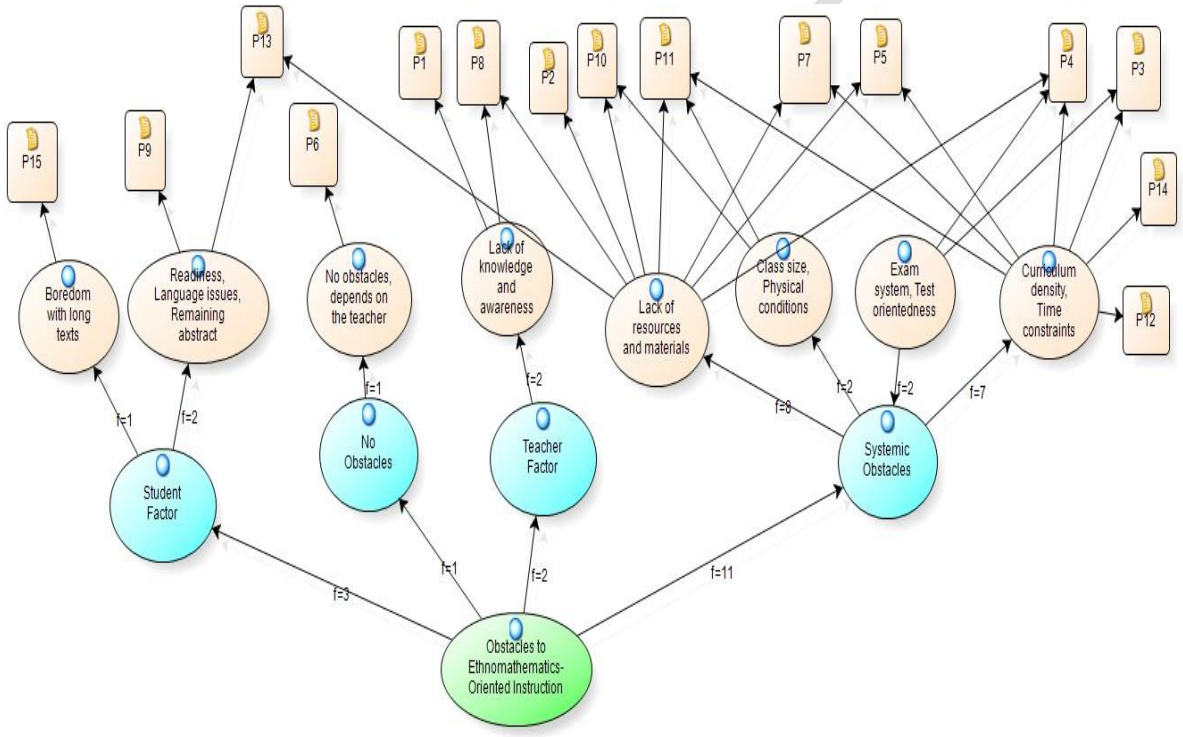

Figure 9. Obstacles to implementation

The vast majority of primary school teachers stated that the greatest obstacles to implementing ethnomathematics-based mathematics instruction were systemic factors. While 11 of the teachers emphasized systemic barriers such as curriculum density, time constraints, and insufficiency of materials, a small number of participants mentioned student- and teacher-related factors.

P7: "Lack of resources. Yes, teacher. In the resources, for example, questions and activities are kept very short, and time is limited."

P3: "Yes, there are. First of all, because we have to keep up with the curriculum, we sometimes have to conduct limited studies. But actually, rather than the curriculum, there are problems stemming from the system in our country. As you know, children take practice exams at a young age and encounter out-of-curriculum questions that shouldn't be in school. In this case, the teacher may have to explain topics that are not in the curriculum to the children, and time goes by. If lessons could be conducted without getting into this race, at least in primary schools, I think there would be no obstacles, and it would be perfectly sufficient."

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

This research aimed to examine primary school teachers' views, awareness, classroom practices, and the obstacles they encounter regarding ethnomathematics-based mathematics instruction from a holistic perspective. The findings are discussed below in line with the research questions.

Regarding the first sub-problem, it was observed that the vast majority of primary school teachers had not previously heard the term "ethnomathematics," yet they possessed an intuitive awareness of its content. Upon hearing the concept, teachers defined it in terms of the relationship between "ethnicity," "culture," and "mathematics." This indicates that teachers hold an experiential understanding rather than conceptual knowledge. This finding aligns with studies in the literature by Sunzuma and Maharaj (2021a, 2021b) and Mania and Alam (2021), which state that teachers possess awareness of ethnomathematical approaches but lack theoretical knowledge. On the other hand, in a study conducted by Çenberci and Horzum (2023) in the Turkish context, it was found that preservice mathematics teachers recognized the culture-mathematics relationship but had low awareness regarding transforming this into a pedagogical tool. The fact that primary school teachers define the concept as "utilizing cultural codes" suggests that their pedagogical intuitions are strong, even if they have not received theoretical training.

In the second sub-problem, it was determined that nearly all teachers used cultural codes in their mathematics lessons. Teachers view carpet and rug patterns as indispensable tools, especially for topics like patterns and symmetry. This result serves as proof that ethnomathematics is not merely a theoretical approach but finds a natural area of application within the classroom. Baştürk (2025) emphasizes that the integration of artifacts such as carpets, rugs, and traditional units of measurement from rural Anatolia into mathematics teaching is critical for enriching the curriculum in a cultural context. Similarly, Dumlu and Ulusoy (2025) revealed that using rug motifs in teaching transformational geometry facilitates students' discovery of mathematical concepts. The fact that teachers turn to local motifs alongside universal examples like "pizza/cake" shows that the process of transforming cultural practices into mathematical models—defined by Arı and Demir (2022) as "ethnomodeling"—is being carried out in classrooms.

The findings for the third sub-problem revealed that teachers view ethnomathematics as a tool that moves mathematics from abstract to concrete and provides the most natural answer to the question, "What will this be useful for?" Participants stated that this approach facilitates the students' process of making sense of the subject. This view is directly supported by the findings of the systematic review study conducted by Batiibwe (2025), which indicates that ethnomathematics-based instruction has a moderate to strong positive effect on students' critical thinking skills and conceptual understanding. Furthermore, Ninawati et al. (2025) and Wulandari et al. (2024) reported that instruction supported by local materials increases students' academic achievement and deepens conceptual understanding. The "sense-making" emphasis by teachers in the field is consistent with the "academic achievement" and "critical thinking" outcomes in the literature.

In the fourth sub-problem, it was observed that teachers' views were divided regarding how the "From Roots to the Future" vision of the Century of Türkiye Education Model was reflected in the curriculum. While some teachers found the curriculum sufficient in this regard, others argued that the approach remained theoretical and could not be put into practice. Although the MEB (2024a) curricula aim to promote "Temporal Integrity" and the transfer of cultural values, teachers' reservations about "putting it into practice" point to a gap between the curriculum and classroom reality. This situation aligns with the activity development challenges noted in Kaya and Yavuz's (2025) study; although preservice teachers have the skills to design creative activities, the complex process of developing them highlights why in-service teachers require ready-made implementation examples.

In the fifth sub-problem, the vast majority of teachers found the textbooks insufficient and too general in reflecting the local cultural fabric. Teachers expressed that the books should be organized to

encompass regional diversity. This finding parallels the results of studies by Supriadi (2019) and Fitrianawati and Setiyawati (2021), which found that student success increases when ethnomathematics-based teaching materials and books are customized according to the local context (e.g., Sundanese culture). The teachers' criticism that "one cannot learn the distant without knowing their own environment" (the near-to-far principle) shows that centralized material design remains limited in meeting local pedagogical needs.

Regarding the sixth sub-problem, it was determined that handicrafts (carpets/kilims) and culinary culture (tarhana, local dishes) were the local elements most frequently used by teachers. Furthermore, the inclusion of specific historical sites such as the "Blaundus Ancient City" in mathematics lessons is consistent with Mutlu's (2025) study on the use of Islamic geometric patterns and Nugraha, Maulana, and Mutiasih's (2020) studies on locally-contextualized mathematics teaching. As Lidinillah et al. (2022) stated, teachers' inclusion of historical and geographical sites in mathematical problem-posing processes (e.g., travel problems, ancient city measurements) strengthens the perception that mathematics exists not only in the classroom but in every area of life.

In the seventh sub-problem, nearly all teachers stated that ethnomathematics-based practices increased students' interest, motivation, and sense of belonging ("Their eyes light up"). This finding is consistent with the literature regarding the affective domain. Khalil (2023) stated that teachers' positive attitudes toward integrating ethnomathematics directly affect student motivation, while Ariani and Suswandari (2024) found that the use of cultural games increased students' participation in the lesson and their positive attitudes toward mathematics. Teachers' observations that a feeling of "I am also a part of this lesson" is created indicate that ethnomathematics contributes to the development of students' mathematical motivation.

In the eighth sub-problem, it was observed that in classrooms with students from different cultural backgrounds, some teachers tried to use cultural differences as an asset, but half of the teachers did not incorporate these differences into their instruction because of time and language constraints. This situation theoretically overlaps with Özcan and Bahadır's (2023) finding that teachers see cultural diversity as a wealth, but practical obstacles (language, curriculum density) limit the reflection of this wealth in the lesson. Similarly, Mallqui and Chávez (2021) state that despite teachers' desire to integrate indigenous cultures into mathematics, they experience difficulties in achieving a compromise between traditional mathematics and ethnomathematics.

In the final sub-problem, teachers emphasized that the biggest obstacles to ethnomathematics applications are systemic factors (curriculum density, time constraints, and lack of materials). This finding is consistent with the lack of materials and time-management problems reported in the studies of Mania and Alam (2021) and Sunzuma and Maharaj (2021b), as well as in the specific context of Türkiye (Mutlu, 2025). Teachers' views that the exam-oriented system constitutes an obstacle to cultural and in-depth learning reveal the fundamental mismatch between education policies and classroom practices. While studies like Kaya and Yavuz (2025) show that preservice teachers can successfully design creative ethnomathematics activities, the findings of the current study reveal that teachers in the field do not have sufficient time or ready-to-use resources to implement them. This constitutes one of the greatest obstacles to the wider implementation of ethnomathematics.

The following recommendations have been developed based on the findings obtained from the research:

- Development of Regional Digital Content: It was found that primary school teachers find textbooks insufficient and too general in reflecting the local cultural fabric (e.g., Uşak rugs, local architecture). Since it is difficult to customize textbooks published for nationwide use for every region, "Mathematics by Region" modules should be created on the Education Information Network (EBA), and teachers should be provided with access to culturally relevant mathematics content (digital fascicles, regional problems) specific to their own regions.

- Flexible Curriculum and Ready-to-Use Activities: Although teachers find the "From Roots to the Future" vision of the Century of Türkiye Education Model philosophically valuable, they stated that they struggle with implementation due to the dense curriculum and the exam-oriented system. Flexible time slots for "cultural mathematics activities" should be created in the program's implementation schedule, or learning outcomes should be presented with ready-made activity examples (in teacher guidebooks) directly linked to cultural contexts.
- Material Support for Intangible Cultural Heritage: The findings identified a lack of materials as one of the most significant obstacles. Materials containing mathematical models of intangible cultural heritage (e.g., Mangala and weaving loom models) should be added to the mathematics equipment sets sent to schools by the Ministry of National Education (MEB).
- Applied Workshops and Seminars: It was observed that the vast majority of teachers had not previously encountered the term "ethnomathematics" but intuitively recognized the relationship between culture and mathematics. In seminars to be organized through the cooperation of universities and Directorates of National Education, practical workshops demonstrating how to use local museums, historical structures, and handicrafts in mathematics lessons should be offered rather than sessions limited to theoretical definitions.
- Inclusive Education Strategies for Multiculturalism: The findings indicated that some teachers with students from different cultural backgrounds in their classrooms did not incorporate these differences into instruction because of language and time constraints. Inclusive education strategies should be taught to both preservice and in-service teachers so they can utilize cultural diversity in the classroom as a mathematical asset (e.g., different measurement methods and different number systems).

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Ethics and Conflict of Interest
This study was approved by the Ethics Committee of Uşak University. The ethics approval was granted on 15.01.2026 under the protocol number 2026-13. All procedures involving human participants were conducted in accordance with institutional and national ethical standards, the Helsinki Declaration, and applicable regulations. Informed consent was obtained from all participants. The authors used Gemini solely for language refinement and grammar correction during the revision process. No AI tool was used to generate research ideas, theoretical content, data, analysis, or interpretations. All substantive intellectual contributions were made by the authors. The authors declare no conflict of interest.

Author Contribution
All authors contributed equally to the research. All authors read and approved of the final manuscript.

Data Availability
The data that support the findings of this study are available on request from the corresponding author.

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