IOJPE
INTERNATIONAL ONLINE JOURNAL OF PRIMARY EDUCATION

Prof. Dr. Nergüz BULUT SERİN
Editor in Chief

Prof.Dr. Mehmet Engin DENİZ
Prof.Dr. Sinan OLKUN
Prof. Dr. Şule AYCAN
Assoc.Prof.Dr. Arzu GÜNGÖR LEUSHUIS
Editors

Message from the Editor,

I am very pleased to inform you that we have published the first 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 The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to International Online Journal of Primary Education (IOJPE).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): Taiwan and Türkiye.

Prof. Dr. Nergüz BULUT SERİN
Editor in Chief

Computer Education and Instructional Technologies in Primary Education
PhD. Aytekin İşman, (Sakarya University, Turkey)
Orcid ID: 0000-0003-0420-7976   Scopus ID: 10839357100   Google Scholar

Ph.D. Ersun İşçioğlu, (Eastern Mediterranean University, North Cyprus)
Orcid ID: 0000-0002-0637-7912   Scopus ID: 36191794000   Google Scholar

PhD. Halil İbrahim Yalın, (Cyprus International University, North Cyprus)
Orcid ID: 0000-0002-6355-7661   Scopus ID: 23096832400   Google Scholar

xPhD. Rozhan Mohammed Idrus, (Daffodil International University, Dhaka, Bangladesh)
Orcid ID: 0000-0001-6877-6946   Scopus ID: 6507359600   Google Scholar

PhD. Sezer Kanbul, (Near East University, North Cyprus)
Orcid ID: 0000-0002-4715-8089   Scopus ID: 26658005100   Google Scholar

Ms Umut Tekgüç, (Bahçeşehir Cyprus University, North Cyprus)
Orcid ID: 0000-0001-5974-5566   Scopus ID: 35300830300   Google Scholar

PhD. Zehra Altınay, (Near East University, North Cyprus)
Orcid ID: 0000-0002-6786-6787   Scopus ID: 8350821600   Google Scholar

Educational Drama in Primary Education
PhD. Alev Önder, (Bahçeşehir University, Turkey)
Orcid ID: 0000-0002-2736-4600   Scopus ID: 26656903100   Google Scholar

Educational Psychology in Primary Education
PhD. Christina Athanasiades, (Psychology, Aristotle University of Thessaloniki, Greece)
Orcid ID: 0000-0003-4916-9328   Scopus ID: 25652700900   Google Scholar

xPhD. Gemechu Abera Gobena, (Psychology, College of Education and Behavioural Sciences, Department of Psychology, Ethiopia, East Africa)
Orcid ID: 0000-0001-5285-5498   Scopus ID: 57193096759   Google Scholar

PhD. Muhammad Sabil Farooq, (Nankai University Tianjin, P.R. China)
Orcid ID: 0000-0001-7034-0172   Scopus ID: 57205442426   Google Scholar

PhD. Rengin Karaca, (Dokuz Eylül University, Turkey)
Orcid ID: 0000-0001-5955-0603   Scopus ID: Google Scholar

PhD. Thanos Touloupis, (Aristotle University of Thessaloniki, Greece)
Orcid ID: 0000-0003-2951-6919   Scopus ID: 56441555400   Google Scholar

Fine Arts Education in Primary Education
PhD. Ayfer Kocabaş, (Dokuz Eylül University, Turkey)
Orcid ID: 0000-0002-5566-212X   Scopus ID: 26656822800   Google Scholar

xPhD. Margaretha Häggström, (University of Gotheburg, Sweden)
iD Orcid ID: 0000-0001-9744-6532   Scopus ID: 57197742912   Google Scholar

Foreign Language Teaching in Primary Education
PhD. Nazife Aydınoğlu, (Final International University, North Cyprus)
iD Orcid ID: 0000-0002-0382-7092   Scopus ID: Google Scholar

PhD. İzzettin Kök, (Girne American University, North Cyprus)
iD Orcid ID: 0000-0003-2229-8058   Scopus ID: 55127933400   Google Scholar

PhD. Perihan Savaş, (Middle East Technical University Turkey)
iD Orcid ID: 0000-0001-9839-3081   Scopus ID: 36337903400   Google Scholar

PhD. Vahid Norouzi Lasari, (Charles University, Prague, Czech Republic)
iD Orcid ID: 0000-0002-3359-2677   Scopus ID: 57700659200   Google Scholar

Guidance and Counselling in Primary Education
PhD. Ferda Aysan, (Dokuz Eylül University, Turkey)
iD Orcid ID: 0000-0003-1396-3183   Scopus ID: 6507300768   Google Scholar

PhD. Mehmet Engin Deniz, (Yıldız Teknik University, Turkey)
iD Orcid ID: 0000-0002-7930-3121 Scopus ID: 660217798   Google Scholar

PhD. Mungin Eddy Wibowo, (Universitas Negeri Semarang, Indonesia)
iD Orcid ID: 0000-0002-3361-6018   Scopus ID: 57210563972   Google Scholar

PhD. Nergüz Bulut Serin, (European University of Lefke, North Cyprus)
iD Orcid ID: 0000-0002-2074-3253 Scopus ID: 26656955100   Google Scholar

PhD. Syamsu Yusuf, (Universitas Pendidikan Indonesia, Bandung, Indonesia)
iD Orcid ID: 0000-0002-3775-8857 Scopus ID: 57212640588   Google Scholar

Mathematics Education in Primary Education
PhD. Benjamin Rott, (University of Cologne, Germany)
iD Orcid ID: 0000-0002-8113-1584   Scopus ID: 56086497300   Google Scholar

PhD. Elizabeth Jakubowski, (Florida State University, United States)
iD Orcid ID: 0000-0001-5348-2400   Scopus ID: 26428775500   Google Scholar

PhD. Emmanuel Edoja Achor (Benue State University, Makurdi, Nigeria)
iD Orcid ID: 0000-0002-6272-0877   Scopus ID: 35760968300   Google Scholar

PhD. Kakoma Luneta, (University of Johannesburg, South Africa)
iD Orcid ID: 0000-0001-9061-0416   Scopus ID: 55893693500   Google Scholar

PhD. Melih Turgut, (Norwegian University of Science and Technology (NTNU), Norway)

Orcid ID: 0000-0003-3777-9882   Scopus ID: 26322098600   Google Scholar

PhD. Moritz Herzog, (University of Wuppertal, Germany)
Orcid ID: 0000-0002-6706-3351   Scopus ID: 57193900500   Google Scholar

PhD. Nazan Sezen Yüksel, (Hacettepe University, Turkey)
Orcid ID: 0000-0002-0539-3785   Scopus ID: 44661914200   Google Scholar

PhD. Osman Cankoy, (Atatürk Teachers Academy, North Cyprus)
Orcid ID: 0000-0002-4765-9297   Scopus ID: 8311142800   Google Scholar

PhD. Sinan Olkun, (Ankara University, Turkey)
Orcid ID: 0000-0003-3764-2528   Scopus ID: 8895882700   Google Scholar

PhD. Stefan Haesen, (Thomas More University, Belgium)
Orcid ID: 0000-0002-2769-9822   Scopus ID: 15519207100   Google Scholar

Measurement and Evaluation in Primary Education
PhD. Bayram Bıçak, (Akdeniz University, Turkey)
Orcid ID: 0000-0001-8006-4677   Scopus ID: Google Scholar

PhD. Emre Çetin, (Cyprus Social Sciences University, North Cyprus)
Orcid ID: 0000-0001-5474-6164   Scopus ID: 55616695500   Google Scholar

PhD. Gökhan İskifoğlu, (European University of Lefke, North Cyprus)
Orcid ID: 0000-0001-8119-4254   Scopus ID: 55745026100   Google Scholar

PhD. Selahattin Gelbal, (Hacettepe University, Turkey)
Orcid ID: 0000-0001-5181-7262   Scopus ID: 15519291100   Google Scholar

Music Education in Primary Education
PhD. Gulsen G. Erdal, (Kocaeli University, Turkey)
Orcid ID: 0000-0002-5299-126X   Scopus ID: Google Scholar

PhD. Sezen Özeke, (Uludağ University, Turkey)
Orcid ID: 0000-0001-9237-674X   Scopus ID: 26658548400   Google Scholar

PhD. Şirin Akbulut Demirci, (Uludağ University, Turkey)
Orcid ID: 0000-0001-8904-4920   Scopus ID: Google Scholar

Pre-School Education
PhD. Alev Önder, (Bahçeşehir University, Turkey)
Orcid ID: 0000-0002-2736-4600   Scopus ID: 26656903100   Google Scholar

PhD. Ilfa Zhulamanova, (University of Soutnern Indiana, United States)
Orcid ID: 0000-0003-3333-4237   Scopus ID: 57191155432   Google Scholar

PhD. Ithel Jones, (Florida State University, United States)

Orcid ID: 0000-0002-0690-3070   Scopus ID: 8696931600   Google Scholar

xPhD. Rebecca English, Queensland University of Technology, Brisbane, Australia)

Orcid ID: 0000-0002-9135-7202   Scopus ID: 36711513200   Google Scholar

PhD. Rengin Zembat, (Maltepe University, Turkey)

Orcid ID: 0000-0002-2377-8910   Scopus ID: 35955365300   Google Scholar

Science Education in Primary Education

PhD. Oguz Serin, (European University of Lefke, North Cyprus)

Orcid ID: 0000-0003-4739-605X   Scopus ID: 26656883200   Google Scholar

PhD. Salih Çepni, (Uludağ University, Turkey)

Orcid ID: 0000-0003-2343-8796   Scopus ID: 16642100700   Google Scholar

PhD. Şule Aycan, (Muğla University, Turkey)

Orcid ID: 0000-0001-8844-0438   Scopus ID: 6603100984   Google Scholar

PhD. Uğur Serin, (Ministry of Education, Necip Fazıl Kısakürek Primary School, Buca, Turkey)

Orcid ID: 0000-0002-4667-9472 Scopus ID: 36544438100 Google Scholar

PhD. Woldie Belachew Balea, (Addis Ababa University, Ethiopia)

Orcid ID: 0000-0002-7891-4385   Scopus ID: 57218449004   Google Scholar

Social Sciences Education in Primary Education

PhD. Erdal Aslan, (Dokuz Eylül University, Turkey)

Orcid ID: 0000-0002-9267-9852   Scopus ID: 56010448700   Google Scholar

PhD. Z. Nurdan Baysal, (Marmara University, Turkey)

Orcid ID: 0000-0002-3548-1217   Scopus ID: 36543669300   Google Scholar

Sports Education in Primary Education

PhD. Erkut Konter, (Dokuz Eylül University, Turkey)

Orcid ID: 0000-0003-1664-9077   Scopus ID: 28167487300   Google Scholar

PhD. Metin Dalip, (State University of Tetova, Macedonia)

Orcid ID: 0000-0002-7142-8931   Scopus ID: Google Scholar

PhD. Rana Varol, (Ege University, Turkey)

Orcid ID: 0000-0002-9196-984X   Scopus ID: 57189325705   Google Scholar

Special Education in Primary Education

PhD. Hakan Sarı, (Necmettin Erbakan University, Turkey)

Orcid ID: 0000-0003-4528-8936   Scopus ID: 8043728500   Google Scholar

PhD. Hasan Avcıoğlu, (Cyprus International University, North Cyprus)

Orcid ID: 0000-0002-3464-2285   Scopus ID: 54974732100   Google Scholar

PhD. Muhammad Zaheer Asghar, (Universitat Oberta de Catalunya, Barcelona, Spain)

Orcid ID: 0000-0003-2634-0583   Scopus ID: 57208667494   Google Scholar

PhD. Tevhide Kargın, (Hasan Kalyoncu University, Turkey)

Orcid ID: 0000-0002-1243-8486   Scopus ID: 7801652354   Google Scholar

Turkish Language Teaching in Primary Education
PhD. Ahmet Pehlivan, (Eastern Mediterranean University, North Cyprus)

Orcid ID: 0000-0002-5987-6475   Scopus ID: 36456968000   Google Scholar

PhD. Yüksel Girgin, (Adnan Menderes University, Turkey)

Orcid ID: 0000-0002-0515-6077   Scopus ID: Google Scholar

Journal Cover Designer
Eser Yıldızlar, (University of Sunderland, England)

Volume 15, Issue 1 (2026)

Table of Contents

EXPLORING VIETNAMESE PRIMARY SCHOOL TEACHERS' KNOWLEDGE, EXPERIENCES, AND PERSPECTIVES IN CLIL IMPLEMENTATION

Le Anh Phuong BUI

Department of Education and Human Potentials Development, National Dong Hwa University, Taiwan
ORCID: https://orcid.org/0009-0001-8226-3650
811488113@gms.ndhu.edu.tw

Wei-Yu LIU

Professor, Department of Education and Human Potentials Development,
National Dong Hwa University, Taiwan
ORCID: https://orcid.org/0009- 0004-7719-5085
weiyu@gms.ndhu.edu.tw

Abstract

In Vietnam, content and language integrated learning (CLIL) has been introduced as an innovative approach to simultaneously develop elementary students' language skills and academic subject knowledge. This study aims to investigate elementary teachers' knowledge, experiences, and perspectives on CLIL implementation in Vietnam. Employing a mixed-methods design, this study administered a questionnaire comprising 20 five-point Likert-scale items to 100 teachers in the pilot phase and 183 teachers in the main phase, and conducted individual interviews with six teachers using nine open-ended questions. The findings reveal that although teachers possessed basic insights, relevant experience, and positive perspectives on CLIL (with mean scores exceeding 3.6), they faced several challenges related to professional development, collaboration and administrative support, and disparities in students' language proficiency. In addition, teachers' knowledge and experience were positively associated with their perspectives on CLIL ($r = .68$, $p < .001$; $r = .52$, $p < .001$, respectively), with knowledge emerging as a significant predictor ($\beta = .62$, $p < .001$), and a positive trend was observed between teachers' language proficiency and their attitudes toward CLIL. Based on the participants' responses, this study proposes several suggestions concerning training programmes, cooperation, and administrative support to enhance the effectiveness of CLIL implementation in Vietnamese elementary schools.

Keywords: Bilingual education, CLIL implementation, primary school, teacher, Vietnam.

INTRODUCTION

In today's interconnected and globalized world, being multilingual and having strong subject knowledge have become increasingly important, as they enable individuals to work successfully in specific fields using an additional or foreign language (Kováčiková & Luprichová, 2023; Mim, 2023). To enhance citizens' multilingual competencies and subject knowledge, many countries, including Vietnam, have implemented bilingual education as a prominent initiative (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024). Accordingly, various approaches, such as English immersion programmes, English as a medium of instruction, and content and language integrated learning (CLIL), have been promoted in many educational contexts (Chen, 2023; Kao, 2022). Among these initiatives, CLIL, which marks a fundamental change in language education, has been widely adopted to simultaneously develop students' content knowledge and language competencies (Kao, 2022; Kováčiková & Luprichová, 2023).

In CLIL implementation, teachers are the main agents as their subject knowledge and teaching skills directly impact the learning process and outcomes of students. In addition, as teachers engage directly with the realities of classroom practices, they gain an in-depth understanding of both the advantages

and challenges associated with CLIL implementation (Szczesniak & Luna, 2022). Accordingly, the success and sustainability of CLIL implementation heavily rely on teachers' expertise. Therefore, investigating their knowledge, experiences, and perspectives, as well as the factors that influence their expertise in CLIL, is significantly essential to propose suitable recommendations, thereby enhancing the effectiveness of CLIL.

There has been growing international interest in research on teachers' knowledge, perceptions, and experiences with CLIL implementation in elementary schools (Campillo et al., 2019; Szczesniak & Luna, 2022). However, most of these studies have been conducted in European and American countries, with limited attention to Asian contexts (Chen, 2023; Kao, 2022). In Vietnam, several studies have examined CLIL implementation (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024). However, they have primarily focused on teachers' expertise across various educational levels, without specifically addressing the elementary level. At this stage, students are in a critical period of simultaneous cognitive, linguistic, and conceptual development, making them particularly sensitive to instructional design in bilingual contexts (Campillo-Ferrer et al., 2020; Coyle et al., 2010; Rutgers et al., 2020). In addition, they are still developing foundational academic concepts alongside emergent literacy skills in both their first and additional languages (Coyle et al., 2010; Rutgers et al., 2020). Consequently, CLIL implementation at the elementary level places greater demands on teachers' expertise, particularly their capacities to scaffold language, mediate meaning, and prevent conceptual misunderstandings (Banegas et al., 2024; Doiz & Lasagabaster, 2017; Karimi et al., 2017; Kováčiková & Luprichová, 2023; Pérez Cañado, 2016; Szczesniak & Luna, 2022). This highlights a clear need for further investigation. To address the above gaps, this present study explores teachers' knowledge, experiences, and perspectives, as well as which factors affect their expertise in CLIL implementation in elementary schools in Vietnam. Based on the findings, possible practices were proposed to contribute to the success of CLIL implementation in Vietnamese elementary schools.

To achieve the research objectives, this study is grounded in the theoretical framework of CLIL, which conceptualizes learning as the simultaneous development of subject knowledge and additional language proficiency through instruction that integrates content and language objectives (Coyle et al., 2010). Following Coyle's (2007) 4Cs framework, CLIL brings together content, communication, cognition, and culture, highlighting that meaningful content learning should be accompanied by purposeful language use and cognitively engaging tasks. CLIL is further informed by constructivist and mediated learning accounts of classroom interaction, where language functions not only as a means of communication but also as a key resource for conceptual development (Coyle et al., 2010). Accordingly, classroom strategies, such as adapted input, visual mediation, and teacher revoicing, are best understood as temporary scaffolds that maintain disciplinary demand while enabling students to progressively appropriate academic language, rather than as simplifications that dilute content rigor (Gibbons, 2015). In this framework, teachers' knowledge, experiences, and perspectives become pivotal in shaping the effectiveness of CLIL implementation.

Literature Review

Content Language Integrated Learning in Elementary Schools

Although numerous definitions of CLIL have emerged, they all share a common emphasis on its dual nature, which simultaneously combines teaching both subject content and a foreign language (Coyle & Mars, 2010; Karimi et al., 2017). This approach allows students to learn subjects using the target language, which enhances their understanding of academic content and language skills. This is because CLIL requires students to use the target language to analyze and communicate the learning materials and complete tasks relevant to real-life situations (Banegas et al., 2024; Karimi et al., 2017). The significant benefits of CLIL for elementary students have been highlighted in numerous existing studies. Above all, CLIL not only develops students' language abilities but also helps them connect their language skills with content knowledge in a practical way (García, 2011; McDougald, 2015). This approach often utilizes the 4Cs model, including content, cognition, communication, culture, to ensure that language learning occurs contextually and balances academic content comprehension with

broader cultural awareness (Coyle, 2007; Coyle et al., 2010). Consequently, it contributes to students' intercultural skills development, given that content learning often involves cross-cultural perspectives critical in today's global world (García, 2011).

Second, CLIL boosts students' motivation and engagement to learn the language, as they can directly see the application of language in practical situations (Banegas et al., 2024; Karimi et al., 2017; McDougald, 2015). Through this approach, students see a direct connection between language proficiency and academic content understanding, increasing their interest in learning. CLIL also develops students' cognitive skills, as it encourages deeper thinking about complex concepts that involve both language and academic content (Coyle & Mars, 2010; McDougald, 2015). Furthermore, CLIL prepares students to face increasingly complex global challenges, equipping them with transferable skills essential in a multilingual and multicultural world (García, 2011).

Although there are numerous considerable benefits CLIL could bring, its implementation has faced a wave of criticism. A major concern is the absence of a well-defined framework, which frequently leads to misinterpretation of its essential features by key stakeholders (Cenoz et al., 2014). While some educators have appreciated that CLIL is flexible and adaptable to various educational settings, others have argued that this same lack of clarity makes it difficult to properly implement CLIL (Cenoz et al., 2014; Szczesniak & Luna, 2022).

Challenges teachers have faced in CLIL implementation in elementary schools
In CLIL implementation, teachers play a key role as main agents who experience the realities of classroom practices, they gain an in-depth understanding of both the advantages and challenges (Doiz & Lasagabaster, 2017). In other words, the success and sustainability of CLIL implementation heavily rely on teachers' professional knowledge, skills, and perspectives. Consequently, numerous studies have been conducted to investigate elementary teachers' expertise regarding CLIL implementation (Szczesniak & Luna, 2022).

Although the advantages of CLIL have been clearly demonstrated, various challenges exist in its implementation (Pérez Cañado, 2018a). The most significant challenge lies in teachers' insufficient professional knowledge. Specifically, a significant number of teachers lacked familiarity with CLIL and only had a general or unclear understanding of what it entails (Savic, 2010; McDougald, 2015; Szczesniak & Luna, 2022). When teachers possess limited knowledge of how to implement CLIL effectively, they undermine its effectiveness (Pérez Cañado, 2018a). Furthermore, their insufficient methodological expertise may lead to their misconceptions of CLIL, ultimately hindering its successful implementation in actual classrooms (Barrios & Milla Lara, 2020).

The second challenge relates to inadequate professional training programs (Barrios & Milla Lara, 2020; Campillo et al., 2019; Chen, 2023). In fact, existing in-service training programs have been criticized as inadequate or misaligned with teachers' practical needs (Barrios & Milla Lara, 2020). In addition, professional development opportunities are limited for teachers (Custodio Espinar & García Ramos, 2020), which resulted in a lack of qualified teachers (Pérez Cañado, 2016). These findings highlight the need for effective training programs to ensure teachers understand and implement CLIL effectively (Milla Lara & Casas Pedrosa, 2018).

On the other hand, teacher collaboration in teaching CLIL represents another considerable challenge. Many studies have indicated a lack of collaboration among teachers (Moreno de Diezmas, 2019; Szczesniak & Luna, 2022). One reason is that legislation in many schools does not facilitate timetable coordination, leaving teachers to manage the organization on their own (Barrios & Milla Lara, 2020). This has led to criticism of school administrators and education authorities for failing to provide adequate support to CLIL teachers (Pavón Vázquez & Méndez García, 2017).

In terms of students, while CLIL has positively influenced their language competencies, learning motivation, self-confidence, intercultural awareness, and cognitive abilities (García, 2011; McDougald, 2015; Milla Lara & Casas Pedrosa, 2018), a significant number of students risk falling behind, primarily due to their limited language proficiency (Romo Escudero & Durán-Martínez, 2019;

Chen, 2023). In other words, learning diversity has not received sufficient attention (Durán-Martínez & Beltrán-Llavador, 2020). If these issues are not addressed, they may undermine the goal of providing equal learning opportunities for all students (García, 2011; Szczesniak & Luna, 2022).

To summarize, existing studies have reported major challenges that teachers face in CLIL implementation, including insufficient subject knowledge, limited practical experiences, weak collaboration among teachers, lack of administrative support, and students' low language proficiency. As a result, many teachers feel unprepared to teach CLIL (McDougald, 2015; Chen, 2023). However, most of these studies focus on European and American countries like Colombia or Spain, where English is taught as a foreign language, and thus offer limited insights into Asian contexts like Vietnam, where recent curriculum reforms have emphasized bilingual education at the elementary level (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024).

In Vietnam, CLIL remains in its early stages and faces major obstacles, including insufficient training programs, policy support, administrative support, and collaboration (Nguyen et al., 2023; Nguyen & Nguyen, 2024). To address these gaps, this study first aims to investigate teachers' knowledge, practical experiences, and perspectives on CLIL in Vietnamese elementary schools, with the goal of identifying strengths to sustain and challenges to overcome by proposing possible solutions.

Factors influencing teachers' perspectives on CLIL implementation
The successful implementation of CLIL is directly linked to teachers' knowledge, experiences, and perspectives (Doiz & Lasagabaster, 2017; Szczesniak & Luna, 2022). Existing studies have indicated that teachers' knowledge of CLIL principles and methodologies is foundational to their perceptions of its practicality and effectiveness in the actual classrooms (Cenoz et al., 2014; Lasagabaster & Sierra, 2010; Rutgers et al., 2020).

Accordingly, teachers who possessed a thorough understanding of CLIL, such as its dual-focused approach on both language and content learning, tended to perceive it as an opportunity to enhance student language proficiency and subject knowledge (Rutgers et al., 2020), and held more positive attitudes toward its implementation (Cenoz et al., 2014). Conversely, those with limited or only basic knowledge viewed it as a daunting challenge (Rutgers et al., 2020), leading to doubt and hesitation that hindered their willingness to adopt CLIL practices (Lasagabaster & Sierra, 2010). These findings underscore the need for adequate training programmes that equip teachers with both theoretical and practical knowledge.

Another factor found to contribute to teachers' differing perceptions of CLIL is their teaching experiences. Pérez Cañado (2018b), Durán-Martínez et al. (2020), and Campillo-Ferrer et al. (2020) revealed significant contrasts between experienced and novice teachers in their perspectives on CLIL implementation. The former expressed more positive perspectives across various aspects of CLIL implementation, while the latter often demonstrated more cautious or critical views (Pérez Cañado, 2018b). Second, these teachers were more aware of the difficulties associated with CLIL and emphasized the value of collaboration for successful implementation. They also appreciated language assistants more fully and employed various tools to evaluate student learning (Durán-Martínez et al., 2020; Campillo-Ferrer et al., 2020). These practical experiences, whether positive or negative, significantly affect their perception of CLIL and their willingness to adopt it in their classrooms.

Language proficiency also plays a crucial role in shaping teachers' perceptions of CLIL implementation. Lasagabaster & Sierra (2010) and Pérez Cañado (2018b) demonstrated a clear correlation between higher language proficiency and more favorable attitudes toward the CLIL initiative, as greater proficiency enhances teachers' confidence in delivering content through a foreign language. In contrast, insufficient language proficiency can lead to increased anxiety and hesitation, limiting teachers' willingness to fully embrace CLIL methodologies (Coyle et al., 2010; Lasagabaster & Sierra, 2010). These findings collectively underscore the importance of supporting teachers' language development to encourage positive perspectives on CLIL implementation.

Overall, international literature has identified three key factors shaping teachers' perspectives on CLIL implementation: knowledge, teaching experiences, and language proficiency. However, most existing studies focus on teachers in European and American countries, with little attention to those in Asian contexts, including Vietnam. While this boy of research is valuable, its transferability to Asian contexts is not straightforward because CLIL in Asia is often embedded in rapid bilingual policy initiatives and uneven system readiness, which can shape classroom language practices and teachers' orientations to CLIL (Chen, 2023; Kao, 2022). In Vietnam, recent studies have suggested that CLIL remains at an early stage and is marked by tensions between policy aspirations and school-level capacity, particularly regarding teacher expertise, collaboration, and institutional support (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024). Importantly, despite the pedagogical sensitivity of the elementary phase, when students develop foundational concepts alongside emergent additional-language literacy (Coyle et al., 2010; Rutgers et al., 2020), Vietnam-based CLIL research has primarily focused on education in general (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024), without paying attention to this elementary education level. In addition, prior studies have seldom explored teacher expertise through an integrated approach that simultaneously considers teachers' knowledge, experiences, and perceptions, as well as the contextual conditions that enable or constrain CLIL implementation (Coyle et al., 2010; Pérez Cañado, 2016; Rutgers et al., 2020).

To address the gaps above, the second aim of this study is to examine how teacher-related factors influence teachers' views on CLIL implementation in Vietnamese elementary schools in Ho Chi Minh City. In doing so, the study aims to refine what teacher expertise entails for CLIL in Vietnamese elementary schools and to offer evidence to inform more context-responsive professional development and support mechanisms. The three following questions are proposed to respond to the two main objectives of this study:

1. What levels of knowledge, experiences, perspectives, collaboration, and administrative support in CLIL implementation do elementary teachers report?

2. What are the relationships between teachers' knowledge and experiences and their perspectives on CLIL?

3. Is there any significant difference in teachers' perspectives on CLIL across groups with different levels of language proficiency?

METHOD

Research Procedures

This study was carried out over six months, from September 2024 to February 2025. To gain a holistic understanding of Vietnamese elementary teachers' expertise in CLIL implementation, a mixed-methods design was employed (Cohen et al., 2018). Quantitative data was collected through an online questionnaire due to the wide distribution of the target population across Ho Chi Minh City, a metropolitan area in Vietnam where many school systems have implemented bilingual education programs (HCMC DET, 2017). Meanwhile, qualitative data was obtained from semi-structured interviews.

To explore Vietnamese primary teachers' knowledge, perspectives, and experiences in CLIL, this study was conducted according to the following steps:

Step 1: Review international literature to select a suitable data collection instrument.

Step 2: Revise the instrument and conduct a pilot study to check the validity and reliability of the instrument in the Vietnamese context.

Step 3: Conduct the formal study to collect the essential data.

Participants

In the pilot study, four experts were invited to assess the content validity of the instrument. These included one expert in English education, one in bilingual education, and two CLIL teachers with

more than five years of teaching experiences. Regarding teachers as the primary participants, the study employed a non-probability purposive criterion-based sampling approach (Creswell & Clark, 2018). Inclusion criteria were: (1) being an elementary teacher, and (2) currently teaching content subjects in English (CLIL/ bilingual programs). Invitations were distributed via email. Regarding the construct validity and internal reliability, a sample of 200 elementary teachers meeting the criteria was invited. Of these, 100 teachers responded, making up 50% of the total invited participants.

In the formal study, to clarify the current situation of CLIL implementation in elementary schools in Ho Chi Minh City, the researchers invited 237 elementary teachers. Notably, 100 participants taking part in the pilot study were not invited in this formal round. A total of 183 teachers responded, accounting for 77.22% of the total number of invites. Participants' information was kept confidential and used solely for the purposes of this study. Their demographics are presented in Table 1.

Table 1. Participants' demographics.

Characteristics	Pilot study				Formal study	
	Experts		Teachers		Teachers	
	n	%	n	%	n	%
Gender						
Female	3	75%	63	63%	146	79.8%
Male	1	25%	37	37%	37	20.2%
Not mentioned	0	0%	0	0%	0	0%
Background education						
Bachelor's degree	1	25%	84	84%	143	78.1%
Master's degree	1	25%	16	16%	37	20.2%
Doctoral degree	2	50%	0	0%	3	1.6%
English proficiency						
Beginner	0	0%	2	2%	5	2.7%
Pre-intermediate	0	0%	17	17%	17	9.3%
Intermediate	1	25%	59	59%	117	63.9%
Advanced	3	75%	22	22%	44	24%
Teaching experiences						
Below 2 years	0	0%	27	27%	26	14.2%
From 2 to 5 years	0	0%	24	24%	41	22.4%
Above 5 years, below 10 years	2	26%	26	64%	48	26.2%
Above 10 years	0	23%	23	23%	68	37.2%

In the formal study group, the proportion of female teachers was 79.8%, nearly four times that of male teachers (20.2%). This is consistent with the gender composition in Vietnamese elementary schools (Trinh, 2023). Second, 78.1% of the teachers had a bachelor's degree, 20.2% had a master's degree, and only 1.6% held a doctoral degree. In terms of English proficiency, most teachers were at the intermediate level (63.9%), followed by 24% at the advanced level, 9.3% at the pre-intermediate level, and only 2.7% at the beginner level. In addition, 37.2% of teachers had over 10 years of experience, followed by 26.2% with 5 to 10 years, 22.4% with 2 to 5 years, and 14.2% with less than 2 years. This indicates a more experienced sample, which may contribute to greater reliability and depth in the study's findings.

Table 2. The interviewees' demographics.

No.	Pseudo	Gender	Background education	Teacher type	English proficiency	Teaching experiences
1	Ai	Female	Bachelor's degree	Subject	Intermediate	7 years
2	Bao	Male	Bachelor's degree	Subject	Advanced	9 years
3	Cong	Male	Master's degree	English	Advanced	11 years
4	Diep	Female	Bachelor's degree	Subject	Intermediate	7 years
5	Dung	Female	Master's degree	English	Advanced	8 years
6	Huy	Male	Bachelor's degree	Subject	Intermediate	6 years

Furthermore, to minimize bias from self-reported surveys, six participants from the formal study group were invited to participate in interviews to obtain qualitative insights. Each interview lasted

about 30 minutes and was audio-recorded with the participant's consent. Table 2 presents the interviewees' information.

Data Collection Instrument

The CLIL Questionnaire

To explore Vietnamese primary teachers' knowledge, perspectives, and experiences in CLIL, items from McDougald's (2015) CLIL questionnaire were adapted and revised. This questionnaire included 20 items addressing four categories: CLIL knowledge, CLIL experiences, perspectives on CLIL with elementary students, and cooperation and administrative support in CLIL. Responses for these items were rated using a Likert scale ranging from "1 = strongly disagree" to "5 = strongly agree".

In the pilot study, because the initial questionnaire was developed in English, it was first translated into Vietnamese. The translated version was then back-translated into English to verify the accuracy of the original content by two experts in English and bilingual education. The Vietnamese version continued to be checked by the four experts. Finally, three items from the CLIL knowledge domain and three items from the CLIL experiences domain were revised, while the remaining items were approved.

Table 3. Exploratory factor analysis of the CLIL questionnaire in the Vietnamese context.

Factors	Items	1	2	3	4	Percentage of variance
CLIL knowledge	CK_1			.801		18. 794%
	CK_2			.754		
	CK_3			.792		
	CK_4			.804		
CLIL experiences	CE_1				.853	18.405%
	CE_2				.861	
	CE_3				.872	
	CE_4				.678	
CLIL perspectives	CS_1	.647				18.001%
	CS_2	.852				
	CS_3	.776				
	CS_4	.604				
	CS_5	.735				
	CS_6	.730				
Cooperation and administrative support in CLIL	CAS_1		.618			16.361%
	CAS_2		.662			
	CAS_3		.750			
	CAS_4		.775			
	CAS_5		.741			
	CAS_6		.714			

After that, to examine the validity and reliability of the questionnaire in the Vietnamese context, the survey was piloted with 100 teachers. The EFA analysis revealed four dimensions that aligned closely with the dimensions initially proposed by the authors and experts (see Table 3), while each category demonstrated good internal consistency with Cronbach's Alpha from .865 to .898 (Creswell & Clark, 2018) (see Table 4). These results prove that the questionnaire is valid and reliable in the Vietnamese context.

Table 4. Internal reliability of the CLIL questionnaire in the Vietnamese context.

Categories	N items	Cronbach's α	Sample item
CLIL knowledge	4	.894	I have sufficient knowledge and skills in CLIL implementation.
CLIL experiences	4	.875	I have already taught content areas in English.
CLIL perspectives	6	.898	CLIL helps elementary students develop their language skills and subject knowledge.
Cooperation and administrative support in CLIL	6	.865	I have helped subject teachers teach subject content through English.

The Interview Questions

To collect in-depth insights into teachers' knowledge, experiences, perspectives, and the collaboration and administrative support they received during CLIL implementation, semi-structured interviews were conducted. Accordingly, the participants were asked seven questions, as presented in Table 5.

Table 5. Guiding for interview questions.

Categories	Interview questions
CLIL knowledge	1. In your opinion, what is CLIL?
	2. How is it related to or different from other language teaching methods?
	3. What kind of training did you receive before teaching CLIL lessons?
CLIL experiences	4. What strategies do you use in your CLIL lessons?
	5. What difficulties do you encounter in teaching CLIL lessons?
	6. How do you think CLIL benefits elementary students?
CLIL perspectives	7. What challenges do they typically face in CLIL lessons?
	8. How do your knowledge and experiences in CLIL affect your thinking and teaching practices?
Cooperation and administrative support in CLIL	9. What kinds of cooperation and administrative support do you receive when implementing CLIL in your school?

Data Analysis

For Likert scale questions, they were analyzed with mathematical statistical methods through SPSS software. First, the means (M) and standard deviations (SD) were calculated to determine the levels of teachers' knowledge, experiences, perspectives, cooperation, and administrative support in CLIL implementation. Second, Pearson correlation and multiple regression were analyzed to examine the relationship between teachers' knowledge and experiences and their views on CLIL. Finally, a one-way ANOVA was conducted to explore the differences in teachers' perspectives on CLIL across three English proficiency groups: low, intermediate, and advanced.

The data from interviews were analyzed using Merriam's (2009) deductive coding process to identify findings in four domains: (1) CLIL knowledge, (2) CLIL experiences, (3) perspectives on CLIL, and (4) collaboration and administrative support. The analysis process began with identifying relevant data and was followed by organizing the data into categories and themes. Table 6 summarizes the interview-data coding scheme.

Table 6. Coding scheme.

Evidence	Codes	Categories	Themes
"CLIL is a learning orientation that integrates the learning of academic subjects with a language different from the learners' mother tongue" (Diep).	Learning subjects through foreign language	Basic insights	Basic insights
"It emphasizes students' development in both language and subject knowledge" (Huy).	Dual development		
"… mainly introduced what CLIL is and its benefits for elementary students but lacked guidance on how to actually implement it in the actual classroom" (Bao).	Theoretical insights	Workshop participation	Relevant experiences
"These sessions did not provide any model lessons or examples of integrated teaching practices,…" (Huy).	Insufficient practice		
"I often use simplified language combined with visual support to help my students understand the lesson more easily" (Ai).	Instructional strategies	Individual adaptation	
"… Actually, we do not receive any specific guidelines or suggestions on how to teach CLIL. Therefore, each of us teaches primarily based on our own thoughts and experiences" (Dung).	Individual interpretation		
"CLIL effectively integrates English with subject knowledge, enriching students' vocabulary and broadening their understanding of the subject…" (Cong).	Dual development	Positive perspectives	Mixed perspectives
"In CLIL lessons, students become more active because they need to interact, think, and use English to learn the subject" (Bao).	Active learning		

Table 6 (Continued). Coding scheme.

Evidence	Codes	Categories	Themes
"…those with higher English proficiency often support peers with lower proficiency" (Cong).	Collaboration		
"… In fact, we can clearly see that students with higher English proficiency learn better in our bilingual lessons" (Diep).	Suitable for intermediate - level students	Low-proficiency students are left behind	
"In my class, I see that it is difficult for students with lower English proficiency to understand my lessons" (Huy).	Left behind		
"In fact, my colleagues never actively offer to help me. I always have to ask them" (Dung).	Limited collaboration	Limited collaboration	Limited collaboration and support
"… and sometimes it depends on who you are working with" (Diep).	Person-dependent collaboration		
"There are no official policies or clear guidelines, no scheduled meetings, and most of the time, we just try to figure things out on our own" (Bao).	Self-reliance	Limited support	
"My school assigned me to teach Science in English. This arrangement was inappropriate because I am an English teacher and I do not have enough knowledge in natural science to teach the subject effectively" (Cong).	Unqualified teachers		

RESULTS

Teachers' Expertise in CLIL Implementation in Elementary Schools

Levels of Teachers' Expertise in CLIL Implementation in Elementary Schools

To identify the levels of teachers' knowledge, experiences, perspectives, collaboration, and administrative support in CLIL implementation in elementary schools, descriptive statistics were used. The results were presented in Table 7.

Table 7. Teachers' expertise in CLIL implementation in elementary schools.

Categories	Sample item	Mean	Std.Dev.
CLIL knowledge	I can explain how CLIL is related to and differs from other language and content learning approaches.	3.9467	.6176
CLIL experiences	I have designed lessons integrating content and language.	3.6038	.8669
CLIL perspectives	CLIL is only suitable for intermediate students of English.	3.9126	.6678
Cooperation and administrative support in CLIL	I am fully supported by the administration on CLIL implementation.	3.9126	.6678

Generally, elementary teachers possessed high levels of knowledge, experience, positive perspectives, collaboration, and administrative support in teaching CLIL, with all mean scores above 3.6. Most participants self-reported that they have essential knowledge and skills related to CLIL (M = 3.967, SD = .7405). In terms of experiences, teachers reported that they had positive experiences in teaching certain subjects in English (M = 3.738, SD = 1.1227). Specifically, 36.8% taught foreign languages, followed by Mathematics (23.9%) and Natural Sciences (17.5%). The remaining participants taught other subjects, such as Arts, Information Technology, and Physical Education, in smaller proportions. Furthermore, teachers had opportunities to participate in CLIL workshops (M = 3.705, SD = .9495), and they already applied specific instructional strategies in their CLIL lessons (Mean = 3.6038, SD = .8669).

Regarding teachers' perspectives on CLIL, the findings indicated that they considered CLIL suitable for elementary students (M = 3.88, SD = .88). Specifically, teachers agreed that CLIL supports the development of language skills and subject knowledge (M = 3.75, SD = .91). However, they also viewed CLIL as most appropriate for students with intermediate English proficiency (M = 3.88, SD = .91). During CLIL implementation, the participants reported receiving administrative support and cooperation to a relatively high extent (M = 3.91, SD = .67).

Teachers' In-depth Insights and Actual Experiences with CLIL Implementation in Elementary Schools

To explore participants' insights into CLIL implementation in elementary schools, semi-structured interviews were conducted with six teachers. The findings were organized into four primary themes: (1) basic insights, (2) relevant experiences, (3) mixed perspectives, and (4) limited cooperation and administrative support.

First, the interview findings indicated that all six teachers viewed CLIL as learning subject content through a foreign language. For example, Diep stated, "CLIL is a learning orientation that integrates the learning of academic subjects with a language different from the learners' mother tongue." Teachers also recognized CLIL as an innovative approach that aims to develop both language and subject knowledge simultaneously. As Huy noted, "it supports students' development in both language and subject knowledge." Their understanding aligns with the definition by Coyle & Marsh (2010) and García (2011), who described CLIL as an educational approach that integrates subject teaching with foreign language learning to simultaneously foster students' language skills and subject knowledge.

In terms of teachers' actual experiences, although they had some opportunities to participate in CLIL workshops, they reported that the number of workshops was limited, and they primarily focused on theoretical insights rather than practical ones. According to Bao, these workshops "mainly introduced what CLIL is and its benefits for elementary students but lacked guidance on how to actually implement it in the actual classroom." Huy complemented that "These sessions did not provide any model lessons or examples of integrated teaching practices, which made it hard for us to visualize how to incorporate CLIL into our classrooms."

In fact, teachers have already applied specific instructional strategies in their CLIL classrooms. For instance, when teaching Science in English to fourth graders, Ai used simplified language and visual aids. In a lesson on the water cycle, instead of using complex terms such as "evaporation," "condensation," and "precipitation," she used expressions like "water goes up," "water turns into a cloud," and "water falls down as rain." To support students' understanding, she displayed a large, colorful diagram of the water cycle and used arrows and icons to show how water moves through each stage. She also pointed to each part while speaking, helping students connect the visuals with the simplified English phrases. However, such simplification of academic language may potentially lead to scientific misconceptions among students if not carefully scaffolded (Belobrovy & Nygård Larsson, 2020). While using expressions like "water goes up" can facilitate immediate linguistic comprehension, it may blur key mechanisms, such as phase change and condensation, and thereby contribute to incomplete or inaccurate concept formation (Joyce et al., 2008). This risk is particularly salient in CLIL contexts, where learners simultaneously negotiate new content knowledge and an additional language (Huang, 2020; Piacentini, 2021). Therefore, simplification should be treated as an entry point rather than an endpoint in instruction. To mitigate misconceptions, teachers should systematically bridge everyday expressions to canonical scientific terminology through explicit scaffolding strategies, such as gradual revoicing and the parallel use of everyday and scientific language (Belobrovy & Nygård Larsson, 2020). Such strategies help preserve conceptual precision while maintaining linguistic comprehension.

Although these practical strategies suggest that teachers made efforts to incorporate CLIL into their teaching, they still tended to rely on personal interpretation and adaptation due to a lack of specific guidance. "… Actually, we do not receive any specific guidelines or suggestions for implementing CLIL. Therefore, each of us teaches primarily based on our own thoughts and experiences" (Dung). Consequently, CLIL implementation remained inconsistent and may not have fully aligned with the intended pedagogical principles (Barrios & Milla Lara, 2020).

The findings also revealed that teachers held mixed perspectives on CLIL implementation with elementary students, with some viewing it as a double-edged sword. On the one hand, the participants highlighted several benefits for young learners. Cong noted that "CLIL effectively integrates English with subject knowledge, enriching students' vocabulary and broadening their understanding of the

subject and the world around them." Bao also highlighted the authenticity of CLIL, stating that "CLIL's alignment with real-life situations makes students' learning more familiar and meaningful." In addition, it was observed that "In CLIL lessons, students become more active because they need to interact, think, and use English to learn the subject" (Bao). Teachers further noted that higher-proficiency students often supported their peers, fostering a collaborative classroom atmosphere (Cong, Ai). Overall, these findings, consistent with McDougald (2015), reflect teachers' belief that CLIL can be applied across all age groups and is not limited to a specific educational level.

On the other hand, some teachers recognized that CLIL can exacerbate educational inequity. They viewed CLIL as more suitable for students with higher language proficiency and noted that it can leave lower-proficiency students behind. "In fact, we can clearly see that students with higher English proficiency learn better in our bilingual lessons" (Diep). Meanwhile, students with lower English proficiency often struggled to keep up with lessons, which reduced engagement and limited their understanding of subject content (Ai, Duyen, & Huy). Such challenges may result in some students being left behind. This concern is consistent with Romo Escudero and Durán-Martínez (2019) and Chen (2023), who noted that without adequate linguistic support, CLIL can widen achievement gaps between students with different language abilities.

During CLIL implementation, although teachers received some cooperation and administrative support, these were still limited. According to Diep, collaboration often depends on personal relationships rather than a systematic approach within the school. She noted, "We only receive support from English teachers when we actively ask for it, and sometimes it depends on who you are working with." Bao further shared that although the school leaders were generally supportive by providing some reference books on teaching Math and Science in English, "There are no official policies or clear guidelines, no scheduled meetings, and most of the time, we just try to figure things out on our own. Additionally, the participants also noted the assignment of unqualified CLIL teachers, resulting in inconsistent teaching quality. Cong further shared his case, "My school assigned me to teach Science in English. This arrangement was inappropriate because I am an English teacher and I do not have enough knowledge in natural science to teach the subject effectively."

The Relationships between Teachers' Knowledge, Experiences, and Perspectives on CLIL
Pearson correlation and multiple regression were analyzed (see Table 8 and Table 9) to examine the relationship between teachers' knowledge and experiences and their views on CLIL.

Table 8. The correlations between teachers' knowledge, experiences, and perspectives on CLIL.

Factors	CLIL knowledge	CLIL experiences	CLIL perspectives
CLIL knowledge	1	.706**	.678**
CLIL experiences		1	.520**
CLIL perspectives			1

Note: ** = $p < .01$.

Table 9. The predictors of teachers' perspectives on CLIL.

Factors	Predictors	*B*	*SE* b	*β*	R²	Δ R²	F (sig)
CLIL perspectives	CLIL knowledge	.671	.083	.621	.463	.463	77.637 ***
	CLIL experiences	.062	.059	.081			

Note: *B*: unstandardized coefficients B; *SE* b: unstandardized coefficients std. error, *β*: standardized coefficients beta, R²: R square, Δ R²: Adjusted R square. *** = $p < .001$.

Prior to conducting the multiple regression analysis, key statistical assumptions are examined. Linearity is assessed using scatterplots of standardized residuals against predicted values, indicating an approximately linear relationship (Field, 2018). Independence of errors is supported by the Durbin–Watson statistic (DW = 1.55), which falls within the commonly accepted range suggesting minimal autocorrelation (Field, 2018). Multicollinearity is not a concern, as tolerance values are .50 and VIF values are 1.996, well within recommended cutoffs (Field, 2018). Examination of standardized residuals suggests approximate normality, with residuals centered around zero (M = .00,

SD = .99), and the residuals-versus-predicted plot does not indicate problematic heteroscedasticity (Field, 2018). Potential outliers are screened using standardized residuals, with no evidence of extreme values beyond commonly used thresholds ($|z| > 3.29$) (Field, 2018). Overall, the assumptions for multiple regression are adequately met.

The regression analysis reveals positive relationships between teachers' knowledge and experiences and their views on CLIL with elementary students in terms of supporting language skills and subject knowledge development. In more detail, teachers' knowledge shows a significantly strong and positive correlation with their perceived suitability of CLIL (r = .678, p < .001), while their teaching experiences also exhibit a moderately positive and significant correlation with these views (r = .520, p < .001). These results suggest that teachers who are more knowledgeable and experienced in CLIL tend to perceive it as more appropriate and beneficial for elementary students.

Furthermore, Table 9 indicates that CLIL knowledge is a significant predictor of teachers' perspectives (β = .621, $p < .001$), accounting for 46.3% of the variance (R^2 = .463). In contrast, CLIL experiences do not significantly contribute to the model (β = .081, $p > .05$). This suggests that it is their understanding of CLIL, rather than mere teaching experience, that most strongly shaped their perceived appropriateness and value of CLIL for elementary students. Specifically, Ai shared, "When understanding how to balance both language and content objectives, I could teach CLIL lessons to my students effectively." Duyen emphasized that her growing familiarity with CLIL principles through workshops allowed her to recognize its effectiveness in enhancing students' language proficiency. Similarly, Bao noted that with more accurate insights from some training programs, he became better at selecting appropriate strategies, making CLIL lessons more accessible to his students. These reflections illustrate how sufficient expertise shapes teachers' well-informed perceptions of CLIL with elementary students.

Differences in Teachers' Perspectives on CLIL by Language Proficiency Levels
To examine whether there are significant differences in teachers' perspectives on CLIL across three English proficiency groups: low, intermediate, and advanced, a one-way ANOVA was conducted (see Table 10).

Table 10. Differences in teachers' perspectives on CLIL across three levels of English proficiency.

Test	Value	p
Levene's test	$F_{(2, 180)}$ = 6.675	.002
ANOVA	$F_{(2, 180)}$ = 1.764	.174
	Partial η^2 = .031	
Games–Howell test	All comparisons	> .05
Group means	Low = 3.6894	.08
	Intermediate = 3.9160	
	Advanced = 4.0152	

Levene's test indicates a violation of the homogeneity of variance assumption ($F_{(2, 180)}$ = 6.675, p = .002). The ANOVA results show no statistically significant difference in CLIL perspectives across three language proficiency groups ($F_{(2, 180)}$ = 1.764, p = .174), and the effect size is small (partial η^2 = .031), indicating that language proficiency explains only a limited proportion of variance in CLIL perspectives. Given the violated homogeneity assumption, the Games–Howell post hoc comparisons are used and indicate no significant pairwise differences among the groups (p > .05).

However, the group means reveal an upward trend: teachers in the low proficiency group have a mean score of 3.69, those in the intermediate group have a mean of 3.92, and those in the advanced group report the highest mean of 4.02. This suggests that while the recorded differences are not statistically significant, higher proficiency may be associated with more positive perceptions of CLIL in elementary schools. This trend aligns with Lasagabaster & Sierra (2010) and Pérez Cañado (2018b), who indicated a clear correlation between language proficiency and acceptance of CLIL. These authors argued that higher proficiency increases teachers' confidence in teaching subjects through a foreign language, which fosters supportive attitudes toward CLIL.

DISCUSSION, CONCLUSION, and SUGGESTIONS

Teachers' Expertise in CLIL Implementation in Elementary Schools

For the first question about levels of teachers' knowledge, experiences, perspectives, collaboration, and administrative support in CLIL implementation in Vietnamese elementary schools, the findings indicated that teachers in Ho Chi Minh City possessed basic CLIL insights. This may be explained by recent Vietnamese institutional initiatives that have emphasized the integration of CLIL into language education (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024), thereby enhancing teachers' familiarity with it. However, such familiarity does not necessarily translate into shared, operational understandings of how CLIL should be enacted in everyday classroom practices.

In terms of teachers' experiences, this study found that the workshops that the participants used to participate in were limited, and they primarily focused on theoretical insights rather than practical ones. As a result, in actual teaching practices, teachers rely on their own interpretation and adaptation. Consequently, CLIL implementation remained inconsistent and may not have fully aligned with the intended pedagogical principles (Barrios & Milla Lara, 2020; Szczesniak & Luna, 2022). This pattern suggests that when training does not provide model lessons, subject-specific task design, or established routines for co-planning and feedback, teachers' experience may remain fragmented and practice-driven, rather than developing into systematically refined CLIL expertise (Milla Lara & Casas Pedrosa, 2018; Barrios & Milla Lara, 2020). This is particularly critical at the elementary level, where effective CLIL requires careful sequencing of content concepts alongside language demands (Coyle et al., 2010; Rutgers et al., 2020). In Vietnam's early-stage CLIL implementation, the issue is not effort or exposure, but experience gained without a clear CLIL pedagogical compass (Nguyen et al., 2023; Nguyen & Nguyen, 2024). Therefore, future workshops should offer more concrete examples such as model lesson plans, classroom demonstrations, and subject-specific integration strategies to help teachers better understand how to effectively implement CLIL in their classrooms (Milla Lara & Casas Pedrosa, 2018; Barrios & Milla Lara, 2020).

Regarding teachers' perspectives, they viewed CLIL as a double-edged sword, bringing both benefits and drawbacks. They also worried that it could leave lower-proficiency students behind. Their mixed views can be interpreted as a response to a structural tension. While CLIL can enhance engagement and meaningful language use, learning opportunities may become uneven when students' language proficiency varies and systematic support is limited. Such concerns have been reported in prior studies on elementary bilingual or CLIL programs (Durán-Martínez & Beltrán-Llavador, 2020; Szczesniak & Luna, 2022). In this study, disparities in students' language proficiency emerged as a significant barrier to effective CLIL implementation in practice, underscoring the importance of differentiated instruction, appropriate language support, and carefully prepared materials so that all students, regardless of proficiency, can engage with and benefit from CLIL lessons (Durán-Martínez & Beltrán-Llavador, 2020).

During CLIL implementation, teachers received limited cooperation and administrative support. They also noted the assignment of unqualified CLIL teachers, resulting in inconsistent teaching quality. This pattern aligns with relevant studies showing that CLIL quality depends heavily on cross-curricular coordination and school supports, but that such structures are frequently underdeveloped in monolingual contexts (Pavón Vázquez & Méndez García, 2017; Moreno de Diezmas, 2019; Barrios & Milla Lara, 2020). In Vietnam, the findings resonate with prior studies describing tensions between policy aspirations and school-level capacity, including gaps in guidance, staffing, and sustained professional development (Nguyen et al., 2023; Nguyen & Nguyen, 2024). Contextually, teachers in Ho Chi Minh City may have greater exposure to bilingual initiatives than many other regions. However, the lack of formalized routines, such as scheduled co-planning time, mentoring, and clear instructional and assessment guidance, can still push teachers toward isolated practices and uneven CLIL quality.

The Relationships between Teachers' Knowledge, Experiences, and Perspectives on CLIL

For the second question on the correlations between teachers' knowledge, experiences, and their perspectives on CLIL, the findings indicated that teachers' knowledge and experience were positively associated with their perspectives on CLIL, with knowledge emerging as a significant predictor. These current findings align with previous studies that emphasize the relationship between teachers' knowledge, experiences, and their perceptions of CLIL. Specifically, Coyle & Marsh (2010), Cenoz et al. (2014), and Rutgers et al. (2020) concluded that teachers with greater familiarity and expertise in CLIL are more likely to perceive it as beneficial for elementary students. Similarly, Campillo-Ferrer et al. (2020), Durán-Martínez et al. (2020), Marsh (2012), and Pérez Cañado (2018b) noted that experienced CLIL practitioners often report higher levels of confidence and hold positive attitudes toward CLIL in enhancing both language proficiency and subject knowledge.

Rather than merely confirming prior research, this study highlights why knowledge, more than experience, plays a stronger role in shaping teachers' accurate perceptions and attitudes toward CLIL. First, CLIL is not a single method but a dual-focused instructional approach that requires teachers to attend to content learning, language development, and cognitive engagement in an integrated way (Coyle et al., 2010). At the same time, CLIL is often understood and interpreted differently across contexts, with persistent ambiguities around its defining features and implementation expectations (Cenoz et al., 2014). In addition, terminological and conceptual blurring, such as CLIL being conflated with other bilingual models, has also been noted, which can further complicate shared understandings of what CLIL entails in practice (Lasagabaster & Sierra, 2010). In this sense, stronger CLIL-related knowledge can help teachers develop a more coherent understanding of CLIL and its classroom enactment, reinforcing the need for targeted professional development to build that knowledge systematically (Rutgers et al., 2020).

Second, experience remains fragmented when it is accumulated through individual and inconsistent adaptations. As reported earlier, the participants in this study described the professional development they received as largely theoretical and noted limited practical guidance, collaboration, and school-level support. As a result, classroom practices often depended on their personal interpretation. When professional development training, collaboration, and school-level support are insufficient, CLIL implementation becomes inconsistent and teachers' perceptions vary substantially (Barrios & Milla Lara, 2020; Szczesniak & Luna, 2022). This helps explain why experience alone may not predict teachers' perspectives and attitudes.

Third, in Vietnam, CLIL has been developing within policy-driven bilingual initiatives, while uneven school readiness can constrain classroom enactment and place additional demands on teachers (Do, 2020; Nguyen et al., 2023; Nguyen & Nguyen, 2024). In this context, knowledge functions as a stabilizing resource by supporting teachers' decisions about integration, scaffolding, and balancing content rigor with language accessibility (Coyle et al., 2010). Accordingly, teachers who develop clearer CLIL knowledge are more likely to hold accurate and positive perceptions, even when institutional conditions for implementation are still limited (Rutgers et al., 2020; Nguyen et al., 2023).

In summary, the current results highlight the critical role of teacher expertise in shaping accurate perceptions and positive attitudes toward CLIL. These findings point to the need for training programs that combine theoretical grounding with practice-oriented support through modelling, classroom-based examples, and subject-specific integration strategies, and that are embedded in school routines such as co-planning and peer observation so that teachers' experience becomes cumulative and transferable (Pérez Cañado, 2016; Milla Lara & Casas Pedrosa, 2018; Porcedda & González-Martínez, 2020).

Differences in Teachers' Perspectives on CLIL by Language Proficiency Levels

Regarding the third question about the differences in teachers' perspectives on CLIL across three different teacher groups of language proficiency levels, this research found no statistically significant difference in CLIL perspectives across three groups. However, this study also recorded an upward

trend, which showed that higher proficiency may be associated with more positive perceptions of CLIL in elementary schools. This pattern can be interpreted in the two following ways.

First, language proficiency operates as an enabling condition for CLIL teaching, as teachers need sufficient language proficiency to manage classroom interaction, explain subject content, and respond to learners through the target language (Pérez Cañado, 2018b; Nguyen et al., 2023). Therefore, teachers' language proficiency and preparedness have been consistently highlighted as central requirements in CLIL implementation (Pérez Cañado, 2018b). However, language proficiency may not be the dominant constraint when compared with systemic conditions such as teacher preparation, professional development, and institutional guidance. In Vietnam, CLIL has remained under-developed, with challenges stemming largely from limited professional learning opportunities and policy-practice gaps. These constraints can restrict coherent classroom enactment even when English proficiency alone is not the primary issue (Nguyen et al., 2023; Nguyen & Nguyen, 2024). Consequently, the observed upward trend without statistical significance likely reflects both methodological factors, such as group imbalance, and contextual realities, in which proficiency matters but is moderated by stronger system-level constraints.

Contextually, these findings suggest that developing teachers' English proficiency can be beneficial. However, such efforts need to be integrated with CLIL pedagogical development and school-level support structures. Otherwise, fostering language proficiency alone are unlikely to result in more coherent CLIL practices (Pérez Cañado, 2018a; Nguyen & Nguyen, 2024).

This study investigates teachers' knowledge, experiences, and perspectives on CLIL implementation in elementary schools in Ho Chi Minh City, Vietnam. The findings show that teachers had a basic understanding of CLIL and positive experiences. However, their application often relied on personal interpretation and adaptation, leading to inconsistent implementation that may not fully reflect CLIL's principles (Barrios & Milla Lara, 2020). These results highlight the need for CLIL workshops that provide concrete examples, such as model lesson plans, classroom demonstrations, and subject-specific strategies, to support more effective and consistent CLIL integration (Milla Lara & Casas Pedrosa, 2018; Barrios & Milla Lara, 2020).

Second, the participants reported several obstacles, including the lack of official policies and guidelines, unsuitable syllabuses, insufficient practical training programs, limited teaching materials, and the assignment of unqualified teachers to CLIL. Although some cooperation and administrative support were provided, these remained limited. In line with previous studies (Pavón Vázquez & Méndez García, 2017; Moreno de Diezmas, 2019; Szczesniak & Luna, 2022), the current findings highlight the need to strengthen collaboration between English and subject teachers and to enhance administrative support in areas such as curriculum planning, clear instructional and assessment guidelines, appropriate teacher assignments, and targeted professional development to ensure that teachers are CLIL-qualified.

Third, teachers considered CLIL beneficial for elementary students regarding developing both language skills and subject understanding. However, some concerns were raised, particularly regarding the risk of students with limited language proficiency falling behind (Romo Escudero & Durán-Martínez, 2019; Chen, 2023). This highlights the need for teachers to adopt differentiated instruction strategies and carefully design learning materials to ensure all students, regardless of their English proficiency, can access and benefit from CLIL lessons.

Furthermore, the study found positive relationships between teachers' knowledge, experiences, and their views on CLIL, with knowledge emerging as a significant predictor of their perspectives. In addition, a positive trend was identified between their English proficiency and their perceptions of CLIL. Specifically, teachers with higher language proficiency tended to report more favorable perspectives. These findings highlight the critical role of teacher expertise, experiences, and language proficiency in shaping accurate perspectives on CLIL (Lasagabaster & Sierra, 2010; Pérez Cañado,

2018b). Therefore, training programs that provide both theoretical and practical insights, along with efforts to enhance language proficiency, are essential to address varied perceptions.

Limitations of the research

Although this study provides valuable insights, several limitations should be acknowledged. First, the data were collected exclusively from Ho Chi Minh City, Vietnam, which may not fully represent the national context. Regional differences in school resources, English exposure, and CLIL-related initiatives may lead to different patterns of teachers' expertise. Future studies should therefore broaden the sampling frame to include multiple provinces and regions, and, if possible, employ stratified sampling across school types to enhance generalizability.

Second, the study relies primarily on online self-reported questionnaire responses and semi-structured interviews. Therefore, the findings may be affected by self-report bias, including social desirability and possible over- or under-estimation of teachers' actual CLIL expertise. In addition, these methods may limit the study's ability to capture how CLIL is enacted in real-time classroom interactions, including scaffolding moves, language choice, differentiation for low-proficiency students, and assessment practices. Future research should triangulate self-reported data with classroom-based evidence such as lesson plans, teaching materials, classroom observations, and interviews with multiple stakeholders, such as school leaders, English teachers, and students. Moreover, longitudinal or intervention-based studies exploring the impact of targeted professional development, such as modelling lessons, co-planning routines, and scaffolding training, could provide more concrete evidence to inform improvements in CLIL implementation in Vietnamese elementary schools.

Funding

Ethics and Conflict of Interest

This study involved voluntary participation of in-service elementary teachers and did not include any physical or psychological interventions. All procedures were conducted in accordance with research ethics principles and the guidelines. Specifically, participants were invited via email and were clearly informed about the purpose of the study and the confidentiality of their responses. The survey was administered using Google Forms, and participants had the option to provide their email addresses or remain anonymous. All participants were fully informed about the study and provided their informed consent by completing a consent form at the beginning of the Google Form survey. They could proceed to the main questions only after confirming their agreement to participate. In addition, no potential conflict of interest was reported by the authors.

Author Contribution

All authors made equal contributions to the conception, design, data collection, analysis, and writing of this manuscript. All authors have read and approved the final version of the manuscript.

Data availability

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

Corresponding Author

Correspondence to Le Anh Phuong BUI, 811488113@gms.ndhu.edu.tw

REFERENCES

Banegas, D. L., Montgomery, P., & Raud, N. (2024). Student-teachers' understanding of language teaching through the CLIL Language Triptych. *Learning and Instruction*, *95*, 1-9. Article 102044. Advance online publication. https://doi.org/10.1016/j.learninstruc.2024.102044

Barrios, E., & Milla Lara, M. (2020). CLIL methodology, materials and resources, and assessment in a monolingual context: An analysis of stakeholders' perceptions in Andalusia. *The Language Learning Journal*, *48*(1), 60–80. https://doi.org/10.1080/09571736.2018

Belobrovy, A., & Nygård Larsson, P. (2020). Meaning-making in science from the perspective of students' hybrid language use. *International Journal of Science and Mathematics Education, 18*(7), 1363–1384. https://doi.org/10.1007/s10763-019-09994-z

Campillo-Ferrer, J., Miralles-Martínez, P., & Sánchez-Ibáñez, R. (2020). CLIL teachers' views on cognitive development in primary education. *Palgrave Communications*, 6, Article 97. https://doi.org/10.1057/s41599-020-0480-x

Campillo, J. M., Sánchez, R., & Miralles, P. (2019). Primary Teachers' Perceptions of CLIL Implementation in Spain. *English Language Teaching*, *12*(4), 149-156. https://doi.org/10.5539/elt.v12n4p149

Cenoz, J., Genesee, F., & Gorter, D. (2014). Critical analysis of CLIL: Taking stock and looking forward. *Applied Linguistics*, *35*(3), 243–262. https://doi.org/10.1093/applin/amt01

Chen, H. (2023). Teaching CLIL to primary school students under Taiwan's bilingual 2030 plan. *TESOL Communications*, *3*(1), 66–86. https://doi.org/10.58304/tc.20240105

Coyle, D. (2007). Content and language integrated learning: Towards a connected research agenda for CLIL pedagogies. *International Journal of Bilingual Education and Bilingualism, 10*(5), 543–562. https://doi.org/10.2167/beb459.0

Coyle, D., Hood, P., & Marsh, D. (2010). *CLIL: Content and language integrated learning*. Cambridge University Press. https://assets.cambridge.org/97805211/30219/excerpt/9780521130219_excerpt.pdf

Creswell, J. W., & Clark, V. L. P. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE.

Custodio Espinar, M., & García Ramos, J. (2020). Are accredited teachers equally trained for CLIL? The CLIL teacher paradox. *Porta Linguarum*, (33), 9–25. http://hdl.handle.net/10481/62800

Do, T. M. H. (2020). Bilingual curriculum enactment in Vietnam in an era of economic and social reform. *Doctoral Dissertation*, School of Teacher Education and Leadership Faculty of Education, Queensland University of Technology. https://eprints.qut.edu.au/208014/1/Thi%20My%20Ha_Do_Thesis.pdf

Doiz, A., & Lasagabaster, D. (2017). Management teams and teaching staff: Do they share the same beliefs about obligatory CLIL programmes and the use of the L1? *Language and Education*, *31*(2), 93–109. https://doi.org/10.1080/09500782.2017.1290102

Durán-Martínez, R., & Beltrán-Llavador, F. (2020). Key issues in teachers' assessment of primary education bilingual programmes in Spain. *International Journal of Bilingual Education and Bilingualism*, *23*(2), 170–183. https://doi.org/10.1080/13670050.2017.1345851

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE.

García, O. (2011). *Bilingual education in the 21st century: A global perspective*. John Wiley and Sons.

Ho Chi Minh City Department of Education and Training [HCMC DET]. (2017). *A signing ceremony between Ho Chi Minh City Department of Education and Training, EMG Education and ACT*. http://edu.hochiminhcity.gov.vn/tin-tuc/leky-ket-hop-tac-giua-so-giao-duc-va-dao-tao-emg-education-va-actcmobile41153-57805.aspx

Huang, Y.-C. (2020). The effects of elementary students' science learning in CLIL. *English Language Teaching, 13*(2), 1-15. https://doi.org/10.5539/elt.v13n2p1

Joyce, C., Bull, A., Hipkins, R., & MacIntyre, B. (2008). Putting the nature of science strand into the water cycle. *set: Research Information for Teachers*, (2), 10–15. https://doi.org/10.18296/set.0486

Kao, Y. T. (2022). Exploring translanguaging in Taiwanese CLIL classes: an analysis of teachers' perceptions and practices. *Language, Culture and Curriculum, 36*(1), 100-121. https://doi.org/10.1080/07908318.2022.2033762

Karimi, P., Lotfi, A. R., & Biria, R. (2017). Efficacy of Content and Language Integrated Learning (CLIL) pedagogical techniques in improving aviation students' engagement in attaining specific learning outcomes. *Journal of Teaching English for Specific and Academic Purposes*, *5*(4), 781–794. https://doi.org/10.22190/JTESAP1704781K

Kováčiková, E., & Luprichová, J. (2023). CLIL as the vehicle of transition from mono- to bilingual instruction at Slovak universities. *Journal of Teaching English for Specific and Academic Purposes*, *11*(3), 753–763. https://doi.org/10.22190/JTESAP231003056K

Lasagabaster, D., & Sierra, J. M. (2010). Classroom observation and teachers' perceptions in a CLIL program. *Language Awareness*, *19*(1), 79–97. https://doi.org/10.1080/09658410903464433

Marsh, D. (2012). *Content and Language Integrated Learning (CLIL): A Development Trajectory*. Cambridge University Press. https://core.ac.uk/download/pdf/60884824.pdf

McDougald, J. (2015). Teachers' attitudes, perceptions and experiences in CLIL: A look at content and language. *Colombian Applied Linguistics Journal*, *17*(1), 25-41. http://dx.doi.org/10.14483/udistrital.jour.calj.2015.1.a02

Merriam, S. B. (2009). *Qualitative research: A guide to design and implement.* John Wiley & Sons.

Milla Lara, M., & Casas Pedrosa, A. (2018). Teacher perspectives on CLIL implementation: A within-group comparison of key variables. *Porta Linguarum*, (29), 159–180. https://doi.org/10.30827/Digibug.54032

Moreno de Diezmas, E. (2019). Students, teachers and management teams in bilingual programmes: Shared perceptions and areas for improvement. *Journal of English Studies*, *17*, 277–297. https://doi.org/10.18172/jes.3564

Nguyen, H. T. M., Nguyen, H. T. T., Gao, X., Hoang, T. H., & Starfield, S. (2023). Developing professional capacity for Content Language Integrated Learning (CLIL) teaching in Vietnam: tensions and responses. *Language and Education*, *38*(1), 118–138. https://doi.org/10.1080/09500782.2023.2260374

Nguyen, T. T. H., & Nguyen, T. M. H. (2024). Content and language integrated learning (CLIL) in Vietnam: Challenges and solutions. *VNU Journal of Foreign Studies*, *40*(2), 1-14. https://doi.org/10.63023/2525-2445/jfs.ulis.5246

Pavón Vázquez, V., & Méndez García, M. (2017). Analysing teachers' roles regarding cross-curricular coordination in Content and Language Integrated Learning (CLIL). *Journal of English Studies*, *15*, 235–260. https://doi.org/10.18172/jes.3227

Pérez Cañado, M. L. (2016). Teacher training needs for bilingual education: In-service teacher perceptions. *International Journal of Bilingual Education and Bilingualism*, *19*(3), 266–295. https://doi.org/10.1080/13670050.2014.980778

Pérez Cañado, M. L. (2018a). CLIL and pedagogical innovation: Fact or fiction? *International Journal of Applied Linguistics*, *28*(3), 369–390. https://doi.org/10.1111/ijal.12208

Pérez Cañado, M. L. (2018b). The evolution of bilingual education in monolingual contexts: An Andalusian case study. In P. Romanowski and M. Jedynak (Eds.), *Current Research in Bilingualism and Bilingual Education* (pp. 207–241). Springer. https://doi.org/10.1007/978-3-319-92396-3_12

Piacentini, V. (2021). CLIL and science education: A review for a language focus in science teaching. *Ricerche di Pedagogia e Didattica. Journal of Theories and Research in Education, 16*(3), 1–24. https://doi.org/10.6092/issn.1970-2221/12646

Porcedda, M. E., & González-Martínez, J. (2020). CLIL teacher training: Lacks and suggestions from a systematic literature review. *Enseñanza and Teaching*, *38*(1), 49–68. https://doi.org/10.14201/et20203814968

Romo Escudero, B., & Durán-Martínez, R. (2019). The human factor in Primary bilingual programmes : The management teams' perspective. *Porta Linguarum*, (31), 131–145. https://dialnet.unirioja.es/descarga/articulo/7015460.pdf

Rutgers, D., Admiraal, W., & Westhoff, G. (2020). *The knowledge base of CLIL teaching in multilingual primary education settings*. https://www.teachingenglish.org.uk/sites/teacheng/files/L019_ELTRA_FINAL.pdf

Savic, V. (2010, May). Are we ready for implementing CLIL in primary language classrooms? *British Council Serbia ELTA Newsletter*. http://www.britishcouncil.org/ro/serbia-elta-newsletter-2010-may.htm

Szczesniak, A., & Luna, R. M. (2022). Teachers' perceptions of Content and Language Integrated Learning (CLIL) in primary schools in Andalusia. *Porta Linguarum*, (37), 237–257. https://doi.org/10.30827/portalin.vi37.18414

Trinh, T. T. H. (2023). Promoting gender equality in education in Vietnam currently. *International Journal of Advanced Multidisciplinary Research and Studies*, *3*(1), 22–28. https://www.multiresearchjournal.com/admin/uploads/archives/archive-1702444251.pdf

About the Authors:

Le-Anh-Phuong Bui
Phuong received his Bachelor's Degree in Primary Education with honors from Ho Chi Minh City University of Education (Vietnam) in 2021. In 2025, he earned his Master's Degree in Education with honors from National Dong Hwa University, Taiwan. He is currently pursuing his Doctoral Degree in Education at National Dong Hwa University, Taiwan. He is also a visiting lecturer at the College of Industrial Economics and Technology (COETI), Vietnam. His research interest includes Literacy Education, Writing Instruction, Picture Books and Education, and Technology Integrated Teaching.

Wei-Yu Liu
Wei-Yu Liu is a full professor in the Department of Education and Human Potentials Development at National Dong Hwa University. Her research interests include Multiple Intelligences, Teaching, Teacher Education, and Indigenous Education.

SPECIAL EDUCATION TEACHERS' VIEWS ON TWICE-EXCEPTIONAL PRIMARY SCHOOL STUDENTS' PROBLEMS AND SOLUTIONS

Fatma YILDIRIM

Ph.D., Independent Researcher, Türkiye
ORCID: https://orcid.org/0000-0002-1981-1765
fatmayl1056@gmail.com

Abstract

Twice-exceptional students (2E) exhibit a combination of two distinct conditions. Consequently, 2E students face a dual disadvantage compared to their peers. Throughout primary school, classroom teachers and special education teachers are responsible for supporting 2E students. The opinions of special education teachers regarding the problems and solutions faced by 2E students are particularly valuable. Therefore, the current study aims to reveal the views of special education teachers on the issues of twice-exceptional students, including their challenges and proposed solutions. Regarding the research method, qualitative research and content analysis were used. A total of 71 special education teachers participated in the study. As a result of the research, the special education teachers defined twice-exceptional students in 6 different forms. They generated 20 themes and 360 codes related to the problems and solutions for twice-exceptional students. The problem themes with the highest number of codes were identification problems, lack of teacher training, and lack of education programs. The solution themes are early and detailed identification, psychological and behavioral support, and individualized mixed programs. Based on the research findings, the necessity of early identification, teacher education, and an educational and psychological-behavioral program has emerged. Research findings are discussed within the framework of the relevant literature.

Keywords: Twice-exceptional, special education, student, teacher.

INTRODUCTION

Twice-exceptional students (2E) with special needs are a group who face social, psychological, physical, academic, and career challenges due to having one or more disabilities coexisting with high intelligence or ability, differentiating them from their same-age peers, influenced by environmental and genetic factors (Baykoç, 2017). 2E students require twice as much special education due to the conflict between two opposing situations. 2E students' needs are not clearly identified because their numbers cannot be determined due to the problems associated with one of the two situations (disability or special talent), resulting in inadequate planning of the education they require. The number of students with special needs enrolled in the special education system in Turkey was 17,000 in the 2000s, but this has increased to over 55,000 since 2019 (MFSS, 2021). However, it is unknown what percentage of these students or how many are 2E students. Among the reasons for this uncertainty is the fact that 2E students simultaneously possess two opposite characteristics or mask one another, preventing them from being recognized at school (Reis et al., 2014). Masking and polarity make diagnosis more difficult. These challenges become sharper for 2E students. As a result, 2E students face educational and social difficulties arising from their complex nature (Heward, 2006). Although 2E students with mixed equations are first recognized by their families, it is easier for teachers to identify 2E students because academic development begins in primary school (Speirs-Neumeister, 2024). For this reason, primary school teachers and special education teachers have important responsibilities. This is because teachers have the opportunity to observe and monitor students' socio-academic development closely. However, to be able to observe and evaluate, it is not sufficient to possess only knowledge and experience related to giftedness; one must also have sufficient theoretical and practical knowledge regarding students with special needs (Wang & Neihart,

2015). Another important point is which institutions and teachers are fully responsible for the education of 2E students who have reached primary school level, because 2E students are both the address group of general schools and classroom teachers and belong to the student group of special education schools.

The double discrepancy in 2E students affects many areas, ranging from academic to social spheres, and occurs with a synchronous development followed by environmental and hereditary factors (Gallagher, 2006). Despite their challenges, they are 2E students who perform differently and are very high in one or more areas of intelligence, ability, or creativity (Kaufman, 2018). Characteristics of 2E students can include a wide imagination, experience energy fluctuations, show original and practical thinking, and have high memory power, but also have processing speed and comprehension problems, show high or low academic performance, and have characteristics that overshadow their talent or intelligence (Assouline et al., 2010; Maddocks, 2018). Therefore, most of the teachers have difficulty recognizing 2E students. Because 2E students do not show similar characteristics compared to other students, including students with special needs and gifted students, the teachers do not have enough information about 2E students and do not know how to identify them. Insufficient knowledge and experience also lead to stress and feelings of inadequacy in teachers (Assouline et al., 2007). To address this challenge, teachers need to be adequately equipped for the needs of 2E students. Classroom teachers and special education teachers who have the necessary knowledge and experience regarding 2E students and their education will be an important resource for addressing the problems of 2E students and finding solutions to these problems.

Preschool, classroom, and special education teachers are the teacher groups most likely to encounter twice-exceptional students (Gierczyk & Hornby, 2021; Alameddine, 2025). Because 2E students have both a disability and a unique advantage, coordinated and continuous interaction and cooperation between special education, classroom teachers, and gifted education specialists is essential for the social, behavioral, and academic development of 2E students (Josephson et al., 2018; Tortop & Ilgaz, 2023). The reasons why special education teachers are important for the multidimensional development of 2E students are that, in addition to being experts in the socio-educational needs of students requiring special education, special education teachers also possess knowledge about gifted students, as special education teachers undergo comprehensive training during their years of preparation for teaching (Foley-Nicpon & Teriba, 2022). Moreover, special education teachers also encounter 2E students in special education schools. However, there is no study in the literature that addresses the need to obtain the views and experiences of special education teachers. This gap leaves a deficiency in terms of holistic development and support for 2E students (Foley-Nicpon et al., 2013; King, 2022). Therefore, it is crucial to gather the opinions of special education teachers regarding 2E students. This will ensure that all relevant groups are involved in improving the education of 2E students.

In the vast majority of universities, there are no courses on 2E students in teaching departments, and there are no separate courses on 2E students in special education departments; those universities only teach it as a short unit in special education and gifted education courses. The reason for this is that 2E students have the lowest proportion of 2E students with special needs and are twice as difficult to diagnose (Gierczyk & Hornby, 2021; Randall, 2021). While diagnostic tools and tests are diverse, varying by type of disability, such as learning disabilities, ADHD, autism, and emotional and behavioral disorders, and are based on psychometric measures, tests for higher intelligence, giftedness, and creativity are limited and controversial in scope. In other words, there has not yet been a highly valid assessment tool developed to measure two specific conditions at the same time. This situation weakens the diagnostic process for both parents and teachers (Morrison & Rizza, 2007; Neihart, 2008). In addition to these challenges, regarding the appropriate education for diagnosed 2E students. There is still no consensus in the literature on whether gifted and talented education should be provided (differentiation education) or whether education should be provided to develop aspects of the comorbid disability and to continue education with peers (inclusion-integration education) (King,

2022). Besides identification issues, there is also a lack of clarity about who should help 2E students carry out educational and instructional activities.

There is no specific, established approach to educating 2E students, and they typically attend either regular classes or special education schools. In general classrooms, an Individualized Education Program (IEP) is usually based on the type of disability, while an Enriched Education Program (EEP) is implemented as part of differentiation strategies aimed at developing the intelligence, talent, and creativity of 2E students (MNE, 2012; Gürsel, 2013). No education system systematically combines these two programs. Additionally, there are very few experts in this area because neither school teachers nor special education teachers are sufficiently prepared. Another issue is that crowded classrooms prevent 2E students, who are mainstreamed, from receiving adequate education (Cansız & Bayar, 2024). Moreover, special education teachers working in special education institutions serve students with various disabilities, which also limits the quality of education these students receive. There is an ongoing dilemma about which institutions and professionals should meet the educational needs of 2E students (Bianco, 2005). However, both classroom teachers and teachers responsible for gifted and talented education and special education teachers need to be involved in educating 2E students. Additionally, an individualized education program is often not developed in collaboration with the school counselor. Working closely with special education teachers is crucial in providing appropriate instructional activities and helping 2E students reach their full potential in the areas where they need support (Foley-Nicpon & Assouline, 2015; Renzulli & Gelbar, 2020). Despite this recognized need, the role of special education teachers in the education of 2E students has been largely overlooked, with this responsibility falling mostly on classroom teachers. However, the education of 2E students is based on cooperation between educational institutions, with contributions from teachers from various fields, classroom teachers, and special education teachers.

Twice-exceptional students are distinguished from their peers by personality, learning style, and development. They exhibit two extreme sets of traits, which coexist like positive and negative poles. 2E students have special needs in one or more areas, such as reading difficulties, attention deficits, and behavioral disorders, along with exceptional talent, giftedness, or creativity (Klingner, 2022). Generally, 2E students continue their education in mainstream settings as part of inclusion practices. Some 2E students attend special education institutions. Classroom teachers are primarily responsible for educating 2E students in mainstream environments, while special education teachers manage their education in specialized settings (Mayes & Moore, 2016). Special education teachers play a significant role in overcoming the psychosocial behavioral problems of 2E students, as special education teachers possess the necessary knowledge and experience in behavioral intervention strategies and methods (Buică-Belciu & Popovici, 2013; Austermann et al., 2024). In addition, special education teachers face many problems about what to do with students whom they think are twice different (Jolly & Barnard-Brak, 2024). Despite these problems, the opinions of special education teachers working in special education subclasses and special education institutions about 2E students have not been taken. Therefore, the current research relies on the perspectives of special education teachers regarding the challenges faced by 2E students and their potential solutions. It is predicted that the results will contribute to the service quality of the education to be given to 2E students.

Theoretical Background of the Study

This study is grounded in the theories of inclusive education and the shared responsibility model. Inclusive education is an approach designed for twice-exceptional students, that emphasizes the full participation of all students, including those who are twice-exceptional (Rapp & Corral-Granados, 2021). Since this research focuses on the perspectives of special education teachers regarding twice-exceptional students, it adopts the shared responsibility framework. The shared responsibility model emphasizes that stakeholders involved in teaching collaborate and share accountability for all outcomes that may occur (Hawes, 2004; Unda et al., 2021). Although considered a relatively new model, the significance of this approach dates back several years. Will (1986) highlighted the need to develop shared responsibility for twice-exceptional students, who sit at the intersection of two types of education that often do not fully benefit from either inclusive or special education, citing

contributions from various experts. Therefore, special education teachers are clearly among the key educational stakeholders responsible for the education and support of twice-exceptional students. Research also indicates that, in terms of cooperation and responsibility, special education teachers tend to have more positive attitudes toward inclusive education compared to other teachers (Alabdallat et al., 2021; MacNeil et al., 2023). Within the framework of shared responsibility, the perspectives and responsibilities of special education teachers toward twice-exceptional students will play a vital role in their education and the challenges they face. This study underscores the importance of special education teachers' awareness of twice-exceptional students and their significant role within a model of shared responsibility.

Research Statements

1. What are the views of special education teachers on who 2E students are?
2. What are the views of special education teachers on the problems of 2E students?
3. What are the views of special education teachers on the solutions to the problems faced by 2E students?

METHOD

Research Design

A qualitative research method was employed. Qualitative research involves a detailed and direct exploration of individuals' experiences, recognizing that each person may perceive events or situations differently. In this context, a phenomenological perspective was used as one of the techniques in interviews (Yıldırım & Şimşek, 2016). The phenomenological approach investigates a phenomenon from multiple perspectives, based on the lived experiences that shape an individual's understanding, particularly when the nature of that phenomenon is not fully clear (Wilson, 2015). Content analysis served as the data analysis method. Content analysis involves translating abstract thoughts and personal experiences into concrete, analyzable categories (Patton, 1990). Purposive sampling was chosen to align with this method. This sampling techniqueprovides access to individuals with rich experiences and offers greater flexibility to the researcher (Marshall & Rossman, 2014). Questions prepared in consultation with special education experts in accordance with content analysis were presented to participants using interview techniques. The interview technique is a qualitative method that captures both intellectual and emotional knowledge and experiences (Patton, 1990). The participating special education teachers were listed as ÖÖ2E1......ÖÖ2E71. Demographic questions covered the institutions where they work, their encounters with 2E students, their knowledge about 2E students, sources of information regarding twice-exceptional students, and their interest in receiving training 2E students.

Participants

The research used purposive sampling and involved special education teachers working at the Ministry of National Education Special Education Practice School, special education sub-classes in general education schools, and those in special education and rehabilitation affiliated with the Ministry. During data collection, participants were told about the research and its content. They were assured thatthat the data would be used only for scientific purposes and that participation was voluntary. In total, 71 special education teachers participated in the study.

Table 1. Participants

Variables	n	%
Schools		
Special Education Practice School	46	64.8
Special Education Classroom in a General School	16	22.5
Special Education And Rehabilitation Centers	9	12.7
Total	71	100
Gender		
Female	36	50.7
Male	35	49.3
Total	71	100

Table 1 shows that the teachers working in Special Education Practice Schools is 46 (64.8%), the number of teachers working in special education subclasses in General Schools is 16 (22.5%), and the number of teachers working in Special Education and Rehabilitation Institutions is 9 (12.7%), and the number of female special education teachers is 36 (50.7%) and the number of male special education teachers is 35 (49.3%).

Data Analysis

The interview technique is a key method in qualitative research, used to uncover individuals' knowledge and experiences through oral or written communication (Berg & Lune, 2015). The interview questions were developed based on a literature review and then refined with input from two experts in the special education department. Their feedback was incorporated, and the revised questions were used in the study. A pilot study was conducted with four field teachers using semi-structured questions. Their feedback confirmed that the questions were clear and precise. Subsequently, interviews were conducted with other special education teachers.

In content analysis, the two primary stages involve identifying themes and codes. The interview data were analyzed in their original form without modifications, as this method prioritizes representing participants' thoughts authentically. However, by maintaining the cause-and-effect relationship, comments were made in line with scientific principles, which contributed to the validity of the research. The codes derived from the opinions of special education teachers were grouped into various themes. This approach helps collect shared codes under a theme and represent the whole, supporting internal consistency (Yıldırım & Şimşek, 2016). To enhance reliability, two independent researchers were asked to recode a sample of the data. The percentage of consistency was calculated using the formula P = Na * 100 / Nt, where the number of matching codes is Na, and the total number of items is Nt. A reliability coefficient above 70% is considered acceptable (Miles & Huberman, 1994). In this study, the inter-coder reliability was calculated to be 85.2%, indicating a satisfactory level of consistency.

RESULTS

Table 2 presents data on special education teachers' prior experiences with 2E students, their self-reported level of knowledge, their sources of information on the topic, and their willingness to participate in 2E training.

Table 2. Distribution of information on 2E students.

Variables	n	%
The situation of encountering twice-exceptional students		
Yes	41	57.8
No	30	42.2
Information status regarding a twice-exceptional student		
Yes	68	95.8
No	3	4.2
Sources of information about twice-exceptional students		
University	55	77.5
Ministry of National Education-MNE (course, seminar)	4	5.6
Personal research	9	12.7
Media	3	4.2
Request to receive educatşon on twice-exceptional students		
Yes	65	91.5
No	6	8.5
Total	71	100

Analysis of Table 2 reveals that, 57.8% of the special education teachers reported having encountered 2E students, and 42.2% reported they had not. When the knowledge about Twice 2E students is analyzed, 95.8% of the teachers stated that they had the knowledge, and 4.2% stated that they did not have any knowledge. Regarding the sources of this information, 77.5% of the participants reported university, 12.5% personal research, 5.6% MNE, and finally 4.2% media. When asked about their

desire to receive training on 2E students, 91.5% expressed a desire for training, compared to 8.5% who did not.

Analysis of Table 3 shows that special education teachers described 2E students in multiple ways.

Table 3. Special education teachers' views on who 2E students are.

Variables		n	%
Identification	Giftedness+Learning Difficulties	12	16.9
	Giftedness+ADHD	11	15.5
	Giftedness+ Autism	8	11.3
Type of Disability	Giftedness + Emotional and Behavioral Disorder	4	5.6
	Giftedness + Learning Disability + ADHD + Autism	20	28.2
	Giftedness + Others (Disabilities et al.)	16	22.5
	Total	71	100

Note: Special Talent + Others: Special ability and one disability (no definition of which disabilities)

Table 3 is examined, 28.2% of the special education teachers described their 2E students as Giftedness + Learning Disability + ADHD + Autism, 22.5% as giftedness + a disability (disability type was not defined), 16.9% as Giftedness + Learning Disability, 15.5% as Giftedness + ADHD, 11.3% as Giftedness + Autism, and 5.6% as Giftedness + Emotional and BehavioralDisorder. Sample statements are given below:

ÖÖ2E1. "These students are gifted and have learning disabilities; students with giftedness and learning disabilities are an example."

ÖÖ2E5. "2E students are those who have both giftedness and a disability."

ÖÖ2E10. "Gifted and Attention Deficit, which we define as 2E students"

ÖÖ2E15. "They are students who twice-different, such as hyperactivity, learning disability, autism, and asperger's syndrome. We can accept individuals diagnosed with at least two of these as individuals who differ from their normal peers."

ÖÖ2E20. "Students who can experience both giftedness and ADHD, etc., at the same time, they have developed logical and analytical thinking skills."

ÖÖ2E25. "Such students form a unique group due to their strengths and difficulties. They may have social and emotional problems, so their differences may not be understood, and they may be excluded because these aspects are underdeveloped."

ÖÖ2E30. "2E students are gifted and 2E students such as attention deficit hyperactivity, learning disabilities, autism, and asperger's syndrome. We can accept them as individuals diagnosed with at least two of these and who differ from their normal peers."

ÖÖ2E35. "Twice exceptional students a concept used for gifted individuals who have difficulties such as specific learning disability, attention deficit hyperactivity disorder, or autism spectrum disorder. 2E students need to be supported both in areas where they are gifted and in areas where they have deficiencies."

ÖÖ2E40. "Gifted students are accompanied by an additional disorder or difficulty."

ÖÖ2E 50. "It refers to students who possess both giftedness and disability."

ÖÖ2E55. "It refers to individuals who are gifted but also have a different disability. For example, individuals who are gifted in addition to their disabilities, such as hyperactivity, specific learning, and autism."

ÖÖ2E60. "Gifted and high-functioning students with autism or another condition."

Table 4 presents the views of special education teachers on the problems faced by twice-exceptional students.

Table 4. Special education teachers' views on the problems of 2E students.

Themes	Codes
Identification	Identification problem (23)
Psychological and Behavioral	Behavioral problem (10), social-communication problem (10), ostracism (9), adaptation problem (7)

Table 4 (Continued). Special education teachers' views on the problems of 2E students.

Themes	Codes
Academic	Masking (10), focusing problems (8), failure (8), low self-esteem (5), labeling (5), motivation (2)
Program	Inadequacy of the education program (11), intervention program (3), and Educational support (3)
School	Placement in an appropriate school (6), educational environment (5), school management (2), inadequacy of classrooms (1)
Teacher	Lack of Education (19)
Tools-Equipment-Materials	Insufficient educational tools (5), lack of resources (3)
Assessment	Inadequacy of evaluation methods and tools (4), Lack of follow-up (5)
Familial and social	Poor awareness (12)
Guidance and Research Center-GRC	Insufficient diagnosis (4)
Total	180

From the opinions of special education teachers, 10 themes and 180 codes were derived from the opinions of special education teachers regarding the problems faced by 2E students. The most frequently coded issue was identification problems (23 codes). Within the theme of psychological and behavioral problems, codes included behavioral problems (10) and social and communication problems (10). In the academic problems theme, codes included masking (10), focusing issues (8), and failure (8). The program problems theme highlighted the inadequacy of the education program (11). The school problems theme included issues with appropriate school placement (6), while the teachers' problems theme pointed to a lack of proper teacher training (19). Insufficient educational tools (5) and lack of follow-up (5) were coded under evaluation problems, poor awareness (12) related to family and social problems, and finally, inadequate diagnosis (4) was coded under problems related to GRC. The opinions of special education teachers regarding the problems of 2E students are provided below.

ÖÖ2E2. "2E students can be difficult to recognize because their giftedness can mask their learning difficulties and vice versa. Early diagnosis and accurate assessment processes are important for teachers to unlock these students' full potential. Without a diagnosis, the needs of 2E students may be overlooked or misinterpreted."

ÖÖ2E8. The education of 2E students should be individually assessed in detail, and the teaching plans and process should be determined accordingly. Gifted individuals can perform many skills in the process by using their practical intelligence, but we may not be able to comprehend the co-existing difficultiesin these individuals due to this (masking). Therefore, the teaching process should be handled with detailed evaluations and instruction."

ÖÖ2E14. "A special education teacher is alone insufficient to realize the potential of 2E students. This situation leads to different psychological problems such as anxiety, inadequacy, and depression in 2E students."

ÖÖ2E21. "Generally, special education teachers do not have much knowledge on this subject because in universities we are given limitedinformation about these issues, that is, about 2E students."

ÖÖ2E27. "2E students need to be diagnosed and receive appropriate educational support. However, there is no common consensus on how to manage thisprocess. Teacher training programs on this subject are limited. The course programs of universities are insufficient for the education of 2E students. If the number of courses is increased, more competent teachers can be trained in the education of 2E students."

ÖÖ2E33. "When gifted 2E students do not receive education according to their levels and fields from the family and the school, they blunt their talents and exhibit problem behaviors. The reasons for problem behaviors in 2E students are: lack of knowledge of the family about 2E students, lack of materials according to the child's level and special talent area, lack of knowledge of the environment, and the educator."

ÖÖ2E46. Since 2E students show giftedness on the one hand, these aspects need to be strengthened, and the aspects in which they show inadequacies need to be strengthened. The CRC report may be insufficient to identify 2E students. For this, it is necessary to spend more time on measurement and evaluation."

ÖÖ2E51. "The education process of 2E students can be more difficult than others, for example, each diagnosis has its own educational requirements, you made your education plan according to ADHD, but if the child has a special talent, then you will have difficulty in providing education, and this will also be hard for the child, who may not receive the support they need. Therefore, both diagnoses should be taken into consideration when planning education, which makes your job very difficult."

ÖÖ2E56. "On one hand, since they show giftedness, these aspects need to be strengthened, and the aspects in which they show inadequacy need to be strengthened. The CRC report may be insufficient to identify 2E students. For this, it is necessary to spend more time on measurement and evaluation. Teachers from different branches can give lessons for this."

ÖÖ2E62. "There is no clear, dedicated program for these individuals. There are generally programs for gifted individuals or individuals with learning deficits."

ÖÖ2E68. "I think it is a problem that they generally focus on one area. When they focus on their abilities, their disabilities are in the background. When we focus on the disability, the ability remains in the background. Therefore, a dual program should be implemented, that is, IEP and ZEP together."

ÖÖ2E69. "First of all, there are problems with the diagnosis and placement of 2E students. Problems arise when students who are referred to GRCs do not receive the correct diagnosis, for example, when they are diagnosed only as gifted and special learning disabilities, or attention deficits are not recognized. When a student is identified as gifted, the family, environment, and teachers may have high expectations for the student, especially academically, and leading to disappointmentwhen the student fails to perform as expected. Another problem is that even if they receive the correct diagnosis, the correct placement is not or cannot be made. Students may be placed as general school students even though they are 2E students. This situation is more common in rural districts, and the reason given for this is the lack of schools and special subclasses suitable for 2E students in the district. "

Table 5 presents the views of special education teachers regarding the solutions to problems experienced by 2E students.

Table 5. Special education teachers' views on the solution of problems faced by 2E students.

Themes	Codes
Identification supports	Supporting Identification and detailed diagnosis (20)
Psychological and Behavioral supports	Social, emotional, and behavioral support (14)
Scientific Study, Faculty of Education Courses, GRC support	Course for faculty of education departments (9), Consistency of GRC identification (4)
Program supports	Special mixed program (16), IEP (8), EEP (8), intervention program (2), project-based education (1)
School supports	Re-school placement (5), comprehensive guidance and counseling (5), reorganization of educational environments (3), out-of-school social activity (1), Special subclass (6), integration (4), co-teaching classes (1), and flipped classroom (1)
Teacher supports	Teacher education (12), in-service education (6), expert teacher (5), collaboration between teachers (3), mentoring (1), Adaptation (2)
Tools-Equipment-Material support	Special material (4), source diversification (2), scientific evidence-based method (1)
Assessment support	Continuous and regular assessment (9)
Collaboration and awareness	Family (11), school administration (5), society (5), school administration (5)
Legislative support	Legal regulation (1)
Total	180

Table 5 categorizes the proposed solutions from special education teachers into 10 themes derived from 180 codes. In the identification supports theme, supporting identification and detailed diagnosis (20); in the psychological and behavioral support theme, social, emotional, and behavioral support (14); in the scientific study theme, faculty of education courses, GRC support, and courses for Education Faculty departments (9); in the program support theme, a special mixed program (16); in the school support theme, re-school placement (5); in the teacher support theme, teacher education (12); in the tools-equipment-material support theme, special materials (4); in the assessment support theme, continuous and regular assessment (9); in the collaboration and awareness theme, family involvement (11); and as the final theme, legislative support and legal regulation (1). The statements are provided below:

ÖÖ2E3. "2E students learn faster than their peers and may have different interests in addition to a type of disability. Therefore, personalized and enriched education programs should be implemented instead of standard curricula. Instead of traditional teaching methods, more flexible and student-centered approaches should be used for these students: Project-Based Learning: Students can be encouraged to prepare projects to solve real-world problems. Flipped Classroom: Students can learn the lesson at home and apply it in the classroom. Mentoring Programs: Opportunities to work one-to-one with experts in the field can be provided."

ÖÖ2E7. Their education should continue with a program prepared individually according to the situation in which their giftedness/talent and diagnosis of disability are reflected in their performance. At the same time, it should be ensured that they are educated in general education classes with necessary adaptationsin the educational environment and materials rather than being separated from their peers."

ÖÖ2E21. "Reverse mainstreaming and integration practices can be used. For this, the teachers' options need to come from different branches."

ÖÖ2E28. "Individualization, diversity, and enrichment curriculum should be applied for the education of 2E students. Providing emotional and social support to 2E students."

ÖÖ2E37. "In the education of 2E students, the skills that 2E students are superior in and the areas where they show inadequacy should be supported, and the necessary social-behavioral intervention program should be applied."

ÖÖ2E42. "Since 2E students have some problems due to being misunderstoodin society, teachers should adapt instructionto meet the needs of 2E students after the educational diagnosis is received, but I think that teachers are in a difficult position due to factors likesome technology and environmental influences, I think that the training teachers have already received is insufficient, and I think that the family and other branch teachers in cooperation with the family and other branch teachers being responsible for this education will provide a higher level of benefit to the individual."

ÖÖ2E49. "More detailed assessment and evaluation tools should be developed for the identification of 2E students. Schools and special subclasses equipped for 2E students should be opened throughout the country (including districts) so that students can be placed in appropriate schools or special subclasses. In-service training can be provided for special education teachers to ensure that 2E students receive a good education. Special education teaching departments of universities should increase the number of courses on the education of 2E students. Studies can be conducted on sample teaching programs for 2E students. Awareness campaigns can be conducted for families, teachers, and school administrations on the education of 2E students. Special education teachers, school psychological counselors, and family cooperation should be ensured in psychological problems experienced by 2E students in schools."

ÖÖ2E56. "In the education of 2E students, the skills that 2E students are superior in and the areas where they show inadequacy should be supported, necessary interventions should be made, and environmental adaptations should be made for 2E students. Teachers who will teach 2E students should be in cooperate with the family."

ÖÖ2E63. Teachers should be involved in education programs. IEPs should be prepared, and guidance and psychological counseling services should be provided."

ÖÖ2E69. "Social Skills Development training can be given to mitigate the risk of difficulty in peer relationships and exclusion. Low self-confidence, social isolation, and emotional ups and downs may occur. In this case, individual or group guidance should be provided to meet the emotional needs of the child. With Peer, the child can come together with 2E students with similar characteristics, where they can express themselves more easily.

Emotional Awareness Training should be provided to help 2E students accept their strengths and weaknesses. The curriculum should be adapted by enriching the areas where the child is strong and supporting the areas where the child has difficulties. Differentiated teaching methods should be used, taking into account the learning style of the child (for example, audio-visual materials, applied learning.”

ÖÖ2E71. “2E students should be identified with the appropriate education system, and their educational support should be provided with the appropriate education system. Since there is no clear program for these individuals, a study should first be conducted to determine the boundaries of the program. A rich educational environment should be prepared according to the classroom environment and materials used. In addition, the personnel who will make a diagnosis about 2E students in the GRC should be have specific expertise in twice-exceptionality.”

DISCUSSION, CONCLUSION, and SUGGESTIONS

The purpose of this study is to obtain the opinions of special education teachers regarding twice-exceptional students. Although the giftedness aspect of 2E students may develop without special intervention, special education teachers are needed in areas where they have special needs, such as learning difficulties, hyperactivity, or high-functioning autism (Hughes, 2019). Moreover, the issue of which school and which teacher develop twice-exceptional students is ambiguous, and existing research has predominantlyfocused on classroom teachers and inclusive and integrative education practices (Şentürk et al., 2022). The specific role of special education teachers largely overlooked and under-researched (Gierczyk & Hornby, 2021). Therefore, the opinions of special education teachers regarding 2E students play a significant role in contributing to the holistic development of 2E students.

The results of the current research reflect this context. As a result of the research, it has been observed that special education teachers possess knowledge about who 2E students are. Specifically, they generally understand learning difficulties, attention deficit hyperactivity disorder, and autism that can accompany special talents and giftedness. The teachers also frequently noted that learning difficulties and attention deficit hyperactivity disorder often occur alongside special gifts in giftedness. Based on this, it was assumed that special education teachers know who 2E students are. In his study with special education teacher candidates, Erdimez (2023) found that these candidates were able to identify gifted students. In contrast, most studies involving general education teachers have found that they often struggle to identify 2E students (Kaya, 2015; Weber et al., 2023; Beumann et al., 2025). The reason for this difference between general school teachers and special education teachers is that general school teachers acquire their knowledge about special education from short courses organized by the Ministry of National Education, while special education teachers acquire knowledge about special education and gifted students through both compulsory and elective courses in their departments at university; in other words, they are trained as specialists in the field (Hernandez et al., 2016; Tortop & Agaoglu, 2022). Given these findings, it is clear that special education teachers can play a crucial role in identifying and supporting 2E students. Therefore, active involvement of special education teachers in the education and behavioral intervention strategies for 2E students in both general and special education schools can significantly aid in their development (Zigmond et al., 2024; Reis & Renzulli, 2025).

Special education teachers identified the primary problems faced by 2E students as, first, identification challenges and, second, deficiencies in teacher training. The identification issue of 2E students is the most studied area in the literature (Baum et al., 2014; Weber et al., 2024). This is because the concept of twice-exceptional is unclear; in other words, there is no consensus on the definition of the term twice-exceptional. Other reasons include problems such as the use of uniform assessment tools, issues with the reliability and validity of diagnostic tools, and delays in diagnosis caused by masking (Gilman et al., 2013; Villanueva & Huber, 2019). Inadequate teacher training, along with the fact that teachers lack sufficient knowledge and experience and rely on traditional labels (Bianco & Leech, 2010), contribute to the problem. Therefore, teachers need to enhance their theoretical and practical competencies to ensure early identification and support for 2E students (Firat & Bildiren, 2022). Teachers' engagement in research, their academic preparation, and ongoing

professional development are factors that can increase their awareness of 2E students. Additionally, two other groups that need to enhance their knowledge and awareness are family and society (Dare & Nowicki, 2015). For this reason, increasing awareness among families and the social environment of 2E students is essential.

Special education teachers emphasized the importance of early and detailed diagnoses in addressing the challenges faced by 2E students. The primary obstacle to early identification is the coexistence of giftedness and disability, which complicates diagnosis for students attending school. Additionally, giftedness and disability can mask each other, and low awareness among professionals and society often leads to these conditions being dismissed as myths (Townend & Brown, 2016; Baum & Schader, 2021). Clues for early identification include symptoms observable at a young age, such as early speech development, intelligence scores, and morning urine control (LeBeau et al., 2022). The current research findings indicate that special education teachers' proposedsolutions align with the literature. Solutions proposed include detailing the identification of 2E students and diversifying diagnostic methods, providing emotional and behavioral support, and creating appropriate, specialized, and differentiated programs for 2E students. Early detection provides valuable information about social and behavioral issues and facilitates timely intervention programs. Another area of concern in 2E students involves emotional and behavioral adjustment problems (Speirs Neumeister, 2024). Detecting these issues early allows for the implementation of targeted support programs. Support in these areas helps 2E students overcome academic and adjustment challenges (Gómez-Arízaga & Conejeros-Solar, 2021). An additional effective strategy is the implementation of a blended education program. This study highlights that a new blended approach is essential for educating 2E students.

Typically, two types of programs are recommended for 2E students: IEP (Individualized Education Program, for disabilities) and EEP (Enriched Education Program, for giftedness) (Pamungkas et al., 2023). However, these programs are difficult for teachers to implement alone because they involve separate procedures, require specialized teachers, and demand extra time. This situation calls for a new differentiated program, combining elements of both IEP and EEP (Gierczyk & Hornby, 2021). Developing and implementing such a program requires collaboration among special education teachers, classroom teachers, psychological and guidance counselors, school administrators, and families (Assouline & Whiteman, 2011). Recognizing, diagnosing, and educating 2E students necessitates close cooperation and consistency. While collaboration occurs with families, schools, and the community, consistency must be maintained between child and adolescent psychiatry in hospitals and guidance and research center services (Flowers et al., 2018). This coordinated effort has a critical impact on educational development. However, the study by Alabdallat and colleagues (2021) shows that there is very little agreement and cooperation between school teachers and special education teachers. This situation weakens the implementation of joint educational and intervention programs. Therefore, encouraging and increasing internal collaboration between general school teachers and special education teachers will contribute to the education of 2E students and the resolution of their problems in a lasting and sustainable way. It is also very beneficial to seek help from subject teachers, as 2E students need education in multiple areas. Therefore, teachers with 2E students can also receive assistance from classroom and subject teachers regarding differentiated and enriched education as a sub-application.

Conclusion

This study gathered the perspectives of special education teachers regarding the complex needs of Twice-Exceptional (2E) students, highlighting a significant gap between teacher awareness and systemic preparedness. The vast majority of participants (95.8%) reported having knowledge of 2E profiles, yet an equally high percentage (91.5%) expressed a strong need for specialized professional training, currently provided mostly at the university level. Importantly, teachers most often identified and reported the necessity of complex typologiesfor 2E students, with Giftedness + Learning Disability + ADHD + Autism being the most common combination (28.2%). This widespread presence of complex typologies underscores the challenges faced by current educational systems. Qualitative results identified identification issues as the primary systemic barrier, followed closely by

significant concerns in the psychological and behavioral domains. These concerns are directly linked to reported gaps in existing educational programs and a notable lack of focused teacher training. Consequently, suggested solutions focused on improving detailed and specialized diagnosis, implementing combined educational programs, and providing mandatory, targeted teacher support and training. Overall, this research confirms that effectively supporting the layered, multi-diagnostic needs of 2E students necessitates a move toward comprehensive system reform, beginning with the development of standardized, multi-dimensional identification protocols that recognize the diversity of 2E profiles.

Suggestions for Researchers

Future research should move beyond the perceptions of special education teachers to address the current limitations in understanding Twice-Exceptional (2E) students. Adopting a multi-stakeholder approach that includes general classroom teachers, parents, and 2E students will provide a more comprehensive understanding of the challenges involved. Studies should use mixed-methods designs, using qualitative insights to develop and validate quantitative instruments . This approach will enhance the generalizability of findings and improve the measurement of key issues, such as identification challenges and gaps in teacher training. Furthermore, research should focus on evaluating the outcomes and implementation fidelity of individualized, mixed programs, rather than relying solely on stakeholder opinions.

Suggestions for Practitioners

In addition to fostering collaboration between special education and classroom teachers for the educational growth of 2E students, opinions and information should also be gathered from preschool teachers, even though compulsory education is not a focus in Turkey. This way, the identification and resolution of issues faced by 2E students can be tracked by educational professionals throughout the process. Special education teachers can contribute to behavior interventions, particularly in collaboration with field teachers and the school counseling service, depending on the school and level of the 2E students.

Limitations

This study, while offering significant depth by exploring the views of special education teachers on twice-exceptional (2E) students, is subject to several limitations inherent to its qualitative design. The reliance on content analysis of self-reported views restricts the scope, as it does not capture the teachers' actual classroom behaviors, real-time interactions, or tacit professional knowledge in practice. These limitations should be carefully considered when interpreting the study's conclusions and informing future research efforts.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics and Conflict of Interest

Ethical approval was given for the research by the Atatürk University Educational Sciences Unit Ethics Board with (the meeting number: 12/29, and decision number: E-56785782-050.02.04-2400002251) approved this study dated 28.12.2023. The research was conducted in strict adherence to the principles of voluntary participation, participant confidentiality, and informed consent, and data were used exclusively for scientific purposes. The author declares that they acted in accordance with ethical rules in all processes of the research. The author declares that there is no potential conflict of interest in the work.

Data availability

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

Corresponding Author

Correspondence to Fatma YILDIRIM, fatmayl1056@gmail.com

REFERENCES

Alabdallat, B., Alkhamra, H., & Alkhamra, R. (2021). Special education and general education teacher perceptions of collaborative teaching responsibilities and attitudes towards an inclusive environment in Jordan. *Frontiers in Education, 6*(1),1-11, https://doi.org/10.3389/feduc.2021.739384

Alameddine, M. M. (2025). What can educators do to accommodate twice-exceptional learners in Lebanon: a case study. *South Florida Journal of Development, 6*(1), e4899. https://doi.org/10.46932/sfjdv6n1-009

Assouline, S. G., & Foley-Nicpon, M. (2007). Twice-exceptional learners: Implications for the classroom. *NAGC Communiqué Teaching for High Potential*, Spring, 9–13.

Assouline, S. G., Foley Nicpon, M., & Whiteman, C. (2010). Cognitive and psychosocial characteristics of gifted students with written language disability. *Gifted Child Quarterly, 54*(2), 102-115. https://doi.org/10.1177/0016986209355974

Assouline, S., & Whiteman, C. (2011). Twice-exceptionality: Implications for school psychologists in the post-IDEA 2004 area. *Journal of Applied School Psychology, 27*(4), 380-402. https://doi.org/10.1080/15377903.2011.616576

Austermann, Q., Reis, S. M., & Delgado, J. (2024). Evidence-based ınstructional practices for twice-exceptional students with autism. *Gifted Child Quarterly, 69*(1), 34-48. https://doi.org/10.1177/00169862241285151

Baum, S. M., & Schader, R. M. (2021). *Twice-exceptionality: a field whose time has come in Understanding twice-exceptional learners,* London: Routledge, 7–31.

Baum, S. M., Schader, R. M., & Hébert, T. P. (2014). Through a different lens: Reflecting on a strengths-based, talent-focused approach for twice-exceptional learners. *Gifted Child Quarterly, 58*(4), 311-327. https://doi.org/10.1177/0016986214547632

Baykoç, N. (2017). *Children with special needs and special education.* Ankara: Eğiten Kitap Publishing.

Berg, B. L., & Lune, H. (2015). *Qualitative research methods in the social sciences* (Translator, Aydın H.). Konya: Educational Publishing House.

Beumann, S., Weber, D., & Benölken, R. (2025). Identifying and fostering giftedness in students with disabilities – potential barriers in ıdentification and support from a mathematics educational perspective. *International Journal of Science and Mathematics Education*. https://doi.org/10.1007/s10763-025-10587-2

Bianco, M. (2005). The effects of disability labels on special education and general education teachers' referrals for gifted programs. *Learning Disability Quarterly, 28*(4), 285-293. https://doi.org/10.2307/4126967

Bianco, M., & Leech, N. L. (2010). Twice-exceptional learners: Effects of teacher preparation and disability labels on gifted referrals. *Teacher Education and Special Education, 33*(4), 319-334. https://doi.org/10.1177/0888406409356392

Bonti, E., & Sofologi, M. (2022). Rethinking inclusion of gifted and twice-exceptional 2E students. In M. Efstratopoulou (Ed.), *Rethinking Inclusion and Transformation in Special Education.* IGI Global. https://doi.org/10.4018/978-1-6684-4680-5.ch002

Buic•-Belciu, C., & Popovici, D. V. (2014). Being twice exceptional: Gifted students with learning disabilities. Procedia-*Social and Behavioral Sciences, 127*, 519-523. https://doi.org/10.1016/j.sbspro.2014.03.302

Cansız, M., & Bayar, A. (2024). Problems and solutions faced by teachers with inclusive students in their classrooms. *Eurasian Journal of Social and Economic Research (EJSER), 11*(3), 88-106. https://dergipark.org.tr/tr/pub/asead/issue/86477/1485833#article_cite

Dare, L., & Nowicki, E. A. (2015). Twice-exceptionality: Parents' perspectives on 2E identification. *Roeper Review, 37*(4), 208–218. https://doi.org/10.1080/02783193.2015.1077911

Erdimez, Ö. (2023). Pre-service special education teachers' perceptions of giftedness. *ATLAS Journal International Refereed Journal on Social Sciences, 9*(52), 83-94. https://doi.org/10.5281/zenodo.10298234

Firat, T., & Bildiren, A. (2022). The characteristics of gifted 2E students with learning disabilities according to preschool teachers. *Early Years, 43*(4–5), 921–937. https://doi.org/10.1080/09575146.2022.2034755

Flowers, C., Test, D. W., Povenmire-Kirk, T. C., Diegelmann, K. M., Bunch-Crump, K. R., Kemp-Inman, A., & Goodnight, C. I. (2018). A demonstration model of ınteragency collaboration for students with disabilities: A multilevel approach. *The Journal of Special Education, 51(4),* 211-221. https://doi.org/10.1177/0022466917720764

Foley-Nicpon, M., & Teriba, A. (2022). Policy considerations for twice-exceptional students. *Gifted Child Today, 45*(4), 212-219. https://doi.org/10.1177/10762175221110943

Foley-Nicpon, M., Assouline, S. G., & Colangelo, N. (2013). Twice-exceptional learners: Who needs to know what? *Gifted Child Quarterly, 57*(3), 169-180. https://doi.org/10.1177/0016986213490021

Gallagher, J. (2006). *The twice-exceptional dilemma.* Washington, DC: National Education Association.

Gierczyk, M., & Hornby, G. (2021). Twice-exceptional students: Review of implications for special and inclusive education. *Educ. Sci., 11*(1), 85. https://doi.org/10.3390/educsci11020085

Gilman, B. J., Lovecky, D. V., Kearney, K., Peters, D. B., Wasserman, J. D., Silverman, L. K., Postma, M. G., Robinson, N. M., Amend, E. R., Ryder-Schoeck, M., Curry, P. H., Lyon, S. K., Rogers, K. B., Collins, L. E., Charlebois, G. M., Harsin, C. M., & Rimm, S. B. (2013). Critical issues in the identification of gifted students with co-existing disabilities: The twice-exceptional. *Sage Open, 3*(3). https://doi.org/10.1177/2158244013505855

Gómez-Arízaga, M. P., & Conejeros-Solar, M. L. (2021). Gifted and twice-exceptional 2e students in the South of the World: Chilean students' experiences within regular classrooms. In: Smith, S.R. (eds) Handbook of Giftedness and Talent Development in the Asia-Pacific. *Springer International Handbooks of Education.* Springer, Singapore. https://doi.org/10.1007/978-981-13-3041-4_8

Gürsel, O. (2013). *Students with special educational needs and special education* (Ed. H. İbrahim Diken). Ankara: Pegem Academy.

Hawes, J. M. (2004). Teaching is not telling: The case method as a form of interactive learning. *Journal for Advancement of Marketing Education, 5(1),* 47-54. https://doi.org/10.63963/001c.150425

Hernandez, D. A., Hueck, S., & Charley, C. (2016). General education and special education teachers' attitudes towards inclusion. *Journal of the American Academy of Special Education Professionals, 11*(3), 79-93. https://doi.org/10.64546/jaasep.318

Heward, W. L. (2006). *Exceptional 2E students: An introduction to special education*. New Jersey, NJ: Pearson Education.

Hughes, C. E. (2019). Targeted professional learning for twice-exceptional students: A double target. In A. M. Novak & C. L. Weber (Eds.), *Best practices in professional learning and teacher preparation: Special topics for gifted professional development*. Prufrock Press Inc.

Jolly, J. L., & Barnard-Brak, L. (2024). Special education status and underidentification of twice-exceptional students: insights from ECLS-K data. *Education Sciences, 14*(10), 1048. https://doi.org/10.3390/educsci14101048

Josephson, J., Wolfgang, C., & Mehrenberg, R. (2018). Strategies for supporting students who are twice-exceptional. *The Journal of Special Education Apprenticeship, 7*(2), 1-11. https://doi.org/10.58729/2167-3454.1073

Kaufman, S. B. (2018). *Twice exceptional: Supporting and educating bright and creative students with learning difficulties*. Oxford, UK: Oxford University Press.

Kaya, F. (2015). Teachers' conceptions of giftedness and special needs of gifted students. *Education and Science, 40*(177), 59-74. https://doi.org/10.15390/EB.2015.2885

King, S. (2022). The education context for twice-exceptional students: An overview of issues in special and gifted education. *Neurobiology of learning and memory, 193*, 107659. https://doi.org/10.1016/j.nlm.2022.107659

Klingner, R. (2022). Twice-exceptional 2E students and their challenges in dealing with normality. *Education Science, 12*, 268. https://doi.org/10.3390/educsci12040268

LeBeau, B., Schabilion, K., Assouline, S.G., Nicpon, M. F., Doobay, A. F., & Mahatmya, D. (2022). Developmental milestones as early indicators of twice-exceptionality. *Neurobiology of Learning and Memory, 194*, 107671. https://doi.org/10.1016/j.nlm.2022.107671

Maddocks, D. L. S. (2018). The identification of students who are gifted and have a learning disability: A comparison of different diagnostic criteria. *Gifted Child Quarterly, 62*(2), 175–192. https://doi.org/10.1177/0016986217752096

Marshall, C., & Rossman, G. B. (2014). Designing qualitative research. New York: Sage. Miles, M, B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded Sourcebook. (2nd ed).* Thousand Oaks, CA: Sage.

Mayes, R. D., & Moore, J. L. (2016). The intersection of race, disability, and giftedness: Understanding the education needs of twice-exceptional, African American students. *Gifted Child Today, 39*(2), 98-104. https://doi.org/10.1177/1076217516628570

MacNeil, K. A., Butler, D. L., & Schnellert, L. M. (2023). From accountability to shared responsibility: A case study of a multi-layered educational change initiative. *Journal Educational Change, 24*(1), 213–241. https://doi.org/10.1007/s10833-021-09440-4

MNE (Türkiye Ministry of National Education), (2012). *Regulation on special education services.* The Official Newspaper, No. 28360, Ankara.

Morrison, W. F., & Rizza, M. G. (2007). Creating a toolkit for identifying twice-exceptional students. *Journal for the Education of the Gifted, 31*(1), 57-76. https://doi.org/10.4219/jeg-2007-513

Neihart, M. (2008). Identifying and providing services to twice exceptional children. Pfeiffer, S. I. (Ed.). *Handbook of giftedness in children: Psychological theory, research and best practices*, 115-137. New York: Springer.

Pamungkas, B., Wahab, R., Suwarjo, S., & Susen, A. (2023). School and family collaboration on twice-exceptional academic program services. *International Journal of Learning, Teaching and Educational Research, 22*(12), 351-367. https://doi.org/10.26803/ijlter.22.12.17

Patton, M. Q. (1990b). *Qualitative evaluation and research methods* (2nd Ed.). London: Sage Publications.

Randall, C. (2021). *The underrepresentation of twice-exceptional students in gifted programs.* Piedmont College.

Rapp, A. C., & Corral-Granados, A. (2024). Understanding inclusive education – a theoretical contribution from system theory and the constructionist perspective. *International Journal of Inclusive Education, 28*(4), 423–439. https://doi.org/10.1080/13603116.2021.1946725

Reis S., Baum S., & Burke, E. (2014). An operational definition of twice-exceptional learners: Implications and applications. *Gifted Child Quarterly, 58*(3), 217–230. https://doi.org/10.1177/0016986214534976

Reis, S. M., & Renzulli, S. J. (2025). Research-based strength-based teaching and support strategies for twice-exceptional high school students with autism spectrum disorder. *Behavioral Sciences, 15*(6), 834. https://doi.org/10.3390/bs15060834

Renzulli, S. J., & Gelbar, N. (2019). Leadership roles for school counselors in identifying and supporting twice-exceptional (2E) students. *Professional School Counseling, 23*(1), 1–11. https://www.jstor.org/stable/27136496

Speirs Neumeister, K. L. (2024). Maximizing the potential of twice-exceptional learners: Creating a framework of stakeholder supports. *Gifted Child Quarterly, 68*(1), 19-33. https://doi.org/10.1177/00169862231193699

Şentürk, Ş., Kefeli, İ., & İlhan Emecan, B. (2022). Policy recommendation for twice exceptional (2E) students in Turkey. *Ondokuz Mayis University Journal of Education Faculty, 41*(2), 677-696. https://doi.org/10.7822/omuefd.1202248

MFSS-Turkish Ministry of Family and Social Services, (2021). *Disability and aging statistics bulletin* https://www.aile.gov.tr/media/74722/eyhgm_istatistik_bulteni_mart_2021.pdf [Access Date: 20.01.2025]

Tortop, H. S., & Agaoglu, O. (2022). Special education teacher' selection, education and appointment policy: Türkiye case. *Journal for the Child Development, Exceptionality and Education, 3*(2), 95-102.

Tortop, H. S., & Ilgaz, G. (2023). Developing of in-service training program for teacher working with gifted learning disabled students. *Journal for the Education of Gifted Young Scientists, 11*(3), 263-279. http://dx.doi.org/10.17478/jegys.1329220

Townend, G., & Brown, R. (2016). Exploring a sociocultural approach to understanding academic self-concept in twice-exceptional students. *Int. J. Educ. Res. 80,* 15–24. https://doi.org/10.1016/j.ijer.2016.07.006

Unda, L. A., Gong, Z., Benati, K., & Loh, C. M. (2023). Role expectations and shared accountability: A framework for school governance. *Financial Accountability & Management, 39*, 790-808. https://doi.org/10.1111/faam.12322

Villanueva, A. S. A., & Huber, T. (2019). The issues in identifying twice exceptional students: a review of the literature. *International Journal of Development Research, 9*(9), 30101-30112.

Wang, W. C., & Neihart, M. (2015). How do supports from parents, teachers, and peers influence academic achievement of twice-exceptional students. *Gifted Child Today, 38,* 148-159.

Weber, D., Beumann, S., & Benölken, R. (2023). Teachers' view of twice-exceptional students– outline of the challenges in recognizing mathematical giftedness and supporting needs of hearing impairment. Thirteenth Congress of the European Society for Research in Mathematics Education (CERME13), Alfréd Rényi Institute of Mathematics; Eötvös Loránd University of Budapest, July, Budapest, Hungary. https://hal.science/hal-04407409/document (Access Date: 09/02/2025).

Will, M. C. (1986). Educating children with learning problems: A shared responsibility. *Exceptional Children, 52*(5), 411-415. https://doi.org/10.1177/001440298605200502

Wilson, A. (2015). A guide to phenomenological research. *Nursing Standard, 29*(34), 38-43. https://doi.org/10.7748/ns.29.34.38.e8821

Yıldırım, A., & Şimşek, H. (2016). *Qualitative research methods in the social sciences*. Ankara: Seçkin Publishing.

Zigmond, N. P., Kloo, A., & Rock, M. L. (2024). Necessary differences between general and special education. In J. M. Kauffman, D. P. Hallahan, & P. C. Pullen (Eds.), *Handbook of special education*. Routledge.

About the Author:

Fatma YILDIRIM, Ph.D.

Fatma Yıldırım is an independent researcher specializing in gifted and special education. She earned her Ph.D. from Soonchunhyang University in South Korea as a recipient of the Korean Government Scholarship Program (KGSP). After completing her doctorate, she served as an Assistant Professor in the Department of Special Education at Atatürk University for three years, teaching both undergraduate and graduate courses. Her research expertise includes gifted and talented education, special education, twice-exceptional (2E) children, and career development for gifted and talented students. She also focuses on teacher education and the professional development of special education teachers. Dr. Yıldırım is proficient in Korean and English and continues her academic contributions through independent research projects.

EXPLORING CITIZENSHIP AND CITIZENSHIP EDUCATION FROM THE PERSPECTIVE OF PRIMARY SCHOOL TEACHERS IN TÜRKİYE

Şehide KILINÇ
Ph.D., Yağızlar Primary School, Adana, Türkiye
ORCID: https://orcid.org/0000-0002-8862-8593
sehidearslanhan83@gmail.com

Abstract

This study aims to explore classroom teachers' views on the concept of citizenship and citizenship education. In line with this purpose, teachers' views on citizenship, their interpretations of the concept of "active" citizenship, the aims of citizenship education, and their classroom practices related to citizenship education were investigated. The study employed an exploratory phenomenological approach, a qualitative research method. The results revealed that teachers conceptualized citizenship as the acquisition of national legal status and identity, rights and responsibilities, participation, and patriotism. It was concluded that teachers often emphasized the themes of "responsibility," "social sensitivity," "participation," and "collaboration" when defining the qualities that an active citizen should possess. In teachers' opinions about the aim of citizenship education, the categories "contributing to the political socialization of students, teaching rights and responsibilities, and contributing to the development of students' values and skills" were most emphasized. It was concluded that teachers mainly included citizenship education in social studies and life sciences courses and used "providing examples" and "direct narration." Teachers also reported school councils and class president elections as extracurricular activities.

Keywords: Citizenship, citizenship education, primary education.

INTRODUCTION

In today's societies, which face various social, cultural, and political changes, the development of citizenship remains a crucial issue in contemporary policy initiatives and public debates. (Dusi et al., 2012). The emergence of social and educational challenges, such as globalization, technological advances, and migration, has necessitated a rethink of the role of schools in developing citizenship. Indeed, education in the 21st century extends beyond meeting the basic needs of the curriculum to become a dynamic process that encompasses the knowledge, skills, and values individuals need in global contexts, preparing them for this complex world (Evans et al., 2009; Pike, 2007). In this context, citizenship education, which plays a fundamental role in the formation of citizens who act with a sense of social responsibility, have critical and democratic thinking and develop social awareness, has become an essential part of the educational curriculum in many countries (Euridyce, 2017; Martínez Guzmán & González Gutiérrez, 2010; Willemse et al., 2015).

Since the twentieth century, many countries around the world have incorporated citizenship education into their education systems as a cross-curricular course, integrated with other subjects, or as a separate course to strengthen their developing political/administrative structures and develop their democratic institutions. (Akar & Aschenberger, 2016; Euridyce, 2017). Some researchers argue that citizenship education can be structured according to countries' own political goals and the influence of the dominant culture (Parker, 2008; Sunal & Haas, 2011). Currently, curricula are among the most essential tools countries use to produce the kind of citizens they desire. Citizenship education, integrated into curricula for courses such as civics, history, and social studies (Kwan-Choi Tse, 2000), is mainly provided within the framework of social education in Turkey, as in many countries.

Today, in many countries' curricula, an emphasis on active, participatory, and critical citizenship can be observed (Lin, 2015; Weinberg & Flinders, 2018). However, to what extent this emphasis in curricula is reflected in teachers' pedagogical practices remains a matter of debate. Many studies show an inconsistency between the curriculum and pedagogical practices in citizenship education. While curricula emphasize active, participatory, and critical citizenship, teachers tend toward traditional, transmission-based citizenship education (Fuentes-Moreno et al., 2020; Marovah, 2019; Obiagu, 2024). In this context, alongside the philosophy of the curriculum, it should not be overlooked that teachers, as practitioners, are the most important actors in the formation of citizenship awareness in students and in raising ideal citizens (Güven, Tertemiz, & Bulut, 2009; Zaman, 2006).

Citizenship education is influenced by many factors such as family, society, and media. Among all these factors, teachers who implement national education policies, the school's vision, and the curriculum are the most important and constitute an indispensable part of citizenship education (Kuş & Aksu, 2017; Westheimer & Kahne, 2004; Veugelers, 2007). Considering that the concept of citizenship is a complex notion that can be understood differently across social, political, historical, and cultural contexts, it should not be ignored that perceptions related to this concept may also affect the way it is taught (Lee & Fouts, 2005; Veugelers, 2011; Walkington & Wilkins, 2000). In fact, teachers, as practitioners in schools, can influence students' citizenship development either consciously through the formal curriculum or implicitly in line with their own understanding of citizenship (Leenders, Veugelers, & De Kat, 2008; Leenders & Veugelers, 2006; Westheimer & Ladson-Billings, 2024).

Citizenship Education in the National Context

To effectively analyze the structure of citizenship education in Turkey, it is essential to understand the concept of citizenship within its national context. The notion of citizenship in Turkey has evolved over different periods. Still, it has consistently centered on the themes of "modernity" and "patriotism," particularly after the establishment of the Republic of Turkey in 1923, following the dissolution of the Ottoman Empire's multinational structure (Kuş, 2020). During the Republican era, significant efforts were made to develop a new nation, culture, and sense of citizenship (Keyman, 2008). This period, marked by nation-building, underscored the importance of establishing a national and secular state structure alongside a cultural and social framework compatible with those attributes (Keyman & İçduygu, 1998).

Consequently, the republican model of citizenship dominated Turkey until the 1950s. This model emphasized duties and obligations more than social rights (Üstel, 2004). In other words, early in the republic, the understanding of citizenship focused on citizens' responsibilities to society and the state, as dictated by the republican tradition (Kadıoğlu, 2006). This duty-oriented and collectivist interpretation of citizenship, which positioned citizenship at the heart of national identity and prioritized obedience to the state alongside adherence to law and order, began to transform with the transition to a multi-party system in the 1950s (Caymaz, 2007; İşyar, 2005). This period witnessed two significant developments: Islam became integral to civic identity, and a more liberal definition of citizenship emerged. Following the 1980s, Turkey's integration into the global neoliberal economic system—prompted by rapid social and economic changes worldwide, along with the rise of rights-based policies—brought citizenship back into focus in terms of rights, duties, and identity recognition. (Keyman & İçduygu, 2005). Additionally, social movements addressing global issues and the migration phenomenon from the 2000s onward have amplified the demands of various ethnic, religious, and cultural groups, fostering a more individualistic, liberal, and multicultural understanding of citizenship (Keyman, 2005; Şimşek & Karaduman, 2023). Throughout this process, significant events such as coups or coup attempts, along with legal reforms, have played a crucial role in shaping the content and direction of citizenship education in Turkey. Militaristic discourses, which intensified after the 1960 military coup, have also been reflected in educational materials (Sen, 2018). During this period, the understanding of political citizenship gained momentum, as the boundaries of the public sphere were defined and the rights and responsibilities of citizenship were emphasized (Şimşek & Karaduman, 2023).

In the 1990s, Turkey's participation in the United Nations Decade for Human Rights Education initiative helped integrate human rights into the country's citizenship curriculum. In the early 2000s, significant changes were implemented in education within the scope of the European Union membership policy. Citizenship education was restructured to move away from a militaristic understanding of citizenship. Instead, an interdisciplinary approach was adopted, emphasizing national values while highlighting universal values and citizenship skills (Sen, 2023). This transition from a traditional approach based on national identity to a modern understanding of citizenship education was realized with a curriculum change in 2005 (Kayacan, 2014). The revised program removed citizenship education as a compulsory subject and integrated it into the social studies curriculum as an intermediate discipline. The current social studies curriculum 2018 includes components related to citizenship education under the theme "Active Citizenship and Global Connections," which focuses on contemporary concepts of rights, freedom, and justice. Furthermore, the Human Rights and Citizenship course for fourth-grade students aims to enhance their awareness of citizenship (MoNE, 2018).

Overall, it can be said that citizenship education in Turkey has been shaped by a duty-and-responsibility framework. This historical background of the concept of citizenship may shape teachers' understandings of citizenship. In this context, it is thought that not only teachers' perceptions of citizenship but also the country's citizenship culture may influence citizenship education.

The Present Study

Studies in the literature show that teachers' beliefs serve as epistemological and moral filters for their pedagogical practices (Fives & Buehl, 2012; Knowles, 2018; Thornton, 2005). While this is true for all disciplines across the curriculum, it becomes even more critical when teaching citizenship competencies. This is because citizenship education is an area of the curriculum where teachers often have greater discretion (Jara et al., 2023). Therefore, it becomes essential to uncover the beliefs of teachers responsible for developing citizenship competencies. Knowles (2018) argues that teachers are guided by their beliefs, and that their approach to policy and citizenship issues can align significantly with these beliefs. Therefore, it is essential to consider teachers' approaches to teaching citizenship competencies and the core beliefs that underpin these approaches.

Upon reviewing the relevant literature, numerous studies have been conducted both nationally and internationally on teachers' perspectives on various aspects of citizenship. Research in Turkey reveals that teachers mostly define the concept of citizenship in terms of national identity, duties, and responsibilities (Güven et al., 2009; Malkoç & Ata, 2021). However, these studies show limitations in how teachers reflect their perceptions of citizenship in classroom teaching processes. Indeed, some international studies have shown that teachers' perceptions of the concept of citizenship influence classroom teaching processes in citizenship education. For example, some studies focusing on the relationship between teachers' citizenship ideals and teaching methods have shown that teachers with a participatory and multifaceted understanding of citizenship frequently use activities based on active teaching methods such as discussion and projects; whereas teachers with a duty and responsibility-oriented understanding of citizenship prefer traditional and teacher-centered activities (Sampermans et al., 2021; De Schaepmeester et al., 2022). Some studies have shown that teachers with a justice-oriented understanding of citizenship are more likely to encourage their students' critical thinking and participation orientations through activities such as inquiry, discussion, and projects (Cleovoulou, 2021; Smith et al., 2024).

When the relevant literature is evaluated together, the limited number of studies on the reasons why this understanding is not sufficiently reflected in teachers' pedagogical practices, despite the emphasis of curricula on active and participatory citizenship, creates a significant gap in the field of citizenship education. This research aims to fill this gap by examining the relationship between teachers' understanding of citizenship and their pedagogical practices.

The aim of this research is to determine classroom teachers' understanding of citizenship and citizenship education and to reveal the extent to which citizenship ideals are reflected in classroom teaching practices. In line with this aim, the following questions are addressed:

✓ How do classroom teachers understand the concept of citizenship and effective citizenship?
✓ How do classroom teachers interpret the aims of citizenship education?
✓ To what extent are the citizenship ideals of classroom teachers reflected in classroom teaching practices?

METHOD

Research Design

This research was designed as an interpretive qualitative study to investigate classroom teachers' perceptions of the concept of citizenship and citizenship education, and how these perceptions are reflected in their pedagogical practices. The interpretive qualitative research approach forms the basis of research inquiries aimed at understanding individuals' experiences, perspectives, and the meanings they attribute to these experiences (Merriam & Graneier, 2019; Schwartz-Shea & Yanow, 2012).

Participants

Participants consisted of 27 classroom teachers working in 5 different primary schools in Sarıçam, Seyhan, Yüreğir, and Çukurova districts of Adana province in the spring semester of the 2023-2024 academic year. The participants were selected using purposive sampling. In purposive sampling, the criterion was "classroom teachers who have taught 4th grade". In Turkey, citizenship education is introduced in the 4th grade of primary school through the course "Human Rights and Civics." Therefore, this criterion was established. Thus, the aim was to include participants who had experienced the central phenomenon under study. Before the study, permission was obtained by submitting and application to the Adana Provincial Directorate of National Education. The participants were volunteers. The demographic characteristics of the participants are shown in Table 1.

Table 1. Data on demographic characteristics of the participants.

Variables		n
Gender	Female	20
	Male	7
Educational Level	Licence	17
	Master's Degree	8
	Ph.D.	2
Professional experience	1-5 years	1
	6-10 years	2
	11-15 years	3
	15-20 years	3
	21 years and over	18
Frequency of teaching 4th grade	1-3 years	10
	4-6 years	13
	7 years and over	4

Table 1 presents the demographic and professional background of the participants. Among the 27 participants, 7 were male, and 20 were female. In terms of academic qualifications, 2 participants held a Ph.D., 8 had a Master's degree, and 17 possessed a Bachelor's degree. Regarding teaching experience, 18 participants had 21 or more years, while 1 participant had fewer than 5 years. When focusing specifically on 4th-grade teaching experience, 10 participants had 1 to 3 years of experience, 13 had 4 to 6 years, and 4 had 7 years or more. To ensure participants' privacy, ethical guidelines were followed, and codes (e.g., P1, P2, P3) were used to protect their identities.

Data Collection Tool

In this study, the researcher created a semi-structured interview form to explore primary school teachers' perceptions of citizenship concepts and education in depth. The design of the semi-structured interview aimed to encourage teachers to articulate their thoughts and experiences clearly and in detail. The researcher carefully crafted the interview questions based on existing literature regarding citizenship education in primary schools, with a particular focus on teachers' perceptions (see Appendix 1). The semi-structured interview form consisted of three parts: 1. An informed consent form, which obtained

participants' written consent for ethical compliance. 2. A demographic information section, which collected details such as gender, age, education level, and teaching experience. 3. A series of open-ended questions that explored classroom teachers' perceptions of citizenship and citizenship education, consisting of eight questions. One of the open-ended questions was: "There are different types of citizenship, such as global citizenship, digital citizenship, and active citizenship. Are you familiar with these types? If so, can you explain them? Which concepts do you think are important, and why?" This format allowed participants to express their views and experiences in a detailed and comfortable manner while encouraging them to clarify concepts through exploratory questions regarding the 'why' and 'how.' To enhance content validity, it is standard practice to involve a team of experts (Polit & Beck, 2006). This approach helps to prevent the research questions from being limited to the researchers' perceptions or experiences of the topic (Davis, 1992). In this context, three experts with experience in classroom teaching, social studies education, and civic education reviewed the questions for clarity and content quality to ensure their validity. Based on the feedback from these experts, the open-ended questions were reorganized.

The researcher utilized the content validity index to evaluate the content validity of the semi-structured interview form. The validity of each item was assessed based on ratings from experts, who were asked to evaluate the relevance of each question to the underlying construct. The rating scale was defined as follows: (1) = not relevant, (2) = somewhat relevant, (3) = relevant, and (4) = highly relevant. The content validity index was calculated by dividing the number of experts who rated each item as a 3 or 4 by the total number of experts consulted (Shrotryia & Dhanda, 2019). For content validity, the content validity index should be 1.00 when there are five or fewer experts, and it should not be lower than .78 when there are six or more experts (Polit & Beck, 2006; Rubio et al., 2003). In this study, the content validity index was 1.00. Furthermore, the content validity index for the questions was .87, based on the interrater agreement index. Consequently, there is a need for a comprehensive study of teachers' perceptions and experiences regarding citizenship and citizenship education.

Data Collection

This study gathered data from participants selected through purposive sampling. Individual interviews were conducted to gain deeper insights into the perceptions and understandings of 4th-grade elementary school teachers regarding citizenship and citizenship education. The interviews took place during the spring semester of the 2023-2024 academic year. Prior to participating in the interviews, participants provided informed consent to address ethical concerns. They were then asked to complete a demographic information questionnaire, followed by a semi-structured written interview. To ensure accurate data collection without time and space constraints, online versions of the demographic questionnaire and semi-structured interview questions were created using Google Forms and distributed to participants via WhatsApp. The data collection process continued until data saturation was achieved, indicating that no new information was being gathered. The decision to stop sampling was made when repeated interviews yielded no new content, confirming that the data had been sufficiently replicated (Brod et al., 2009). The sampling process lasted approximately two months, from April to June 2024.

Data Analysis

This study gathered data from 27 classroom teachers who shared their perspectives and experiences regarding citizenship and citizenship education. After collecting the data, the researcher reviewed the semi-structured interview forms to identify and correct any missing information and spelling errors. The researcher then employed a content analysis to examine participants' responses to the interview questions. This method was chosen to uncover concepts that could explain the collected data and to systematically categorize it (Schreier, 2012; Yıldırım & Şimşek, 2011). The goal was to gain insight into the participants' understanding and experiences of citizenship. A structured content analysis procedure was implemented in this study (Mayring, 2015). To enhance the reliability of the analysis, the content analysis was conducted using MAXQDA 2020 software. Utilizing computer-assisted qualitative data analysis software significantly improves the reliability of the coding process (Baralt, 2012). The analysis followed a five-step procedure proposed by Gao and Zhang (2020), which included:

1. Cleaning the original data: Reading through the data, identifying and correcting errors, and checking for consistency.

2. Data coding: Reading the original data multiple times to develop clear codes.

3. Creating themes: Comparing original codes, examining the relationships between them, and naming the themes.

4. Categorizing themes: Organizing themes into various categories based on specific standards and principles.

5. Writing the report: Composing a scholarly report based on the analyzed data, which includes appropriate and persuasive citations relevant to the research questions and literature (p. 8).

The data were organized using MAXQDA 2020, a data analysis software, following a systematic analysis procedure. In the initial stage, the original data was cleaned, and transcriptions were checked for typos and inconsistencies. The data analysis process aimed to identify recurring patterns of meaning in participants' narratives rather than simply quantifying their responses to the interview form. During the coding phase, the data sets were re-examined, and initial codes were created. In the theme generation stage, the coders categorized the initial codes into relevant themes. The derived themes were then organized into higher-level concepts during the categorization stage. To develop the coding framework, both conceptual and data-driven strategies were employed (Schreier, 2012). The coders defined the main categories based on existing literature and theories regarding teachers' perceptions of citizenship and citizenship education (Margot & Kettler, 2019). After reviewing all interviews, additional categories were integrated into the main coding framework. In the final stage, the researcher compiled a concise report detailing the entire process. To enhance the reliability of the coding and categorization, an expert faculty member in the field collaborated with the researcher throughout all five stages. Reliability was assessed using Miles and Huberman's formula: reliability = number of consensuses / (total number of consensuses + disagreements). According to Miles and Huberman (2016), a reliability coefficient of 90% is generally expected. In this study, the reliability calculation indicated a high level of agreement between the coders ($\alpha = .96$). Disagreements regarding codes and categories were reviewed, and a joint decision was made. Finally, participants' statements were presented with direct quotes to clarify the tables and enhance the understanding of the codes and themes. During the presentation of the teachers' statements, the coding, such as P/1, P/2, and P/27, adhered to the ethical rules of the research.

RESULTS

In this section of the study, the codes, categories, and themes that emerged from the interview data on classroom teachers' views of citizenship and citizenship education were analyzed and visually presented using MAXQDA 2020. Below, you will find a "code matrix" visualization that clusters the data according to the participants' opinions, offering a comprehensive perspective on the research.
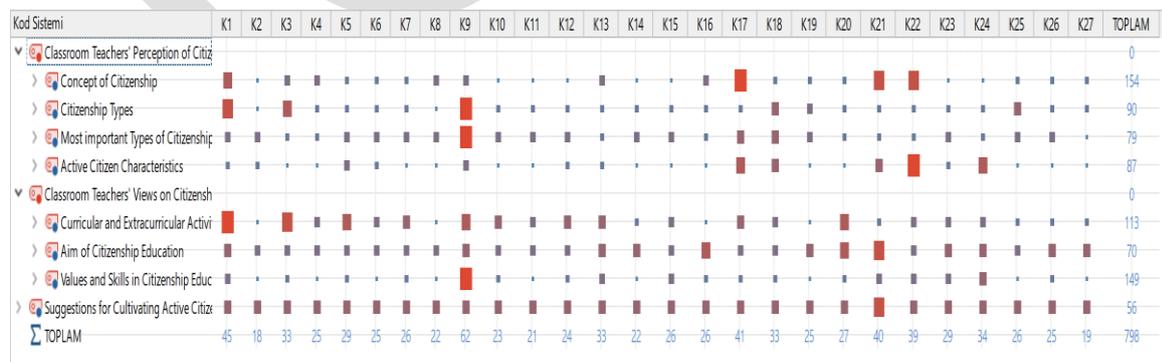
Figure 1. MAXMap code matrix.

Figure 1 illustrates that a total of 798 codes were generated for three sub-objectives based on the opinions of 27 participants regarding the research. The participants categorized their codes as follows: P17, P21, and P22 pertained to the concept of citizenship; P1, P3, and P9 were categorized under types

of citizenship; P9 and P17 represented the most important types of citizenship; and P5, P9, P17, and P24 were associated with characteristics of active citizens. Regarding the subgoal focused on classroom teachers' perspectives on citizenship education, participants assigned codes P9, P23, and P24 to the category of values and sPills relevant to citizenship education. In the category concerning the purpose of citizenship education, participants P16, P20, and P21 expressed their opinions more fervently. Lastly, when discussing suggestions for developing influential citizens in our country, participant P21's views were particularly prominent, while overall, participants expressed their opinions on this topic less frequently.

Citizenship as a Normative Identity

In this section, we present the classroom teachers' views of citizenship, their understanding of the different types of citizenship, and their views on what constitutes effective citizenship. These findings, reflecting the first sub-objective of the study, are illustrated visually in Figure 2, which showcases the participants' views of citizenship.
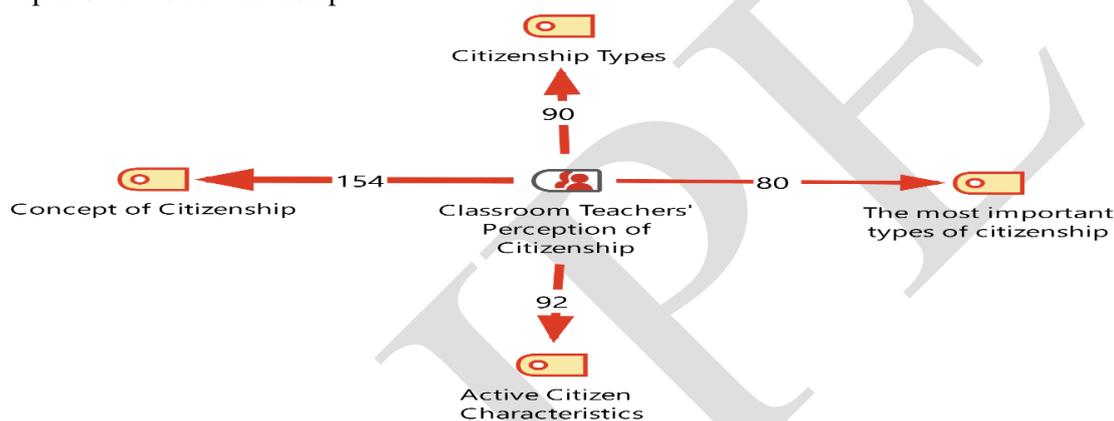
Figure 2. MAXMap Code Theory Model of teachers' views on citizenship perception.

The concept of citizenship

To explore classroom teachers' views of citizenship, participants were asked to define citizenship during the interviews, and their responses were analyzed. The meanings that participants attributed to citizenship are illustrated in Figure 3.
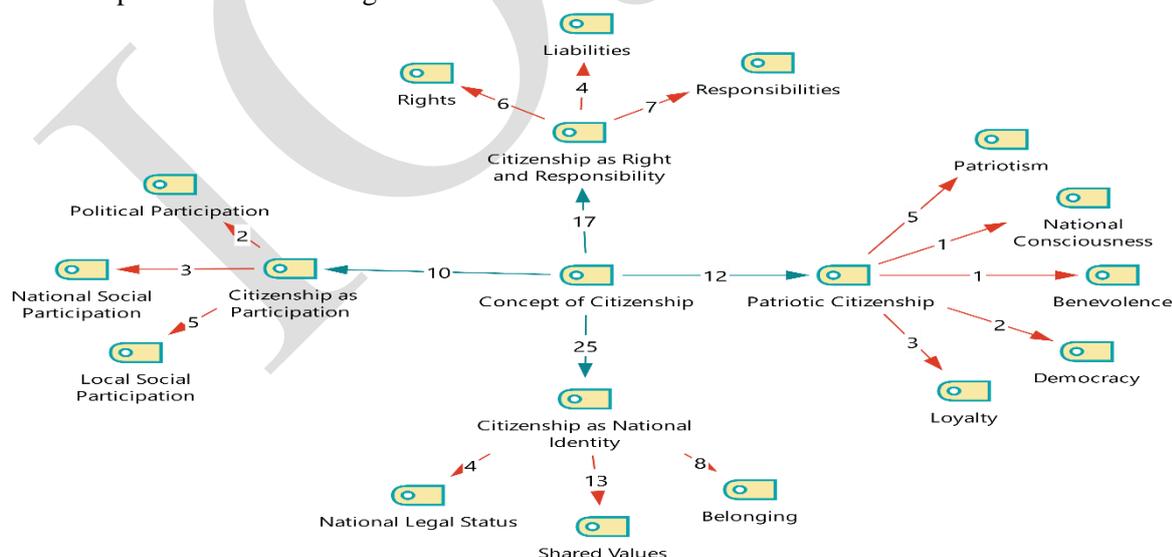
Figure 3. MAXMap Code Theory Model for the concept of citizenship.

Figure 3 shows that participants defined the concept of citizenship within the frameworks of national identity, rights and responsibilities, patriotic citizenship, and participation. Participants' views were mostly concentrated around national identity and rights and responsibilities.

Citizenship as national identity: In this category, participants most frequently defined citizenship in terms of shared values and a sense of belonging. Citizenship was explained by most participants through language, culture, flag, and common history, and was associated with the feeling of "being part of a community." In this context, citizenship was expressed more as an identity and a sense of belonging rather than a legal bond between the individual and the state. Accordingly, one participant defined citizenship as "the identity of a country, belonging to a common group and a sense of belonging" (P16), while another participant expressed it as "being part of a community at the local, national, or global level" (P1). Some teachers explained citizenship in terms of the legal bond between the individual and the state. Nevertheless, these definitions were also primarily located within the domain of national identity and belonging. This suggests that teachers primarily conceptualised citizenship as a social and cultural identity rather than a legal status.

Citizenship as rights and responsibilities: A significant number of teachers explained citizenship in terms of rights and responsibilities. In participants' narratives, duties such as complying with constitutional rules, protecting national interests, and maintaining social order were associated with the concept of citizenship. Obligations such as paying taxes, completing military service, and contributing to society were expressed as core elements of citizenship. In one teacher's words, a citizen is "a person who safeguards national interests and does not avoid taking responsibility" (P3). Similarly, another teacher emphasized that citizenship "includes both rights and certain obligations" (P22). In these views, the concept of rights was mostly addressed in connection with responsibilities.

Patriotic citizenship: Some teachers explained citizenship directly through love of country and loyalty. In this context, citizenship was associated with values such as loyalty to the country, social sensitivity, and protecting the continuity of the nation. One teacher expressed citizenship as "loyalty to the country and sensitivity toward society" (P7), while another defined it as "a sacred concept worth dying for" (P10). These views indicate that citizenship was perceived as an emotional and moral responsibility.

Citizenship as participation: Some participants addressed citizenship within the context of social and political participation. For these participants, citizenship was associated with identifying national problems, developing solutions, and participating in decision-making processes. One teacher defined citizenship as "identifying the country's problems and taking steps to improve quality of life" (P24), while another expressed it as "having the knowledge and skills necessary to actively participate in national decisions" (P16). However, the relatively limited presence of these views compared to other definitions indicates that political participation processes remained secondary in the perception of citizenship.

When the findings are evaluated together, they show that teachers conceptualize citizenship more in terms of identity, belonging, and responsibility, and attach less importance to participation and democratic processes. These narratives show that teachers interpret citizenship as a means of maintaining social order, duty, responsibility, and loyalty rather than as an active, participatory, and political process. Consequently, citizenship emerges as a normative ideal associated with social order.

Conceptualization of Active Citizenship

Classroom teachers' knowledge and assessments of types of citizenship, the types they consider most important, and their views on the characteristics of an active citizen are compiled under this theme.

According to the classroom teachers' views on defining the types of citizenship, the results are presented in Figure 4.
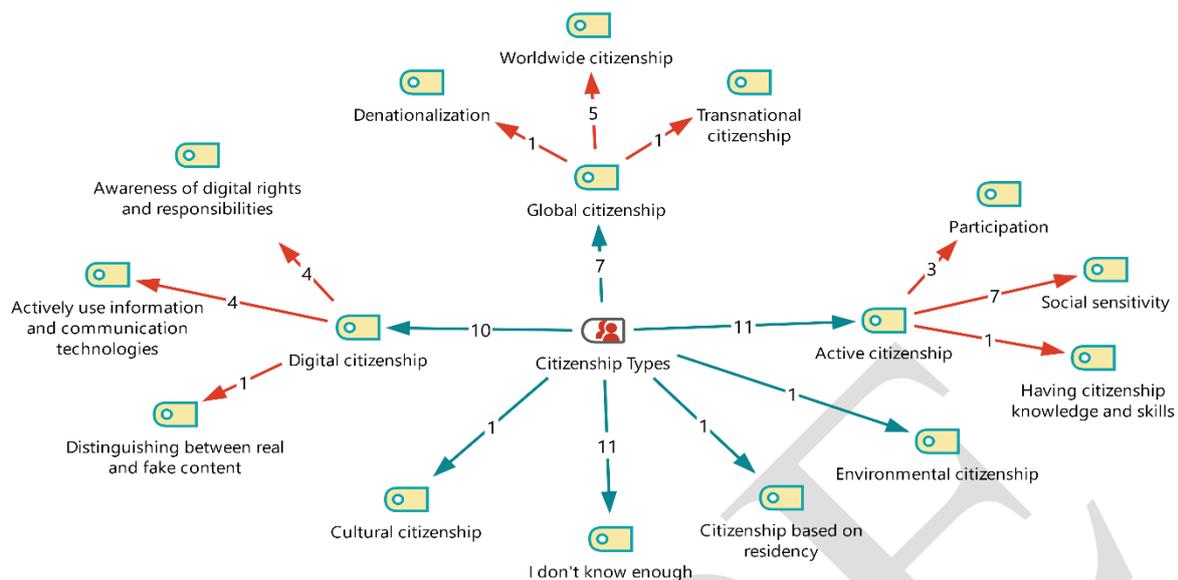
Figure 4. MAXMaps the Code Theory Model of types of citizenship.

Figure 4 shows that approximately one-third of teachers do not have sufficient knowledge about types of citizenship. The narratives of teachers who expressed their opinions reveal that teachers are most familiar with the concepts of active citizenship and digital citizenship. This situation shows that teachers define the concept of citizenship primarily through the types of citizenship that are prominent in current, widespread discourse.

When examining participants' definitions of active citizenship, they most often associate it with social awareness and participation. According to teachers, an active citizen is an individual who is not indifferent to events around them, takes responsibility for issues related to the country, and intervenes when necessary. For example, while some participants defined an active citizen as "a person who can intervene in events around them and actively take responsibility for issues related to the country" (P6, P9, P18, P24), others expressed it as "an individual who actively participates in all kinds of decisions and activities related to the country" (P1, P4). Furthermore, one teacher explained active citizenship as "possessing the knowledge and skills required for citizenship in democratic societies" (P25). These findings show that teachers perceive active citizenship primarily through a participatory lens, shaped by responsibility and sensitivity.

In their definitions of digital citizenship, teachers most often emphasized the dimensions of having digital rights and responsibilities and actively and correctly using information and communication technologies. In addition, some participants touched on themes such as distinguishing between correct and incorrect information in the digital environment and the removal of international borders, albeit to a limited extent.

An analysis of participants' narratives reveals that digital citizenship is defined as individuals being aware of their rights and responsibilities in digital environments (P9), using information and communication technologies correctly and effectively (P1, P18), and distinguishing between true and false news (P1). These definitions show that digital citizenship is approached more as conscious use and individual responsibility.

In the definitions of global citizenship, the emphasis was mostly on "world citizenship," followed by the perception of transnational citizenship. Global citizenship has mostly been associated with a sense of belonging to the world and a global perspective. For example, one teacher defined global citizenship as "belonging to the world at the local, national, and international levels and working for the welfare of the world" (P1). In contrast, another teacher expressed it as "having a global perspective" (P9). However, one participant took a negative view of global citizenship, stating that the concept was

"created to destroy nations" (P3). This statement shows that the concept of global citizenship is perceived differently, and sometimes critically, by teachers.

Overall, the findings show that participants emphasized active and digital citizenship, while having more limited knowledge of other types of citizenship. In particular, environmental, cultural, and transnational dimensions of citizenship showed limited awareness. This suggests that teachers' understanding of citizenship is limited to certain normative and contemporary dimensions.

Teachers' views on the most important types of citizenship were analyzed, and the results are presented in Figure 5.
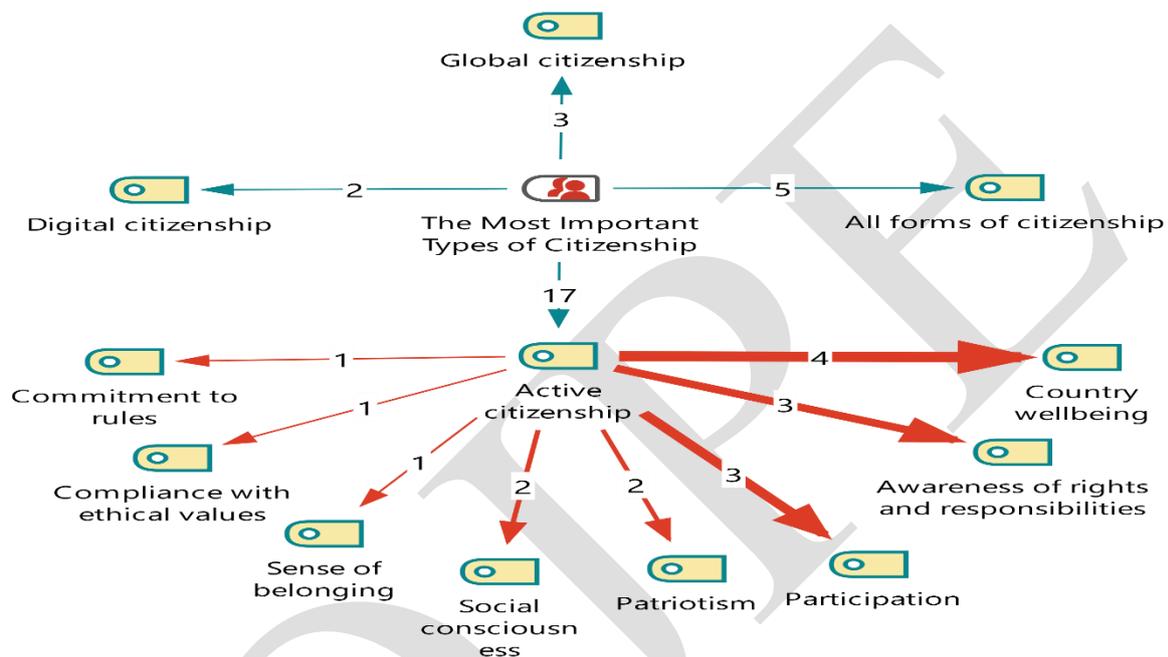
Figure 5. MAXMaps the Code Theory Model of the most important types of citizenship.

Figure 5 shows that the majority of teachers consider active citizenship to be the most important type of citizenship. In addition, some teachers stated that all types of citizenship are important, while others emphasized global and digital citizenship.

When examining why teachers consider active citizenship important, it is evident that this concept is particularly associated with contributing to the country's welfare, a sense of responsibility, and sensitivity to social issues. According to the participants, an active citizen is not only an individual who knows their rights but also someone who strives for the country's development. Indeed, one teacher stated that they see active citizenship as a "duty" to fight for the country's development, contribute to it, and serve the community (P10). Similarly, another participant stated that they do not consider individuals who do not see the country's problems as their own and do not produce solutions to be citizens (P18).

Some teachers explained active citizenship more in terms of duties and responsibilities. For example, one participant emphasized that citizens must fulfill their duties in the country's development (P7). At the same time, another stated that citizenship goes beyond responsibilities such as voting and military service and also includes actively intervening in social issues (P9). In this view, the teacher stated that an active role could be played through means such as petitioning or participating in civil society organizations on issues such as global warming, war, children's rights, and social equality.

When these findings are evaluated together, it is evident that while teachers associate active citizenship with participation, they interpret this participation more in terms of taking responsibility and contributing to society. Therefore, in teachers' perception, active citizenship represents the ideal of

individuals who support social order and work for the benefit of the country, rather than political participation and democratic decision-making processes.

The views of classroom teachers regarding the characteristics of an active citizen are presented in Figure 6.
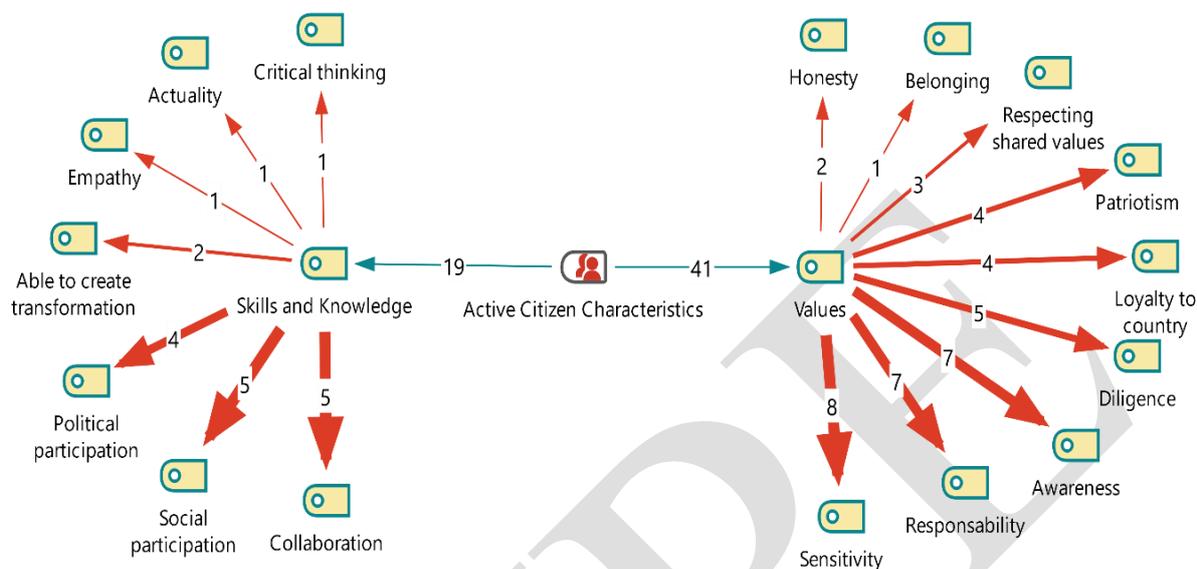
Figure 6. MAXMaps the Code Theory Model of active citizen characteristics.

Figure 6 shows that classroom teachers' views on the characteristics required for active citizenship are grouped around two main dimensions: values and knowledge and skills.

In the teachers' narratives, active citizens are primarily defined as individuals who possess certain personal and social values. Participants particularly emphasized sensitivity, responsibility, and awareness regarding the characteristics of an active citizen; these were followed by values such as diligence, loyalty to the country, patriotism, and respect for shared values. In these definitions, citizenship was primarily associated with an individual's sense of duty to society and the country. Indeed, one teacher defined an active citizen as "a person who is not indifferent to events around them, who can intervene and achieve results" (P14). In contrast, another teacher described them as "an individual who loves their country, is aware of their national and spiritual values, and is sensitive to their surroundings" (P17). Similarly, another participant stated that an active citizen is someone aware of their responsibilities and acts in cooperation with society (P18).

In terms of knowledge and skills, teachers associated cooperation, social participation, and political participation with the characteristics of active citizenship. However, they placed less emphasis on skills such as critical thinking, empathy, staying up to date on current events, and effecting change. Accordingly, it is possible to say that teachers interpret active citizenship more in terms of social harmony and responsibility, placing less emphasis on the dimensions of democratic debate and critical participation. However, some participants explained active citizenship directly through participation. For example, one teacher defined participating in a peaceful protest against a law they believed to be unfair as an act of active citizenship (P1). Another teacher described an active citizen as an honest, responsible, tax-paying individual who strives to protect their country (P22).

Overall, the findings reveal that teachers approach active citizenship in terms of both values and skills, but that the values dimension is more dominant than the skills dimension in this definition. In other words, in teachers' perceptions, active citizenship is highlighted more as an individual who maintains social order, fulfills responsibilities, and adapts to society, rather than as a critical and transformative actor.

Classroom teachers' views on citizenship education

Teachers' views on the aim of citizenship education were analyzed. The findings from classroom teachers on citizenship education are presented in Figure 7.
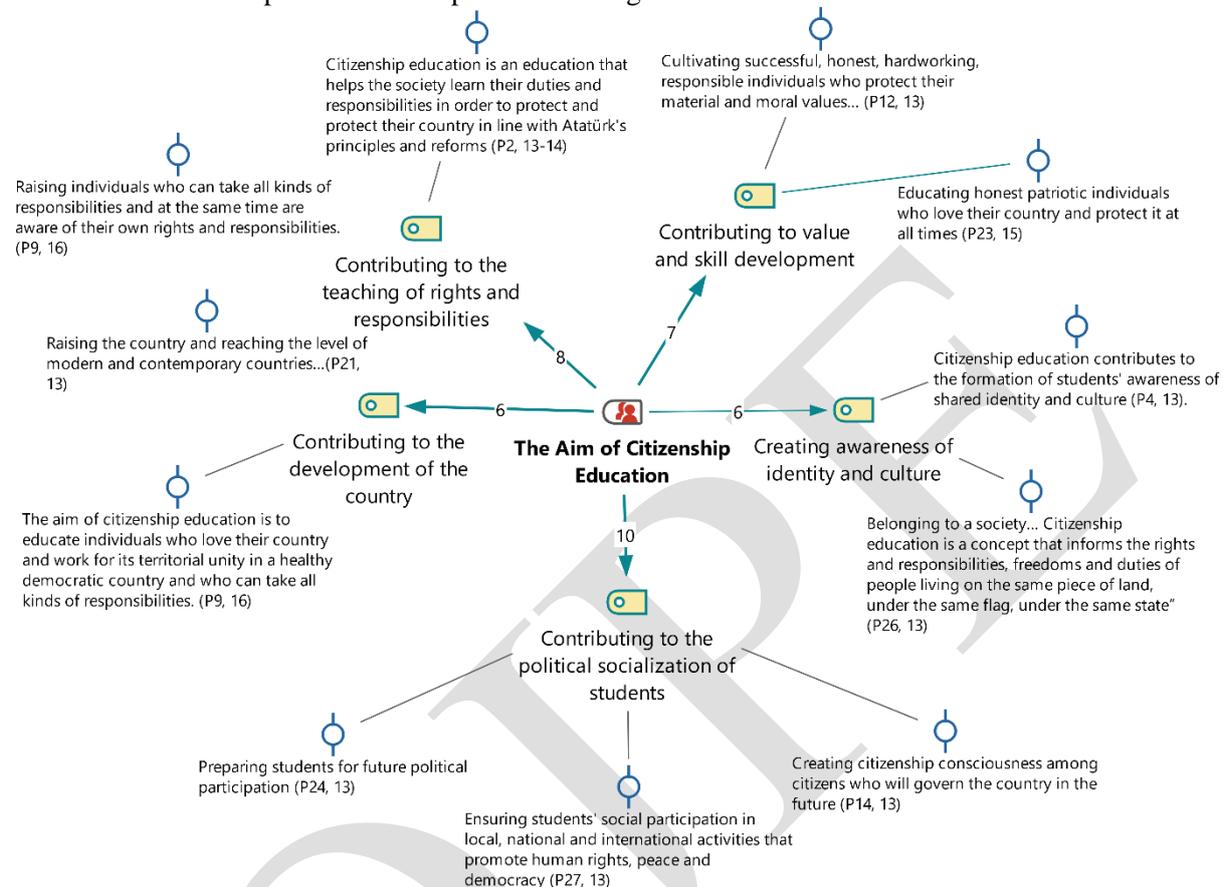
Figure 7. MAXMaps the Code Theory Model regarding the aim of citizenship education.

The opinions of classroom teachers reveal that perceptions of the purpose of citizenship education vary in different dimensions. Teachers define citizenship education not so much as a subject focused on the transfer of knowledge, but rather as a process that prepares students for social life and instills certain behavioral patterns. In this context, teachers' views were grouped around the categories of teaching rights and responsibilities, political socialization, value and skill development, contributing to the country's development, and identity-cultural awareness.

First, teachers expressed the fundamental purpose of citizenship education as developing students as individuals who know their rights and responsibilities. According to the participants, citizenship education is important for individuals learning their duties within society and contributing to the maintenance of social order. In this regard, citizenship education has been seen as a process that helps students acquire behaviors such as obeying rules, taking responsibility, and fulfilling their social obligations. In addition, teachers emphasized that citizenship education contributes to students' political socialization. Students' participation in social life, developing sensitivity to social issues, and understanding democratic processes have been considered important goals of citizenship education. In other words, citizenship education has been interpreted as a process that helps individuals recognize that they are members of society and take an active role in social life. In addition, teachers stated that citizenship education is closely related to the development of values and skills. Among the important goals of citizenship education are instilling values such as respect, responsibility, helpfulness, and social awareness in students, and developing skills such as cooperation, communication, and coexistence. In this respect, citizenship education has been evaluated as an area that supports not only cognitive but also emotional and social development. In the teachers' narratives, another objective of citizenship

education was to contribute to the country's development. Participants associated the progress of society and the development of the country with the cultivation of conscious individuals. Therefore, in civic education, social benefit and collective responsibility were considered important beyond individual gains. Finally, teachers stated that civic education creates identity and cultural awareness in students. Students feeling that they belong to the society they live in, recognizing cultural values, and developing awareness of their shared past were seen as important functions of civic education.

Overall, the findings show that while teachers accept civic education as an area that develops participatory democratic processes, they interpret this process primarily in terms of its functions of maintaining social order, instilling responsibility, and creating a sense of belonging.

Implementation of Citizenship Education: Courses, Methods, and Experiential Contexts

Figure 8 presents classroom teachers' opinions on which courses or extracurricular activities provide citizenship education.
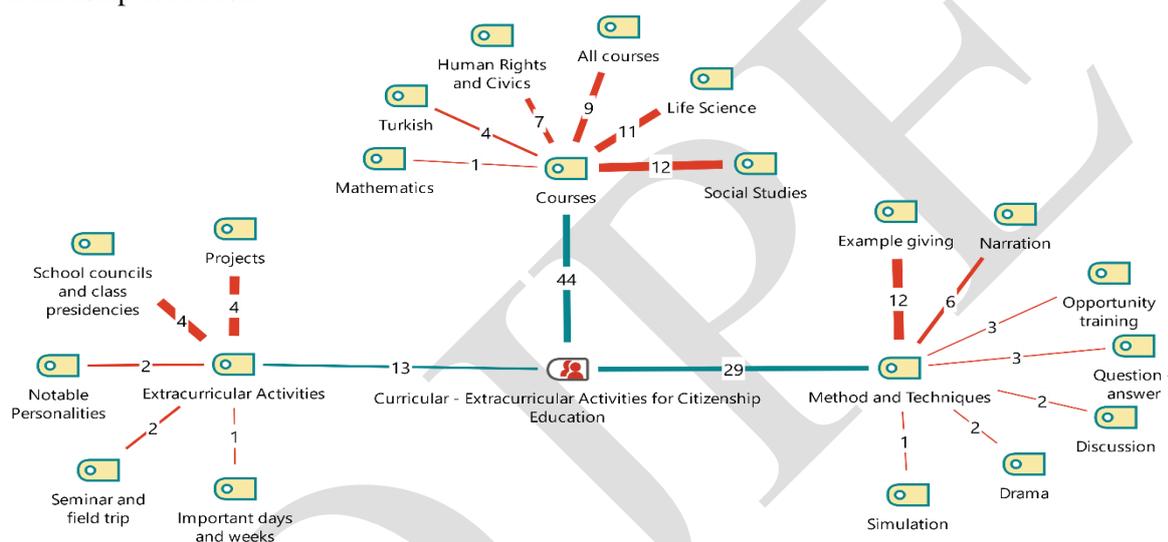
Figure 8. MAXMaps the Code Theory Model regarding activities for citizenship education.

Teachers' views regarding the courses and activities through which they implement citizenship education were grouped under three main categories: courses, instructional methods and techniques, and extracurricular activities.

In their narratives, teachers stated that social studies, life sciences, and the human rights and citizenship course were particularly influential in developing citizenship awareness. However, some teachers also emphasized that citizenship education is not limited to specific subjects and that all courses can contribute to developing this awareness. For example, one teacher stated that "although all courses are important in building citizenship awareness, life sciences, social studies, and human rights courses are more decisive in this regard" (P1). Similarly, another participant expressed that "this awareness can be developed in all courses where activities can be carried out" (P25). These findings indicate that teachers view citizenship education not as content belonging to a particular subject, but as an interdisciplinary area.

When the instructional methods used to develop citizenship awareness are examined, it is evident that teachers rely primarily on exemplification and lecturing. In addition, techniques such as question–answer, drama, incidental teaching, and limited discussion were also mentioned in teacher narratives. One teacher stated that they planned to develop citizenship awareness by explaining important historical figures and national examples (P25). Another teacher reported using lecturing, question–and–answer, and drama methods and noted that they tried to concretize the abstract nature of the concept of citizenship (P3). Another participant stated that they paid special attention to democracy and social identity development in their lessons and asked students questions such as "Who would I be if I had

been born and raised in another family?" in order to foster empathy (P14). Moreover, presenting individuals who contribute to their country in sports, arts, and science was also expressed as a way of building citizenship awareness (P10). These findings show that teachers mainly adopt an information-transmission, teacher-centered, and example-based approach in citizenship education, while participatory and discussion-oriented methods are used more limitedly.

Within extracurricular activities, teachers reported including projects, school councils, class representative elections, seminars, trips, and special days and weeks. These activities were evaluated as environments in which students could experience citizenship. One teacher stated that practices such as school councils and student representation provide students with the opportunity to experience citizenship (P9). Another teacher reported providing a democratic experience through in-class elections and voting practices (P13). International projects were also considered a field that develops citizenship awareness. For instance, one teacher stated that projects such as eTwinning, which enable students to collaborate with peers from different cultures, help develop values such as respect, empathy, and responsibility (P1). Similarly, another participant indicated that they directed students toward projects they could participate in outside school (P21). These findings show that teachers do not limit citizenship education only to classroom instruction and teaching methods, but also include experience-based activities. However, when the scope of these activities is examined, they appear to remain largely limited to school-based settings.

When the research findings are considered together, it can be said that teachers' views on the aims of citizenship education are consistent with their understanding of the concept of citizenship. Teachers most often define citizenship in terms of identity, belonging, responsibility, and social order. Accordingly, they associate citizenship education primarily with students learning their rights and responsibilities, achieving social adaptation, and developing values. In contrast, the participation dimension of citizenship, such as democratic discussion, critical thinking, and political participation, remains in the background.

Teachers also reflect this understanding in their pedagogical practices. Although teachers state that active citizenship is the most important type of citizenship, in classroom practices, they mostly prefer lecturing, exemplification, and guidance-based instructional approaches. Extracurricular activities are seen as those that support student participation; however, this participation generally remains limited to school-based, structured activities.

Therefore, the findings show that teachers' understandings of citizenship do not directly translate into pedagogical practices in citizenship education. In other words, while active citizenship is strongly emphasized in teacher narratives, a more normative, transmission-based approach to citizenship education emerges in teaching practices.

DISCUSSION, CONCLUSION, and SUGGESTIONS

Revealing teachers' views and perspectives on the concept of citizenship and citizenship education constitutes an important resource regarding how citizenship education is addressed in schools. This study, in line with research findings, examines classroom teachers' understanding of the concept of citizenship and citizenship education, and how this understanding is reflected in their classroom pedagogical practices.

The findings reveal that classroom teachers conceptualize citizenship as acquiring national legal status and identity, knowing rights and responsibilities, and being participatory and patriotic. In teachers' narratives, citizenship was defined in terms of belonging, shared values, and a sense of responsibility; the dimensions of participation and negotiation were addressed to a lesser extent. This situation shows that teachers primarily perceive citizenship as a cultural and normative identity. These findings are consistent with previous studies showing that teachers' understanding of citizenship in Turkey is largely shaped by national identity and duty (Güven et al., 2009; Malkoç & Ata, 2021; Kadıoğlu et al., 2016; Gürkan & Doğanay, 2020). However, this research differs from other studies in that it reveals that this normative understanding of citizenship is not merely a matter of perception but also decisive in teachers'

pedagogical practices. In the international literature, teachers' perceptions of citizenship vary by context. While participatory citizenship is prominent in countries such as Chile, Australia, England, and the USA (Chin & Barber, 2010; Martínez-Rodríguez et al., 2019), research has shown that national and nationalist understandings of citizenship are dominant in more centralized countries such as Singapore (Sim, 2008). In light of these findings, it is possible to say that teachers' understanding of citizenship is shaped not only by individual preferences but also by national citizenship culture and education policies. In the study, teachers emphasized active citizenship as the most important type of citizenship. However, when examining teachers' definitions of active citizenship, it is evident that this concept is primarily addressed in terms of responsibility, social sensitivity, and working for the benefit of the country. It is noteworthy that dimensions such as political participation, social participation, critical inquiry, and democratic deliberation are given limited attention. This result draws attention to the theoretical distinction between normative and participatory citizenship, which are frequently discussed in the literature (Westheimer & Kahne, 2004; Veugelers, 2007; Biesta, 2011). Normative citizenship is based on the individual's adaptation to the social order, fulfillment of responsibilities, and commitment to common values. In contrast, participatory citizenship is based on the individual's critical thinking, participation in public debates, and active role in democratic decision-making processes (Parker, 2008; Biesta, 2011). Westheimer and Kahne (2004) consider citizenship in three types: "responsible citizen," "participatory citizen," and "justice-oriented citizen." The findings of this research show that although teachers stated they considered active citizenship important, their understanding of active citizenship was more closely defined within the category of "responsible citizenship." Indeed, teachers define an active citizen as an individual who is responsible, sensitive to social problems, loyal to their country, hardworking, and supportive of social order. Although teachers' narratives refer to social and political participation, it is clear from the relevant definitions that this understanding of participation remains within a normative framework.

These results can be considered a reflection of Turkey's historical citizenship culture. In Turkey, the understanding of citizenship has been shaped around duty, loyalty, and national unity since the proclamation of the Republic (Üstel, 2004; Kadıoğlu, 2006). Considering this historical background, it is not surprising that although teachers embrace the discourse of active citizenship, their definitions of active citizenship are closer to the "responsible citizen" typology. In this context, the research results show that ideal citizenship education can be achieved not only through curriculum changes but also through the restructuring of teachers' beliefs and pedagogical backgrounds.

According to the research results, classroom teachers view the main purpose of citizenship education as fostering civic awareness among their students. In addition, in the teachers' narratives, citizenship education is considered important for contributing to students' socialization processes through political and social participation, raising individuals' awareness of their rights and responsibilities, instilling national identity and cultural awareness, and supporting the development of values and skills related to citizenship. In this respect, teachers evaluate citizenship education not so much as a process of information transfer, but as a process that influences students' ability to find their place in social life. These findings largely coincide with studies in the literature. In Önal, Öztürk, and Kenan's (2018) study, teachers in England reported that citizenship education improved students' social skills, increased their political literacy, and strengthened their capacity to question world problems. Çetiner and Şimşir (2024), on the other hand, revealed that teachers expressed the aims of citizenship education more as raising individuals who fulfill their duties, contribute to the social order, and benefit their families and country. Similarly, Badou's (2013) study highlighted the dimensions of developing political literacy, fostering identity awareness, and teaching rights and responsibilities in citizenship education. Parallel to these findings, the Eurydice (2017) report also shows that citizenship education in European countries focuses on goals such as critical thinking, political literacy, and active participation. From this perspective, it is possible to say that the aims expressed by teachers are aligned with those of international citizenship education. However, as seen in the present study, the issue that needs to be discussed is not so much the aims of citizenship education themselves, but rather how these aims are reflected in classroom pedagogical practices.

Regarding the subjects through which citizenship education is provided, social studies, life skills, and human rights and citizenship courses were most frequently mentioned by teachers. This indicates that citizenship education is identified with specific subjects. The literature frequently emphasizes the central role of social studies lessons in acquiring citizenship knowledge, skills, and values (Althof & Berkowitz, 2006; Uğurlu, 2011; Polat, Özgül, & Bayram, 2023). However, the perception of citizenship education as being integrated into the content of specific courses suggests that citizenship is treated more as a program-based content. Regarding teaching methods, it was found that teachers most frequently use information-transfer-based methods, such as lecturing, providing examples, and question-and-answer sessions. More participatory methods, such as drama, discussion, and projects, are less frequently used, and it appears that a teacher-centered approach generally prevails in citizenship education.

This result presents a striking picture, given that active citizenship is widely regarded as the most important type of citizenship in teachers' discourse. The emphasis on active and participatory citizenship in teachers' narratives shows inconsistency with their classroom practices. However, international literature indicates a strong relationship between teachers' beliefs and pedagogical preferences (Thornton, 2005; Sampermans et al., 2021; De Schaepmeester et al., 2022). However, when viewed specifically in Turkey, this inconsistency can be explained by several factors: the historical shaping of the understanding of citizenship in Turkey around the axes of duty, commitment, and social unity; insufficient emphasis on the practical application of citizenship education in teacher training programs; and the perception of political issues as sensitive in the classroom environment, leading teachers to prefer more controllable methods.

Conclusion
This research reveals how classroom teachers understand the concept of citizenship and citizenship education, and how this understanding is reflected in classroom practices. The research findings show that teachers largely address citizenship within the framework of national identity, belonging, responsibility, and social order. Despite the emphasis on active citizenship in teachers' discourse, the study concludes that this concept is primarily understood in terms of raising responsible and compliant individuals. The study also concluded that there is a certain gap between the aims of citizenship education and teachers' classroom pedagogical practices. Accordingly, teachers value students' political and social participation through citizenship education; however, in classroom practice, they tend towards a more information-transfer-based, teacher-centered approach.

In conclusion, strengthening citizenship education within a more participatory, critical, and democratic framework seems possible not only through program changes but also through a reassessment of teachers' understanding of citizenship and their classroom practices. In this context, this study makes a conceptual and contextual contribution to the literature by highlighting the gap between teachers' ideals and practical applications in citizenship education.

Recommendations
This research has revealed a gap between teachers' understanding of citizenship and their classroom practices. Therefore, teacher training programs should focus more on democratic and participatory approaches to citizenship education, rather than solely on conceptual content. Teacher candidates should be equipped with skills in discussion-based teaching, creating a conducive classroom environment, and fostering community engagement. Future research could compare the relationship between teachers' beliefs and pedagogical practices across various contexts.

Funding

Ethics and Conflict of Interest
This study was approved by Çukurova University, Social and Humanities Research Ethics Board, no 957032, on 14.03.2024. The author declares that they acted in accordance with ethical rules in all processes of the research. The author declared no conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author upon reasonable request.

Corresponding Author

Correspondence to Şehide KILINÇ, sehidearslanhan83@gmail.com

REFERENCES

Akar, H., & Aschenberger, F. K. (2016). Students' civic knowledge and perceptions of civic concepts in a private school: a comparative international perspective. *International Journal of Curriculum and Instructional Studies*, *6*(12), 115-132.

Akhtar, S. (2010). *The understanding, perspectives, and attitudes of Scottish primary school teachers towards education for citizenship* (Unpublished doctoral dissertation). The University of Strathclyde.

Arslan, K. (2022). *Velilerin bakış açılarına göre vatandaşlık eğitimi* [Citizenship education according to parents' views] (Unpublished master thesis). Sakarya University.

Brod, M., Tesler, L. E., & Christensen, T. L. (2009). Qualitative research and content validity: Developing best practices based on science and experience. *Quality of Life Research*, *18*, 1263–1278.

Bakioglu, A., & Kurt, T. (2009). Öğretmenlerin demokrasi, vatandaşlık ve vatanseverlik algılarının nitel olarak incelenmesi [A qualitative analysis of teachers' perceptions of democracy citizenship and patriotism]. *Marmara University Atatürk Education Faculty Journal of Educational Sciences*, *29*(29), 19-39.

Baralt, M. (2011). Coding qualitative data. *Research methods in second language acquisition: A practical guide*, 222–244.

Bıçak, İ., & Ereş, F. (2018). Öğretmenlerin vatandaşlık eğitimi ve vatandaşlık eğitimi sürecine yönelik görüşleri [Teachers' views concerning citizenship education and the citizenship education process]. *The Journal of Turkish Educational Sciences*, *16*(2), 257–279.

Boadu, K. (2013). Teachers' perception of the importance of teaching citizenship education to primary school children in Cape Coast, Ghana. *Journal of Arts and Humanities*, *2*(2), 137-147.

Brenner, M. (2006). Interviewing in educational research. In: J. L. Green, G. Camilli, G. & P. B. Elmore (Eds.), *Handbook of complementary methods in education research* (p. 357–370). Washington, DC: Routledge.

Ceylan, A., & Bozkurt, E. (2023). Examining the good citizenshıp percepiıons of prospective primary school teachers. *International Journal of Education, Technology and Science*, *3*(4), 1323–1347.

Chin, K., & Barber, C. E. (2010). A multi-dimensional exploration of teachers' beliefs about civic education in Australia, England, and the United States. *Theory & Research in Social Education*, *38*(3), 395–427.

Cleovoulou, Y. (2021). *21st century pedagogies and citizenship education: Enacting elementary school curriculum using critical ınquiry-based learning*. Spain: Universidad de Salamanca. https://doi.org/10.5772/intechopen.96998

Çelik, H. (2009). *Sosyal bilgiler öğretmenlerinin vatandaşlık eğitiminin bugünkü durumu ve geleceğine ilişkin görüşleri* [Views of social studies teachers related to the present circumstance and future of citizenship education] (Unpublished doctoral dissertation). Marmara University.

Çetiner, A. (2023). *Sosyal bilgiler ve sınıf öğretmenlerinin vatandaşlık eğilimleri ve sınıf içi uygulamalara ilişkin görüşleri* [Social studies and classroom teachers' tendencies and views on classroom practices] (Unpublished doctoral dissertation). Necmettin Erbakan University.

Çetiner, A., & Şimşir, M. (2024). The views of classroom teachers with the title of head teacher on citizenship education. *Journal of Research in Social Sciences and Language*, *4*(1), 47–64.

Çolak, K., Kabapınar, Y., & Öztürk, C. (2019). Sosyal bilgiler derslerini veren öğretmenlerin küresel vatandaşlığa ve küresel vatandaşlık eğitimine bakışları [Social studies courses teachers' views on global citizenship and global citizenship education]. *Education and Science*, *44*(197), 335-352. https://doi.org/10.15390/EB.2019.7721

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research, 5*(4), 194–197. https://doi.org/10.1016/S0897-1897(05)80008-4

De Schaepmeester, L., van Braak, J., & Aesaert, K. (2022). Teach what you preach? The relationship between teachers' citizenship beliefs and citizenship education in the classroom. *The Journal of Social Studies Research*, *46*(4), 363-378.

Değirmenci, Y., & Eskici, B. (2019). Öğretmen adaylarının etkin vatandaşlık algılarının incelenmesi [Examination of prospective teachers' perceptions of active citizenship]. *OPUS International Journal of Society Researches, 11*(18), 232-256. https://doi.org/10.26466/opus.537074

Dijkstra, A. B., Geijsel, F., Ledoux, G., van der Veen, I., & ten Dam, G. (2015). Effects of school quality, school citizenship policy, and student body composition on the acquisition of citizenship competences in the final year of primary education. *School Effectiveness and School Improvement, 26*(4), 524–553. https://doi.org/10.1080/09243453.2014.969282

Doğanay, A. (2009). Öğretmen adaylarının vatandaşlık algısının ve eylemlerinin siyasal toplumsallaşma bağlamında değerlendirilmesi [in Turkish]. I. Uluslararası Avrupa Birliği, Demokrasi, Vatandaşlık ve Vatandaşlık Eğitimi Sempozyumu Bildirileri [Proceedings of the 1st International Symposium on the European Union, Democracy, Citizenship and Citizenship Education] (p. 2844).

Dusi, P., Steinbach, M., & Messetti, G. (2012). Citizenship education in a multicultural society. Teachers' practices. *Procedia – Social and Behavioural Sciences, 69*, 1410–1419. https://doi.org/10.1016/j.sbspro.2012.12.080

Egüz, Ş., & Kafadar, T. (2020). Active citizenship from the perspective of pre-service social studies teachers. *Elementary Education Online*, *19*(2), 565-579. https://doi.org/10.17051/ilkonline.2020.690003

Ereş, F. (2015). Vatandaşlık eğitimi ve karakter eğitimi politikalarının değerlendirilmesine yönelik nitel bir çalışma [A qualitative study on the evaluation of citizenship education and character education policy]. *Mehmet Akif Ersoy University Journal of Education Faculty*, *1*(36), 120–136.

Ersoy, A. F. (2007). *Sosyal bilgiler dersinde öğretmenlerin etkili vatandaşlık eğitimi uygulamalarına ilişkin görüşleri* [The opinions of teacher regarding the practices of effective citizenship education in social studies course(Unpublished doctoral dissertation). Anadolu University.

Eryılmaz, Ö., Bursa, S., & Ersoy, A. F. (2018). Sosyal bilgiler öğretmenleri ve öğrencilerinin etkin vatandaşlık ile sivil toplum kuruluşu algıları [Social studies teachers' and students' perceptions of active citizenship and non-governmental organisations]. *International Online Journal of Educational Sciences*, *10*(2), 258-276. https://doi.org/10.15345/iojes.2018.02.018

Estellés, M., Amo, F. J., & Romero, J. (2021). There is a consensus on the purposes of citizenship education in teacher education. *Social Sciences*, *10*(5), 164. https://doi.org/10.3390/socsci10050164

Eurydice (2017) "Citizenship education at school in Europe", http:// www.eurydice.org Date of downloading: 05.10.2024.

Evagorou, M., Vrikki, M., & Papanastasiou, E. (2023). Students' and teachers' voices on the outcomes of a citizenship education curriculum. *Citizenship, Social and Economics Education*, *22*(2), 100–117.

Evans, M., Ingram, L., Macdonald, A., & Weber, N. (2009). Mapping the 'global dimension' of citizenship education in Canada: The complex interplay of theory, practice and context. *Citizenship, Teaching and Learning, 5(2),* 17–34.

Fives, H., & Buehl, M. M. (2014). Exploring differences in practicing teachers' valuing of pedagogical knowledge based on teaching ability beliefs. *Journal of Teacher Education*, *65*(5), 435-448.

Fuentes-Moreno, C., Sabariego-Puig, M., & Ambrós-Pallarés, A. (2020). Developing social and civic competence in secondary education through the implementation and evaluation of teaching units and educational environments. *Humanities and Social Sciences Communications*, 7. https://doi.org/10.1057/s41599-020-0530-4

Gürkan, B., & Doğanay, A. (2020). Factors affecting citizenship education according to perceptions and experiences of secondary-school teachers. *Turkish Journal of Education*, *9*(2), 106–133.

Güven, S., Tertemiz, N., & Bulut, P. (2009). Vatandaşlık ve vatandaşlık eğitimine yönelik sınıf öğretmenlerinin görüşleri [Views of class teachers on citizenship and citizenship education]. *Black Sea Journal of Social Sciences*, *1*(1), 149–170.

Hoskins, B. L., Janmaat, J. G., & Villalba, E. (2012). Learning citizenship through social participation outside and inside school: An international, multilevel study of young people's learning of citizenship. *British Educational Research Journal, 38*(3), 419–446. https://doi.org/10.1080/01411926.2010.550271

Jang, H. Y., Yang, J. E., & Shin, Y. S. (2022). A phenomenological study of nurses' experience in caring for COVID-19 patients. *International Journal of Environmental Research and Public Health*, *19*(5), 2924.

Jara Ibarra, C., Sánchez Bachmann, M., Cox, C., & Miranda, D. (2023). The meaning of citizenship: Identifying the beliefs of teachers responsible for citizenship education in Chile. *Theory & Research in Social Education*, *51*(3), 464–485.

Jerome, L. (2012). England's citizenship education experiment. *England's Citizenship Education Experiment*, 1–208.

Kadıoğlu, A., Keyman, F., & Çakmaklı, D. (2016). *Vatandaşlık araştırması bulgular raporu* [in Turkish]. *İstanbul: Konda.*

Kayacan, G. (Haz.) (2014). *"Biz" kimiz? Ders kitaplarında kimlik, yurttaşlık, haklar* [in Turkish]. İstanbul: Tarih Vakfı Publications.

Keyman F (2008). *Aydınlanma, Türkiye ve vatandaşlık* [in Turkish]. İstanbul: Osmanlı Bankası Arşiv ve Araştırma Merkezi.

Keyman, E. F., & İçduygu, A. (1998). *Türk modernleşmesi ve ulusal kimlik sorunu: Anayasal vatandaşlık ve demokratik açılım olasılığı* [in Turkish]. *A. Ünsal (ed.)*, *75*, 169–180.

Kilci, Z. (2019). *Sosyal bilgiler öğretmenlerinin dijital vatandaşlığa yönelik görüşleri ve uygulamaları* [Social studies teachers' digital citizenship opinions and applications] (Unpublished master thesis). Anadolu University.

Knowles, R. T., Torney-Purta, J., & Barber, C. (2018). Enhancing citizenship learning with international comparative research: Analyses of IEA civic education datasets. *Citizenship Teaching & Learning*, *13*(1), 7-30.

Koh, C., Liu, W., Chye, E., & Divaharan, S. (2013). Student teachers' views on national education: the need for greater alignment between policy and praxis, *Asia Pacific Journal of Education, 33*(4), 424–443, https://doi.org/10.1080/02188791.2013.810142

Koutselini, M. (2008). Citizenship education in context: Student teacher perceptions of citizenship in Cyprus. *Intercultural Education,* 19, 163–175. https://doi.org/10.1080/14675980801889690

Kuş, Z., & Aksu, A. (2017). Vatandaşlık ve vatandaşlık eğitimi hakkında sosyal bilgiler öğretmenlerinin inançları [Social studies teachers' beliefs on citizenship and citizenship education]. *International Journal of Turkish Education Sciences*, *2017*(8), 18–41.

Kwan-Choi Tse, T. (2000). Deformed citizenship: A critique of the junior secondary economic and public affairs syllabus and textbooks in Hong Kong. *Pedagogy, Culture & Society*, *8*(1), 93–110.

Lee, W. O., & Fouts, J. T. (2005). *Education for social citizenship: Perceptions of teachers in the USA, Australia, England, Russia, and China* (Vol. 1). Hong Kong University Press.

Leenders, H., & Veugelers, W. (2006). Different perspectives on values and citizenship education. *Curriculum and Teaching*, *21*(2), 5–20.

Leenders, H., Veugelers, W., & De Kat, E. (2008). Teachers' views on citizenship education in secondary education in the Netherlands. *Cambridge Journal of Education*, *38*(2), 155–170.

Lin, A. (2015). Citizenship education in American schools and its role in developing civic engagement: a review of the research. *Educational Review*, 67, 35, 63. https://doi.org/10.1080/00131911.2013.813440

Malkoç, S., & Ata, B. (2021). Sosyal bilgiler öğretmenlerinin vatandaşlık tiplerinin belirlenmesi [Determination of the citizenship types of social studies teachers]. *Ankara University Journal of Faculty of Educational Sciences (JFES)*, *54*(2), 459–496. https://doi.org/10.30964/auebfd.897458

Margot, K. C., & Kettler, T. (2019). Teachers' perception of STEM integration and education: a systematic literature review. *International Journal of STEM Education*, *6*(1), 1–16.

Marovah, T. (2019). Citizenship formation through curriculum and pedagogical practices: Evidence from two Zimbabwean teachers' colleges. *South African Journal of Education*. https://doi.org/10.15700/saje.v39ns2a1411

Martínez-Rodríguez, R., Muñoz-Labraña, C., & Sánchez-Agustí, M. (2019). What does it mean to be a citizen? A comparative study of teachers' conceptions in Spain and Chile. *Education as Change*, *23*(1), 1–24.

Mayring, P. (2014). *Qualitative content analysis: theoretical foundation, basic procedures, and software solution*. Klagenfurt. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-395173

Merriam, B. (2013). Nitel araştırma türleri [Six common qualitative research designs] (Trans. F. K. Canbaz & M. Öz). in S. Turan (Ed.), Nitel *araştırma desen ve uygulama için bir rehber* [in Turkish] *(*p. 21–37) Ankara: Nobel Academic Publishing.

Merriam, S. B., & Grenier, R. S. (Eds.). (2019). *Qualitative research in practice: Examples for discussion and analysis*. John Wiley & Sons.

Mhlauli, M. B. (2012). The paradox of teaching citizenship education in Botswana primary schools. *European Journal of Educational Research*, *1*(2), 85–105.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd Ed). Thousand Oaks, CA: Sage.

Neubauer, B. E., Witkop, C. T., & Varpio, L. (2019). How phenomenology can help us learn from others' experiences. *Perspectives on Medical Education*, *8*, 90–97.

Obiagu, A. (2024). Being a good citizen in a postcolonial context: Justice-oriented citizenship implications of Nigerian teachers' civic education ideologies. *Theory & Research in Social Education*, 52, 273-311. https://doi.org/10.1080/00933104.2024.2305463

Ontas, T., & Koc, E. S. (2020). Primary school teacher candidates' views of citizenship and ıdeal citizenship. *International Journal of Educational Methodology*, *6*(2), 455-470.

Önal, G., Öztürk, C., & Kenan, S. (2018). Teachers' perspectives on citizenship education in England. *Education & Science*, *43*(196), 243-256. https://doi.org/10.15390/EB.2018.7060

Özbek, R., & Köksalan, B. (2015). Evaluation of pre-service teachers'opinions concerning the objectives of the citizenship education. *Electronic Journal of Social Sciences*, *14*(54), 129-140. https://doi.org/10.17755/esosder.91761

Parker, W. C. (2003). *Teaching democracy: Unity and diversity in public life*. Teachers College Press.

Parker, W. C. (2008). Knowing and doing in democratic citizenship education. *Handbook of research in social studies education*, p. 65–80.

Pederson, P. V. & Cogan, J. J. (2003). Civic education pedagogy and assessment in the pacific rim: Six cases. *International Journal of Social Education, 17*(1), 16–30.

Pike, M. A. (2007). The state and citizenship education in England: A curriculum for subjects or citizens? *Journal of Curriculum Studies, 39(4),* 471-489

Polat, S., Özgül, İ., & Bayram, H. (2023). How should citizenship education be given?: A study based on the opinions of social studies teachers. *International Journal of Assessment Tools in Education*, *10*(1), 98–113.

Polit, D. F., & Beck, C. T. (2006). *Essentials of nursing research: Methods, appraisal, and utilization* (6th ed.). Philadelphia: Lippincott Williams & Wilkins.

Polit, D. F., & Beck, C. T. (2008). *Nursing research: Generating and assessing evidence for nursing practice*. Lippincott Williams & Wilkins.

Rubio D., Berg Weger M., Tebb S., Lee E., Rauch S. (2003). Objectifying content validity: Conducting a content validity study in social work research. *Social Work Research*, 27, 94–104.

Sampermans, D., Reichert, F., & Claes, E. (2021). Teachers' concepts of good citizenship and associations with their teaching styles. *Cambridge Journal of Education*, *51*(4), 433–450.

Schreier, M. (2012). *Qualitative content analysis in practice*. Sage Publications.

Schugurensky, D. (2010). Citizenship learning for and through participatory democracy. in *Learning citizenship by practicing democracy: International initiatives and perspectives*, 1-19. Newcastle: Cambridge Scholars Publishing.

Schwartz-Shea, P., & Yanow, D. (2013). *Interpretive research design: Concepts and processes*. Routledge.

Sen, A. (2022). Three evils of citizenship education in Turkey: Ethno-religious nationalism, statism, and neoliberalism. *Critical Studies in Education*, *63*(3), 307–322.

Sen, K. (2023). Citizenship education under authoritarian Islamic nationalism: an exploration of teachers' conceptions of citizenship in Turkey. *Journal of Curriculum Studies*, *55*(2), 171–186.

Shah, R., Brett, P., & Thomas, D. (2020). Visualizing civic values: Representations of idealized citizenship behaviours in images found in Nepalese social studies textbooks. *Citizenship Teaching & Learning*, *15*(1), 79–99.

Shrotryia, V. K., & Dhanda, U. (2019). Content validity of the assessment instrument for employee engagement. *Sage Open*, *9*(1), 2158244018821751.

Sim, J. B. Y. (2008). What does citizenship mean? Social studies teachers' understandings of citizenship in Singapore schools. *Educational Review*, *60*(3), 253–266.

Smith, B., Neoh, J., McDowall, A., & Kim, E. (2024). Preparing teachers for critical global and democratic practice: shifting inquiries into the teaching of democracy and global citizenship in teacher education. *Curriculum Perspectives*, *44*, 525–536. https://doi.org/10.1007/s41297-024-00235-0

Sunal, C. S., & Haas, M. E. (2011). How do students develop citizenship in democratic and global societies? *Social Studies for The Elementary and Middle Grades (A Constructivist Approach)*, 133–172.

Şentürk, M., Şimşek, U., Tıkman, F., & Yıldırım, E. (2017). Sosyal bilgiler ve sınıf eğitimi öğretmen adaylarının gözünden vatandaşlık eğitimi: Nitel bir çalışma [The views of pre-service social studies teachers and pre-service classroom teachers about citizenship education: A qualitative study]. *Dicle University Journal of Ziya Gökalp Faculty of Education*, (32), 913–925. https://doi.org/10.14582/DUZGEF.1871

Şimşek, A., & Karaduman, E. (2023). Türkiye'de vatandaşlık eğitiminin yönü (II. Meşrutiyet döneminden günümüze 2022) [The direction of citizenship education in Turkey (From the period of II. constitutionalism to the present 2022). *Selçuk University Journal of Studies in Turcolog*, (Special Issue), 75–108. https://doi.org/10.21563/sutad.1378237

Tangül, H., & Soykan, E. (2021). Comparison of students' and teachers' opinions toward digital citizenship education. *Frontiers in Psychology*, *12*, 752059.

Teherani, A., Martimianakis, T., Stenfors-Hayes, T., Wadhwa, A., & Varpio, L. (2015). Choosing a qualitative research approach. *Journal of Graduate Medical Education*, *7*(4), 669–670.

Thornton, S. J. (2008). Continuity and change in social studies curriculum. *Handbook of Research İn Social Studies Education*, 15–32.

Tomé, V., Sikharulidze, M., Lobzhanidze, S., & Urchukhishvili, G. (2024). Digital Citizenship Education: Perceptions on the concept, self-reported competences, and practices of Georgian school society.

Uğurlu, C. T. (2011). Avrupa Birliği ülkelerinde ve Türkiye'de vatandaşlık eğitimi [Citizenship Education in European Union Countries and Turkey]. *Electronic Journal of Social Sciences, 10*(37), 153–169.

Ulger, M. (2013). İnsan hakları ve vatandaşlık eğitimi ara disiplin alanı uygulamasının sosyal bilgiler öğretmenlerinin görüşleri bağlamında değerlendirilmesi [Evaluation of ımplementation of human rights and citizenship ınterdiscipline domain in the context of social studies teachers' opinions]. *Turkish Journal of Education*, *2*(3), 14–29. https://doi.org/10.19128/turje.181061

Üner, S. S., & Yeşil, R. (2014). The examination of the views of primary school teachers and preservice primary teachers on European Union citizenship from the point of different variables: A qualitative study. *Participatory Educational Research*, *1*(2), 68–82.

Veugelers, W. (2007). Creating critical-democratic citizenship education: empowering humanity and democracy in Dutch education. *Compare: A Journal of Comparative and International Education*, *37*(1), 105–119.

Veugelers, W. (2011). Theory and practice of citizenship education: The case of policy, science and education in the Netherlands. *Revista de Educacion*, (1), 209-224.

Walkington, H., & Wilkins, C. (2000). Education for critical citizenship: the impact of teachers' world-view on classroom practice in the teaching of values. *School Field*, *11*(1), 59–78.

Weinberg, J., & Flinders, M. (2018). Learning for democracy: The politics and practice of citizenship education. *British Educational Research Journal*, *44*(4), 573-592. https://doi.org/10.1002/berj.3446

Westheimer, J., & Kahne, J. (2004). What kind of citizen? The politics of educating for democracy. *American Educational Research Journal*, *41*(2), 237–269.

Westheimer, J., & Ladson-Billings, G. (2024). *What kind of citizen?: Educating our children for the common good.* Teachers College Press.

Willemse, T. M., ten Dam, G., Geijsel, F., van Wessum, L., & Volman, M. (2015). Fostering teachers' professional development for citizenship education. *Teacher and Teaching Education, 49*, 118–127. https://doi.org/10.1016/j.tate.2015.03.008

Wong, K. L., Lee, C. K. J., Chan, K. S. J., & Kennedy, K. J. (2017). The model of teachers' perceptions of 'Good Citizens': Aligning with the changing conceptions of 'Good Citizens'. *Citizenship Teaching & Learning*, *12*(1), 43–66.

Yıldırım, A., & Şimşek, H. (2011). Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in social sciences] (8th edition) Ankara: Seçkin Publishing.

Zaman, H. (2006). *Teachers' perceptions of citizenship and citizenship education: A comparative study* (Unpublished doctoral dissertation). University of Pittsburgh.

About the Author

Şehide KILINÇ, Ph.D.

Şehide KILINÇ holds a Ph.D. from Gazi University, Institute of Educational Sciences. She currently serves as the principal of Yağızlar Primary School. Her research interests include primary education, citizenship education, classroom teaching, child well-being, and inclusive education. Her studies focus on teachers' and students' perspectives in primary education and on the factors that influence children's participation and well-being in educational environments.

TANGIBLE OR INTANGIBLE: IS THAT A DILEMMA FOR GAMIFIED FLIPPED LEARNING IN PRIMARY SCHOOL MATHEMATICS?

Önder KARAMERT
Dr., National Education Academy, Department of Educational Technology, Türkiye
ORCID: https://orcid.org/0000-0002-6882-7843
onderkaramert@gmail.com

Özden DEMİRKAN
Prof. Dr., Gazi University, Faculty of Education, Türkiye
ORCID: https://orcid.org/0000-0002-7201-6410
oozden@gazi.edu.tr

Abstract

Gamification plays an important role in flipped learning environments. Recent studies underscore the effectiveness of gamified approaches within these settings, but also indicate that most designs for gamification are predominantly digital-based. This study aims to explore the competition between tangible (physical) and intangible (digital) forms of gamification in the context of flipped learning. Specifically, it assesses the impact of both tangible and intangible gamified flipped learning approaches on students' mathematical literacy self-efficacy beliefs and their engagement levels towards learning activities. The study group for this quasi-experimental study was composed of 69 fifth-grade students from a public school in Türkiye. The study group was separated into three groups: two experimental groups (tangible and intangible) and one control group. The findings indicate that both tangible and intangible gamification in a flipped learning environment have a positive impact on students' personal experience of their mathematical literacy self-efficacy beliefs. However, neither approach had a significant impact on students' engagement levels. These results suggest that gamified flipped learning could be an effective strategy for enhancing students' personal experience of their mathematical literacy self-efficacy beliefs at the primary education level. The study provides pedagogical implications based on these results and offers recommendations for future research.

Keywords: Gamification, flipped learning, primary education.

INTRODUCTION

Technological developments in our age have brought about fundamental changes in learning processes in educational environments. Educational technology is area that has been deeply affected by these changes. The modern age has created new educational needs, which in turn have caused the advent of innovative educational technologies. Traditional methods are no longer sufficient to achieve contemporary learning goals. There is a growing need for new student-centred learning approaches that can enhance learning environments with technological capabilities. One of the prominent approaches, the flipped learning approach, is gaining increasing attention in learning environments.

The flipped learning approach, which attracts attention with its potential to transform educational environments, is defined as a pedagogical approach in which the traditional learning environment is reversed (Bergman & Sams, 2023). Its main goal is to provide sufficient time for practical experience-based learning in school by enabling theoretical knowledge to be learned outside of class. Flipped learning extends the time allocated for activities such as problem-solving, discussion, and peer interaction in the classroom by transferring the theoretical knowledge acquisition process outside of the class environment using technological tools. Thanks to this feature, flipped learning allows classroom time to be allocated to in-depth learning activities, creating more time for meaningful learning and the development of higher-level skills for students (Bishop & Verleger, 2013; Sargent & Casey, 2020).

Flipped learning not only offers students the opportunity to learn theoretical knowledge at their own pace, but also removes teachers from their role as presenters and transforms them into guides who deepen learning (Bergman & Sams, 2023). Flipped learning is frequently preferred by teachers today due to its advantages. Although flipped learning provides significant benefits in terms of learning objectives, it faces challenges related to students' self-efficacy and engagement in learning activities (Hao & Fang, 2024; Li & Li, 2022).

Recent studies show that, despite the apparent benefits of flipped learning, students' self-efficacy and engagement levels in the learning process are not high enough (Li & Li, 2022; Lo & Hew, 2021; Sailer & Sailer, 2021). The low level of students' self-efficacy beliefs and active engagement in learning activities is cited as one of the factors contributing to the reduced effectiveness of the flipped learning approach (Ahmed & Asiksoy, 2021; Hwang et al., 2015). This situation may prevent students from effectively learning the theoretical prerequisites for meaningful learning (Lo & Hew, 2020). A review of the literature reveals that the flipped learning approach is supported by auxiliary approaches to overcome this problem (Sanz-Angulo et al., 2025). In particular, student-centred approaches aimed at increasing student motivation have been found to help solve existing problems in flipped learning (Xiao & Hew, 2024). Among these approaches, gamification stands out prominently (Ekici, 2021; Ng & Lo, 2023). Flipped learning supported by gamification is an effective strategy that has the potential to positively influence students' approaches to learning objectives (Candel et al., 2024; Do et al., 2023; Gutierrez-Gonzalez et al., 2023).

Gamification is defined as the integration of game design elements into non-game contexts (Deterding et al., 2011; Zichermann & Cunningham, 2011). The main idea behind gamification is to use the motivational features of games to make learning activities more interesting for students (Kapp, 2012). The basic aim of gamification, which is related to Self-Determination Theory proposed by Deci and Ryan (1985), is to influence participants' internal and external motivations positively and thus increase their motivation and commitment to a specific goal (Dominguez et al., 2013; Hamari et al., 2014). Gamification attracts attention with its potential to influence students' active engagement and commitment to learning goals in educational settings (Hanus & Fox, 2015; Majuri et al., 2018; Xiao et al., 2021). Current research shows that gamification can yield positive results when used to increase motivation, academic achievement, engagement, and self-efficacy (Hao & Fang, 2024; Huang et al., 2026; Pan et al., 2026; Yllana-Prieto et al., 2021). In this regard, gamification can help overcome the current self-efficacy and engagement problems related to the out-of-class process of the flipped learning approach through its components, such as avatars, badges, and levels. In addition, it can contribute to creating the dynamism needed for the in-class process of the flipped learning environment.

Current studies show that digital-based software approaches are preferred for the gamification of flipped learning environments (Ekici, 2021). Although recent studies present results for gamification in various contexts of educational sciences, it can be observed that the focus is on digital-based platforms (e.g., Kahoot!, Quizlet, Quizizz, Socrative) in terms of implementation (Arsyad et al., 2024; Candel et al., 2024; Pratiwi et al., 2024; Zou, 2020). Contrary to popular belief, there is no requirement to use digital software for gamification (Dodero et al., 2014; Xiao & Hew, 2024). Although numerous studies have examined the effects of gamification on student motivation and achievement, most research considers gamification as a single instructional approach. However, gamification can be implemented through different design patterns, such as tangible and intangible elements, which may lead to different learning experiences (Dodero et al., 2014; Gennari et al., 2017). Despite this distinction, empirical comparisons of these two forms of gamification are limited, particularly in mathematics education contexts. Furthermore, few studies have examined how these approaches influence students' mathematical literacy self-efficacy and classroom engagement within flipped learning environments. Therefore, this study aims to compare the effects of tangible and intangible gamification on students' mathematical literacy self-efficacy beliefs and engagement in the primary flipped mathematics learning environments.

Gamification elements can be classified as intangible or tangible. In intangible gamification (completely digital, hybrid systems, or semi-digital), elements such as points, badges, leaderboards, and virtual

rewards which represent the feedback process within the learning system are integrated into learning environments via digital learning platforms. In tangible gamification, however, gamification elements are designed to be physically tangible rather than relying on digital platforms. These tangible elements are thus integrated into the learning environment. Adaptability to learning objectives is fundamental in both types of gamification (Karamert & Kuyumcu-Vardar, 2021). Gamification elements can also be implemented using traditional approaches and paper-based platforms (Gennari et al., 2017; Xiao & Hew, 2024). There is a need for further research focusing on this gamification aspect. Research conducted in this direction can provide deeper insight and help make educational gamification more efficient for learning environments. The results obtained from studies conducted in this direction can contribute to the individualisation of the Gamified Flipped Learning (GFL) approach according to the purpose and environment in which it can be used. In other words, it can contribute to the design of a GFL approach that is more student-centred and personalised. Based on this, the present research was conducted to contribute to filling this existing gap. With the elimination of these uncertainties, gamification designs more suitable for learning environments can be realised. Thus, the present research aims to pinpoint which type of gamification is more influential in this regard in a flipped learning environment and to fill the gap in the literature on this subject.

This research was designed based on the main idea that tangible gamification can be as effective as intangible counterparts in improving students' self-efficacy and engagement levels in the flipped learning approach. The study aims to fill the existing gap in the literature by determining the effect of the flipped learning approach supported by tangible and intangible gamification on primary school students' Mathematical Literacy Self-efficacy Beliefs (MLSB) and engagement in mathematics course. The potential of gamification to increase internal and external motivation in students, when combined with the flipped learning supported by tangible and intangible gamification elements, offers a promising approach. The study focuses on this fundamental advantage of gamification. It aspired to identify the type of gamification that is most influential in enhancing students' MLSB and engagement in a mathematics course. Additionally, the research aims to deliver a practical guide for educators regarding tangible and intangible gamification. In this way, the study aims to inspire more innovative gamification designs for flipped learning environments.

The primary intent of this study, which focuses on two different types of gamifications in a flipped learning environment (tangible and intangible), is to investigate the extent to which a flipped learning approach enhanced with gamification elements changes primary school students' mathematical literacy skills compared to a traditional learning approach. Mathematical literacy skills are related to the ability to apply mathematics to everyday life and are highly critical skills in terms of mathematics education (Bakker et al., 2021; Bolstad, 2023; Throndsen et al., 2020). The development of students' abilities in this skill is an issue that needs to be addressed, as it can increase their beliefs about these abilities, that is, their self-efficacy beliefs (Ozgen, 2013). This objective is consistent with the individualised learning opportunities offered by the flipped learning approach and the structure of gamification, which increases students' motivation and self-efficacy beliefs. In this study, the flipped learning process was incorporated into the learning environment by linking pre-class and in-class learning activities with gamification elements. This is expected to affect students' MLSB positively. The second intent of the study is to investigate the extent to which the flipped learning approach, enhanced with tangible and intangible gamification elements, changes primary school students' engagement in mathematics courses compared to the traditional learning approach. Engagement is one of the critical components of learning environments (Sever, 2014; Wang et al., 2014). Since high levels of student engagement directly affect their academic achievement, it is considered an area that needs to be improved (Christenson et al., 2012; Fredricks et al., 2004). This objective is consistent with the student-centred structure of the flipped learning approach, which encourages engagement, and the structure of gamification, which directs students to participate in learning content actively. In the study, learning activities related to the flipped learning process are supported by gamification elements that encourage student engagement. This is expected to increase students' active engagement levels in learning activities.

The fact that the GFL approach is related to constructivist and self-determination theory is seen as agreeing with the student-centred structure of the current learning environment. This has recreated a noteworthy role in generating the objectives of this study. The present study, designed in line with these intents, endeavours to answer the research questions listed below.

> 1) Do primary school students' mathematical literacy self-efficacy beliefs differ in terms of the tangible gamified flipped learning, the intangible gamified flipped learning, and the traditional learning approach?

> 2) Do primary school students' engagement levels differ in terms of the tangible gamified flipped learning, the intangible gamified flipped learning, and the traditional learning approach?

This research presents promising results regarding the use of the GFL approach in the context of learning objectives. This study contributes to the literature by proposing a non-digital-based approach to the use of gamification in educational settings. Additionally, it is expected that the current research will serve as a helpful guide for educators on the integration of tangible and intangible-based gamification approaches into flipped learning environments. Moreover, this study contributes to primary school mathematics education in several key respects. Firstly, at the primary school level, where student motivation and engagement are particularly critical for learning, it provides empirical evidence regarding the implementation of different gamification structures within a flipped learning environment. Secondly, by examining the effects of tangible and intangible gamification elements, which have largely been overlooked in previous research, on students' mathematical literacy self-efficacy and engagement, it offers a comparative perspective. Finally, the study provides practical guidance for primary school teachers by underlining how different gamification designs can be integrated into classroom practice to assist active learning and student engagement in primary mathematics education.

Background

This section of the study examines the concepts that form the theoretical basis of the study. The study's background is established through an analysis of existing relevant research. First, the approach of GFL, which combines gamification and the flipped learning model, is discussed. This is followed by the examination of MLSB and engagement, which are the dependent variables of the study. Finally, a review of existing research related to the GFL approach is presented.

Gamified Flipped Learning

GFL is an innovative teaching approach that combines game design elements with the flipped learning model. In traditional flipped learning, theoretical instruction is typically provided through videos and digital content prior to the class, while class time is provided to active learning and problem-solving activities (Bergmann & Sams, 2023). By incorporating gamification elements, defined as the application of game design elements in non-game contexts (Deterding et al., 2011), into the learning environment, students' interest in learning objectives can be increased (Candel et al., 2024; Zainuddin et al., 2022).

The primary goal of the GFL model is to make the learning process more interactive and engaging, thereby increasing student engagement and motivation for learning objectives (Xiao & Hew, 2024; Zou, 2020). Gamification can increase the effectiveness of the flipped learning approach by improving students' motivation, collaboration skills, and problem-solving abilities through its game elements (Daliranfirouz et al., 2024; Do et al., 2023; Kapp, 2012; Lo & Hew, 2020). This model is implemented by conducting gamified classroom activities (e.g., group discussions or problem solving) following gamified pre-class teaching activities (e.g., instructional videos or digital content). The GFL model encourages students to engage in learning activities through game elements such as points, badges, and levels (Daliranfirouz et al., 2024; Ghafouri et al., 2024).

This hybrid approach prioritises student-centred and interactive learning experiences by reversing the traditional teaching structure (Thongmak, 2019). Game design elements are frequently used by researchers to overcome engagement problems encountered in traditional flipped learning models (Hao

& Fang, 2024; Li & Li, 2022) by utilising their entertaining nature (Ekici, 2021; Zainuddin et al., 2020). Additionally, by facilitating instant feedback and peer interaction during the learning process, it has the potential to support the development of 21st-century skills such as critical thinking, collaboration, and creativity (Marell-Olsson, 2021). By incorporating these features, GFL promotes active knowledge construction in learning environments and thus aligns with constructivist learning theory.

Mathematical Literacy Self-Efficacy Beliefs

Mathematical literacy can be defined as a cognitive ability that enables individuals to apply mathematics to real-life situations (OECD, 2022). In other words, mathematical literacy refers to the use of mathematical thinking to approach daily-life problems, rather than simply memorising formulas (Graven et al., 2023). Mathematical literacy is important not only for basic mathematical calculations but also for helping individuals make conscious decisions regarding logical thinking (Jablonka, 2015; Throndsen et al., 2020). Furthermore, current studies indicate that mathematical literacy is also related to creative thinking, digital literacy, and environmental literacy (Zeng, 2025). In this context, it can be said that mathematical literacy is an important competency that should be fostered in mathematics education.

The concept of self-efficacy, one of the components of Albert Bandura's Social Learning Theory, refers to individuals' judgements about their ability to plan and carry out actions to achieve a specific goal (Bandura, 1977). In other words, self-efficacy is an individual's awareness of their ability to cope with a situation they encounter. Self-efficacy can affect educational outcomes because it is related to characteristics such as student motivation and engagement (Zimmerman, 1995). The higher students' self-efficacy beliefs are, the more their motivation and engagement in educational goals increase (Bandura & Schunk, 1981). Therefore, considering that motivation and engagement are critical factors in mathematics education, it can be said that self-efficacy beliefs are of crucial importance (Schunk, 1991).

Mathematical literacy is accepted as one of the most fundamental skills for students' ability to understand mathematics in modern mathematics education (Höfer & Beckmann, 2009). How students position themselves in terms of these skills, and their motivation awareness, is related to self-efficacy beliefs (Bandura, 1977). In this context, MLSB refers to individuals' thoughts about their abilities concerning mathematical content encountered in social life (Özgen & Bindak, 2011). Self-efficacy beliefs in mathematical literacy abilities represent students' motivation and self-confidence in mathematics, as well as their ability to demonstrate determination in the problem-solving process (Pajares & Miller, 1994; Zimmerman, 2000). Students with high MLSB are more likely to show willingness and determination towards challenging mathematical tasks (Schunk et al., 2008), while students with low beliefs are more likely to exhibit avoidance behaviour associated with anxiety (Dweck, 2006; Stipek & Gralinski, 1996). Therefore, it can be said that improving self-efficacy beliefs regarding mathematical literacy abilities is a critical concept for increasing students' motivation and academic achievement. It is clear that educational programs should prioritise improving students' self-efficacy beliefs in mathematical literacy to enable the cultivation of competent individuals (Zakariya, 2022).

Engagement

Engagement refers to students' cognitive, emotional, and behavioural involvement in learning objectives (Wang et al., 2014). In other words, engagement refers to the commitment level students have to the learning environment and the individual responsibility level they take for learning objectives. Engagement is a concept that expresses the degree to which students are engaged in academic content carried out in an educational setting. In addition, students' attention, curiosity, and interest in interaction related to learning goals are associated with engagement (Fredricks et al., 2004). Active engagement refers to meaningful engagement in learning goals through action-oriented behaviours such as asking questions, discussing, and collaborating (Christenson et al., 2012). With these qualities, engagement is considered a critical component of effective and meaningful learning (Reeve, 2013).

Student engagement can be identified as a concept that reflects students' psychological attitudes towards a course (Cevikbas & Kaiser, 2022). It is a comprehensive concept that reflects students' emotional, behavioural, and cognitive endeavours in the learning process (Reinke et al., 2022). In this context, engagement is associated with students actively participating in learning processes and developing a sense of belonging towards learning objectives (Reschly & Christenson, 2022). As engagement is a concept that directly influences student motivation towards learning processes, its impact on academic achievement can be significant (Jansen et al., 2023). Engagement, which is directly linked to the academic performance factor in students' academic lives, is shaped by the interaction of factors such as individual characteristics, family, school, and the social environment (Reinke et al., 2022; Reschly & Christenson, 2022). In this context, engagement can be considered a key component that addresses both the academic and social aspects of learning environments.

The primary goal of engagement is to improve learning performance by helping students actively construct knowledge (Christenson et al., 2012; Skinner et al., 2009). In educational settings, active engagement is widely preferred because it is compatible with constructivist and student-centred pedagogies. Techniques such as collaborative learning, problem-based tasks, and technology-supported interactions are widely used to encourage engagement (Prince, 2004). These techniques, which aim to increase engagement, generally work by creating meaningful learning experiences that orient students to interact with their teachers and peers. As students engage in learning environments, their intrinsic motivation may increase, leading to more effective learning (Schunk et al., 2008). Ultimately, active engagement encourages deep learning by transforming students from passive listeners to active participants who construct and make sense of knowledge (Skinner et al., 2009).

Related Work

This section presents recent studies that examine the GFL approach in the context of self-efficacy and engagement. The studies listed in Table 1 are classified and presented in the context of self-efficacy and engagement.

Table 1. Current studies related to gamified flipped learning.

Author(s)	Gamification Platform	Research Aim Category	Conclusion
Ahmed and Asiksoy (2021)	Digital (Intangible)	Self-Efficacy	It was determined that GFL positively influenced students' innovation skills but had no impact on their self-efficacy beliefs. Additionally, it was noted that students held a favourable opinion of GFL.
Ghafouri et al. (2024)	Digital (Intangible)	Self-Efficacy	Research shows that the use of GFL significantly enhances students' ability to assess patient health. Additionally, student satisfaction with GFL is notably high.
Ng and Lo (2023)	Digital (Intangible)	Engagement	It has been determined that GFL significantly contributes to student engagement and sustainable learning performance, and students hold a positive view of the process.
Xiao and Hew (2024)	Hybrid (Tangible and Intangible)	Engagement	Students in the GFL group, who received tangible rewards, performed significantly better in intrinsic motivation, engagement, and learning performance.
Yllana-Prieto et al. (2021)	Digital (Intangible)	Self-Efficacy	It was concluded that there was an improvement in students' attitudes and self-efficacy levels after using GFL.
Zainuddin et al. (2022)	Digital (Intangible)	Engagement	It was determined that GFL has positively impacted student engagement levels.

Table 1 shows studies that examine the GFL approach in terms of self-efficacy and engagement concepts. These studies, which utilise various elements of gamification, primarily report positive results. Although the existing research successfully examines the impact of the GFL approach, it includes limitations in terms of the platform and application method of gamification. However, a deeper examination of the literature reveals several significant limitations. Firstly, most studies conceptualise gamification as a uniform instructional approach without distinguishing between different gamification elements. In particular, the distinction between tangible and intangible gamification has largely been insufficiently researched. Secondly, while many studies focus predominantly on the digital or non-physical designs of gamification elements such as points, badges, and leaderboards, relatively few investigate the pedagogical effects of tangible gamification elements in educational settings. Thirdly, existing research tends to focus on specific gamification elements, such as reward and feedback systems, rather than examining different design structures for gamification in learning environments.

Among the limited number of studies addressing this distinction, Xiao and Hew (2024) differentiate between tangible and intangible gamification elements. However, their focus lies more on reward-based mechanisms rather than a comprehensive comparison of gamification structures. This highlights the need to investigate the differing effects of tangible and intangible gamification on educational outcomes.

In consideration of these limitations, this study aims to provide a more comprehensive perspective by systematically comparing tangible and intangible gamification within a flipped learning environment. It focuses not only on intangible gamification elements but also on the wider design of gamified learning experiences. This study aims to contribute to the literature by providing a deeper understanding of how gamification elements, particularly when embodied in learning environments, affect students' self-efficacy and engagement.

METHOD

Research Model

One of the matching-only research models, the pretest-posttest control group model, was chosen as the research model for this study. This model is used in experimental research to test and compare the effects of an application. This research model was chosen as the research model because it allows for the comparison of data collected from matched groups based on a specific factor (Fraenkel et al., 2011). In this model, the research process begins with dividing participants into matched groups. Following this stage, pretest applications were conducted. The research process was completed with posttest applications after the experimental procedure. The process related to the research model is outlined in Table 2.

Table 2. The matching-only pretest-posttest control group design.

Group		Pretest	Process	Posttest
E1	M	A1	X	A4
E2	M	A2	Y	A5
C	M	A3	Z	A6

E1: GFL intangible experimental group
E2: GFL tangible experimental group
C: Control group
M: Matching based on mathematics academic accomplishment
A1: Intangible experimental group pretest application
A2: Tangible experimental group pretest application
A3: Control group pretest application
X: GFL is supported by intangible gamification
Y: GFL is supported by tangible gamification
Z: Traditional learning approach
A4: Intangible experimental group posttest application
A5: Tangible experimental group posttest application
A6: Control group posttest application

Table 2 shows the quasi-experimental model of the study. The entire experimental procedure was performed within the extent of the fifth-grade mathematics course, which consisted of five lessons per week, each lasting 40 minutes. The experimental and control groups (E1, E2, and C) were matched (M) according to their academic accomplishment in mathematics prior to the study. The pursuit of this matching was to prevent the possible effect of self-confidence derived from academic achievement on the dependent variables of the study, MLSB and engagement.

Following the matching process, pretests of the MLSB and engagement scales were performed for all three groups. After the pretests, the experimental process was initiated. In all three groups, the mathematics teaching process was carried out by following the Fifth-Grade Mathematics Curriculum, which includes the dependent variables of the study, mathematical literacy skills (Milli Eğitim Bakanlığı [Ministry of National Education] [MoNE], 2018). In addition, the teaching process of the experimental groups differed from that of the control group in that gamification applications and the flipped learning approach supported it. The control group teaching process was accomplished using the traditional teaching process (Z).

Since this study investigated the effects of different types of gamification on the dependent variables, the research model was designed with two experimental groups. In accordance with this objective, the teaching process of the experimental groups was differentiated in terms of the type of gamification applications. In addition to the flipped learning approach design, the mathematics course teaching procedure was enhanced by intangible gamification elements (X) in the first experimental group (E1) and tangible gamification elements (Y) in the second experimental group (E2). The experimental process, which was implemented after the pretests, lasted a total of 11 weeks, consisting of a pilot week and 10 implementation weeks. The pilot week was conducted to increase students' familiarity with the process. Data from the pilot week were not incorporated into the research data set. The experimental procedure was completed after the posttest applications.

Study Group and Ethics

The study group comprises three classes with a total of 69 students in the fifth-grade at a public school in Türkiye during the 2022-2023 academic year. The classes were matched to be equivalent in terms of academic accomplishment in mathematics. One of the three classes was randomly selected as the experimental group, in which the flipped learning process supported by tangible and intangible gamification elements was implemented. The other class served as the control group, in which the traditional teaching method was used. The research was conducted over a total of 11 weeks, including a pilot week and 10 implementation weeks, within the extent of the mathematics course. All students in the class participated fully in the 10-week implementation process, and no student preferred to leave the implementation until the end of the research period. The study group's demographic characteristics are shown in Table 3.

Table 3. Study group demographic characteristics.

Group	Female	Male	Sum
Intangible Element Group (E1)	12 (52.17%)	11 (47.83%)	23 (100%)
Tangible Element Group (E2)	12 (52.17%)	11 (47.83%)	23 (100%)
Control Group (C)	13 (56.52%)	10 (43.48%)	23 (100%)
Sum	37 (53.62%)	32 (46.38%)	69 (100%)

Table 3 shows the study group characteristics. Each group in the study was represented by 23 students aged 10. The intangible element group (n=23) consisted of 12 females (52.17%) and 11 males (47.83%). The tangible element group (n=23) is similar to the intangible element group, consisting of 12 females (52.17%) and 11 males (47.83%). The control group (n=23) consists of 13 females (56.52%) and 10 males (43.48%). The study group comprises 69 students, including 37 females (53.62%) and 32 males (46.37%). Compared to older students, 10-year-old students are more prone to games and game culture

due to their age level (Boyd & Bee, 2014). Since this study is related to game philosophy and culture, it was considered that the fifth-grade would be more suitable for the study group.

The necessary conditions related to research ethics were provided before the study (Lodico et al., 2010). Written permissions were obtained from the relevant institutions prior to the study. Student participation in the research process was entirely voluntary. The written permissions were obtained from parents since the students were under 18 years of age. The students and parents were informed in detail about the process and reminded that they had the right to leave the process at any time. The students and parents were informed that the data collected would only be utilised for this study and that personal information would remain confidential.

Data Collection

Study data were gathered utilising a scale method. Two five-point Likert-type scales were used for the dependent variables of the study. In order to determine students' MLSB, the mathematical literacy self-efficacy scale developed by Baypınar and Tarım (2019) to determine students' self-efficacy beliefs regarding their mathematical literacy skills was used in the study. The scale, developed with the engagement of 1124 students, was designed using a five-point Likert scale. The scale, consisting of 30 items, includes the mathematical skill dimension (items 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15), the personal experience dimension (items 16, 17, 18, 19, 20, and 21), scientific modelling dimension (items 22, 23, 24, and 25), and social context dimension (items 26, 27, 28, 29, and 30). The Cronbach's Alpha reliability coefficient of the scale, which explains 48.34% of the variance, was calculated as .92. The Cronbach's alpha reliability coefficients for the dimensions of the scale were determined as .90 for the mathematical skill dimension, .75 for the personal experience dimension, .78 for the scientific modelling dimension, and .81 for the social context dimension. The scale was associated with MLSB, one of the dependent variables of this study. It was referred to as the MLSB scale throughout the study.

The engagement scale, developed by Wang, Bergin, and Bergin (2014) and adapted to Turkish culture by Sever (2014), was used in this study to determine students' levels of engagement. The scale, which comprises 23 items on a five-point likert scale, includes the affective engagement dimension (items 1, 2, 3, 4, 5, and 6), the behavioural engagement-compliance dimension (items 7, 8, 9, and 10), the behavioural engagement-effortful classroom participation dimension (items 11, 12, and 13), cognitive engagement dimension (items 14, 15, 16, 17, 18, 19, and 20), and disengagement dimension (items 21, 22, and 23). The Cronbach's Alpha reliability coefficient of the scale, which explains 65.32% of the variance, was calculated as .93. The Cronbach's alpha reliability coefficients for the scale's dimensions were determined as .87 for the affective engagement dimension, .82 for the behavioural engagement-compliance dimension, .74 for the behavioural engagement-effortful classroom participation, .89 for the cognitive engagement dimension, and .69 for the disengagement dimension.

Implementation

This research was performed within the extent of a primary school mathematics course consisting of five lessons per week. The teaching process for all groups was planned and implemented in line with the objectives of the Fifth-Grade Mathematics Curriculum (MoNE, 2018). The mathematics topics covered in the research implementation process and the time allocated to them were determined in accordance with this curriculum. Table 4 shows the topics covered in the mathematics lessons during the implementation period of the study.

Table 4. Mathematics course topics during the implementation process.

Week	Topic	Time
1 (Pilot Test Week)	Basic Geometric Concepts	200 minutes
2	Basic Geometric Concepts	200 minutes
3	Basic Geometric Concepts	200 minutes
4	Triangles and Quadrilaterals	200 minutes

Table 4 (Continued). Mathematics course topics during the implementation process.

Week	Topic	Time
5	Triangles and Quadrilaterals	200 minutes
6	Triangles and Quadrilaterals	200 minutes
7	Data Collection and Analysis	200 minutes
8	Measurement: Length and Time	200 minutes
9	Measurement: Length and Time	200 minutes
10	Measurement: Area	200 minutes
11	Measurement: Area	200 minutes

The mathematics lessons relating to the study implementation process are shown in Table 4. Throughout the process, all pre-class (instructional videos, weekly tasks, mini-tests) and in-class activities were designed weekly in accordance with the learning objectives for these topics. For example, all activities related to Week 4 were designed in accordance with the learning objectives for the "Triangles and Quadrilaterals" topic. Although the educational content for both the experimental (E1 and E2) and control (C) groups was organised around these topics, the way in which it was implemented differed. The teaching process for the control group was conducted using a traditional teaching approach that did not include any elements of flipped learning or gamification. In the experimental groups, the teaching process was carried out using the flipped learning approach. Additionally, the instruction strategy for both experimental groups was enhanced with gamification elements. Also, the teaching strategy in both experimental groups differs in terms of the gamification platform. The intangibly designed gamification elements supported the teaching process of the intangible element experimental group (E1) via an intangible platform. In contrast, the gamification elements of the tangible element experimental group (E2) were designed using traditional pen-and-paper applications and presented via a platform created using this method. This section of the study outlines the applications implemented to support the teaching processes for the study group. Then, the differences between the flipped learning and gamification applications in the experimental and control groups were discussed.

The flipped learning environment and intangible gamification elements of the study were provided to students through MOODLE. MOODLE is an open-source learning management system. The name MOODLE is an acronym for "Modular Object-Oriented Dynamic Learning Environment". MOODLE is a popular learning management system that enables educational institutions and teachers to create, deliver, manage, and evaluate online education (Buchner, 2022; Cole & Foster, 2007). Thanks to its content focused on the protection of personal information, MOODLE has gained widespread use worldwide (Conde et al., 2010). Its free availability, user-friendly interface, customisable features through downloadable plugins, and flexible design structure that can be adapted to specific needs make it an advantageous platform for creating learning environments (Costello, 2013). Due to its flexible design, it accommodates the inclusion of flipped learning elements and gamification elements. Gamification elements of this research were explicitly designed for the study and with defined usage objectives in the learning management system. With these advantageous aspects, MOODLE was considered suitable for the study and was chosen as the teaching management system for the research.

Student registration in the system was carried out by the researcher. Following this stage, the process of creating classes for tangible and intangible study groups within the system was initiated. Students were assigned to their respective classes through the system. Login credentials for accessing the system were created individually for each student. Usernames (IDs) and passwords for accessing the system were distributed to the students. Following this phase, sections were created on the system where instructional videos, instructional presentations, mini-tests, weekly tasks, and answer keys for weekly tasks could be uploaded. Unlike the tangible element group, a section was created in the intangible element group's class on the system where intangible gamification elements could be placed. A video guiding the system's operation was prepared by the researcher and placed in the relevant section of the system in both MOODLE classrooms. After the announcements and academic calendar sections were

also created, the general setup process was completed with the design of discussion areas specific to both classes.

After the general setup phase, the pilot week phase was initiated. The purpose of the pilot week was to increase students' familiarity with the system and identify any shortcomings in the system. The system was improved and made more suitable based on student suggestions and the experience gained. This research aims to examine the effect of GFL on MLSB and engagement. The content of the experimental applications was determined in line with this aim.

Flipped learning process

The flipped learning model used in this study was adapted from the 10-step flipped learning model proposed by Lo et al. (2017). In this model, the flipped learning stages are divided into two main sections: out-of-class and in-class. The purpose of the model is to guide the flipped learning approach to be applied in the mathematics teaching process. Since the specified stages were primarily developed for the mathematics teaching process, this model was considered appropriate for the research and was chosen as the flipped learning model.

Several special adjustments were made to the model proposed by Lo et al. (2017) to suit the purpose of the research. In this study, the proposed stages were revised to suit the content of experimental applications better, as contemporary learning methods, techniques, and gamification elements support the flipped learning model. Figure 1 shows the flipped learning model used in the study.
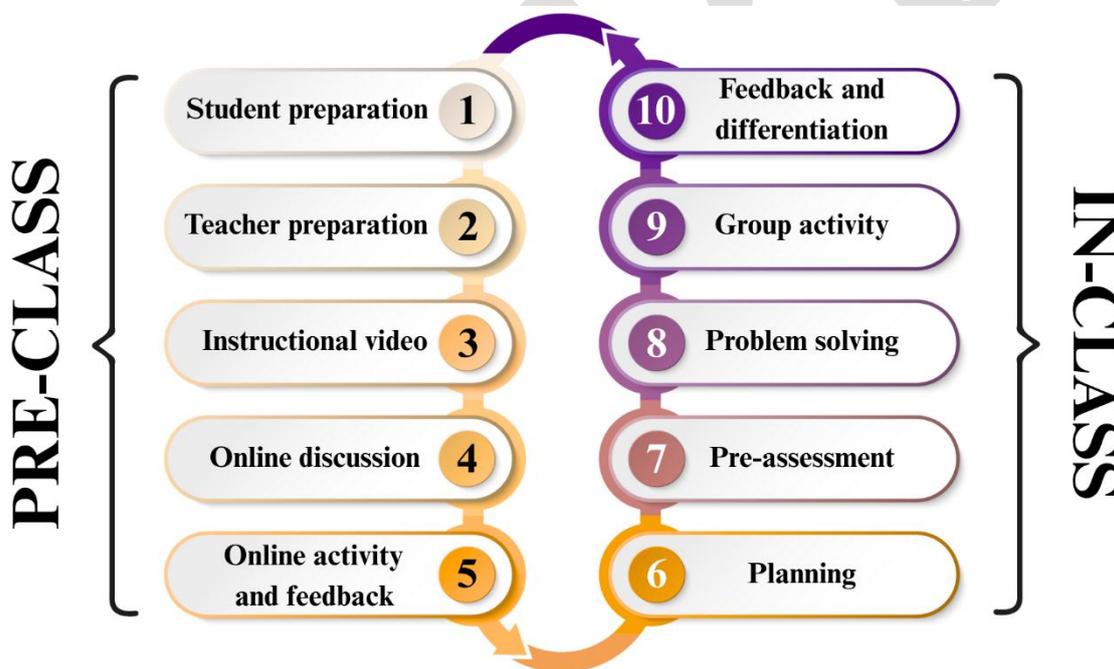
Figure 1. The flipped learning model of the research.

Figure 1 shows the study's flipped learning approach model. The model is divided into two main categories: pre-class and in-class. Each category consists of five stages, and the model comprises 10 steps. The first main category of the process, the pre-class process, begins with a preparation phase for students and teachers. This stage is followed by the instructional video stage. After the video phase, there is an online discussion section where discussions related to the current topic are held. The pre-class teaching process is completed with the online activity and feedback section.

The planning stage, in which the necessary procedures are implemented based on student experiences and feedback related to the pre-class teaching process, constitutes the first stage of the in-class process in the model. Following this stage, a mini pre-assessment was conducted to test students' prior learning related to the pre-class process. Student-centred learning practices, such as problem-solving and group

discussions, were performed based on the results of the pre-assessment stage. Following this stage, the classroom teaching process of the model was completed with the feedback and differentiation phase, where necessary feedback, differentiation, and enrichment activities were provided.

The model-based applications started with the first phase at the beginning of each implementation week and were completed with the tenth phase. This process was repeated as a cycle from the beginning to the end of the implementation process. The flipped learning process is the same for both experimental groups and was implemented through MOODLE. The design of the pre-class teaching content and instructional videos was based on Mayer's (2009) multimedia design principles. The activities of the in-class teaching process were designed based on the flipped teaching process model proposed by Talbert (2017).

Gamification process

Five gamification elements were selected for the study: Collection Table, Avatar, Badge, Progress Bar, and Level. These elements are among the most preferred and most positively reported elements for gamification in learning environments (Behl et al., 2022; Ekici, 2021). The element designs and definitions were based on the Pyramidal Gamification Design Model proposed by Werbach and Hunter (2012). Since the aim of the study also included comparing gamification elements in tangible and intangible concepts, it was critical that the elements included in the process could be designed in both ways. The five gamification elements mentioned above were considered appropriate for the study and were chosen because they could be designed in both tangible and intangible forms.

In this study, the elements were designed to have the same function in both designs so that tangible and intangible elements could be effectively compared. In addition, it was ensured that the tangible elements had the same visual form as the intangible elements as much as possible. The intangible experiment group's flipped learning process was supported by gamification elements designed intangibly and presented via MOODLE. The tangible experiment group's flipped learning process was supported by gamification elements designed tangibly using traditional pen-and-paper methods. Below are descriptions of the tangible and intangible gamification elements used in the research, along with images illustrating their use in the application process. Figure 2 shows the intangible version of the research's gamification model, and Figure 3 shows the tangible version.

Figure 2. Intangible collection table and element usage.
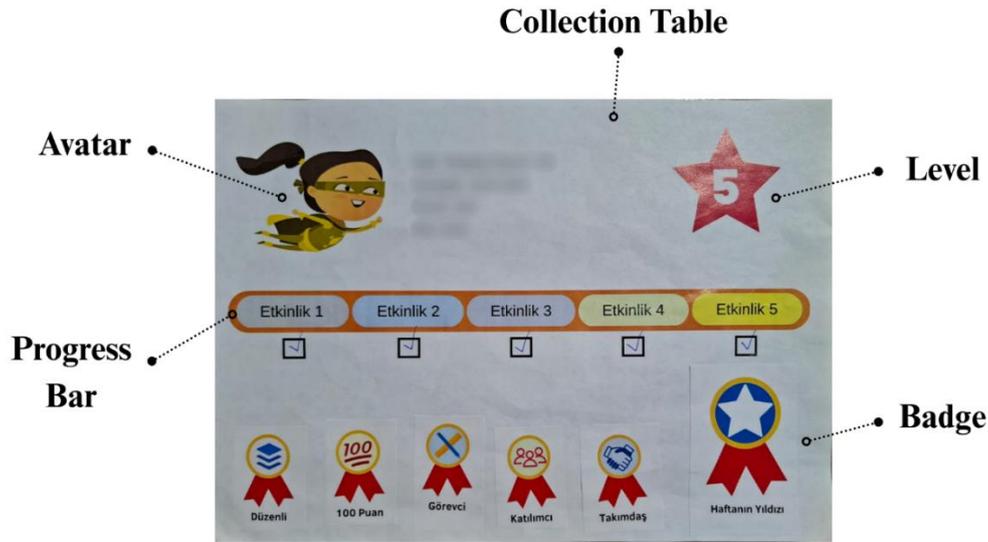
Figure 3. Tangible collection table and element usage.

Figures 2 and 3 contain visuals related to the design of the tangible and intangible gamification models of the study. The gamification elements preferred to be used in the study are included in both models. The definitions and roles of the gamification elements utilised in the study are as follows.

- Collection Table: A personal file element in which students can store the elements they collect throughout the process. The collection table was designed to contain gamification elements in both experimental groups.

- Avatar: An element of the visual content that students have chosen to represent themselves in the process. In both groups, students chose their avatars. Students were allowed to make changes to their avatars throughout the process.

- Badge: This is a visual element that students earn based on their achievements during the process. The visuals of the badges were specially designed for the study to be consistent with the tasks in the process. The visuals and functions of the badges used in the research process are shown in Figure 4.

Figure 4. Research badge set.

Figure 4 shows the images and functions of badges explicitly designed for the study. The badges were designed to be compatible with the flipped learning approach of the study. The first four badges were designed for the pre-class process of flipped learning, while the other two badges were designed for in-class process learning activities.

- Progress Bar: This element visually demonstrates the degree of completion of the students. The progress bar used in the intangible group automatically advanced according to the students' completion percentages. The teacher manually advanced the progress bar used in the tangible group according to the students' completion status.

- Level: This element indicates the expertise level of students in the gamification process. There are 10 levels in both experimental groups. Each level was used to represent the week in progress. Students who had tasks or activities missing for the week in progress were advanced to the level of the week in progress when they completed the support activities.

One of the main goals of gamification is to improve individuals' sense of belonging to their environment (Manzano-Leon et al., 2021; Werbach & Hunter, 2012). In this regard, the element design was created so that every student could engage in the process, gain something meaningful, contribute their own insights, and find opportunities for self-expression. With this in mind, it is expected to improve students' sense of belonging during the implementation period and thus increase their self-efficacy and engagement levels.

Data Analysis

The data analysis of the study was performed using the SPSS software package. The statistical significance level for all analyses was set at $p<.05$. Normality analyses were classified according to the dimensions of the scales used in the study and the pretest and posttest implementations. As a result of the analysis, it was determined that the skewness and kurtosis values of the mean scores of the dimensions of the MLSB scale and the engagement scale were between -3 and +3. In this regard, it was determined that the data set showed a normal distribution (Hopkins & Weeks, 1990; Kline, 2023).

In quasi-experimental studies, it is necessary to evaluate whether the experimental and control groups are at the same level in terms of the dependent variable before the experimental procedures. It is stated that the type of analysis to be performed should be decided based on these evaluations (Fraenkel et al., 2011). In this context, Analysis of Variance (ANOVA) was performed to determine the level of statistical difference between the study groups in terms of the mean scores of the pretest applications of the MLSB and engagement scales, which are the data collection tools of the study. The ANOVA results for the MLSB and engagement scales pretest applications are presented in Table 5.

Table 5. ANOVA results for the MLSB and engagement scale pretest values.

Scale	Dimension	F	p
Mathematical Literacy Self-Efficacy Beliefs	Mathematical Skill	2.83	.06
	Personal Experience	6.60	.00*
	Scientific Modelling	.31	.73
	Social Context	.06	.93
	Scale Overall	2.53	.08
Classroom Engagement	Affective Engagement	1.27	.28
	Behavioural Engagement-Compliance	.07	.92
	Behavioural Engagement-Effortful Classroom Participation	.21	.80
	Cognitive Engagement	1.34	.26
	Disengagement	2.10	.13
	Scale Overall	1.45	.24

*p<.05

Table 5 shows the ANOVA values obtained for the pretest applications of the MLSB and engagement scales. MLSB scale mathematical skill (F=2.83; p=.06>.05), scientific modelling (F=.31; p=.73>.05), social context (F=.06; p=.93>.05), and scale overall (F=2.53; p=.08>. 05) dimensions. However, a statistically significant difference was found in the pretest mean scores for the personal experience dimension (F=6.60; p=.00<.05). When Table 5 is examined, the affective engagement (F=1.27; p=.28>.05), behavioural engagement-compliance (F=.07; p=.92>.05), behavioural engagement-effortful classroom participation (F=.21; p=.80>.05), cognitive engagement (F=1.34; p=.26>.05), disengagement (F=2.10; p=.13>.05), and scale overall (F=1.45; p=.24>.05) dimensions of the pretest mean scores not show a statistically significant difference between the intangible element, tangible element, and control groups that formed the study group.

In this regard, the analysis of data related to the Personal Experience Dimension (PED), which is a dimension of the MLSB scale, was performed using covariance analysis (ANCOVA). This analysis method aims to compare the means of different groups by controlling the effects of one or more continuous covariates (Büyüköztürk, 1998). Thus, the statistical power of the measurements increases and the bias that arises from the standard variable decreases (Aldrich & Cunningham, 2016). Data analyses for all dimensions of the engagement scale and all dimensions of the MLSB scale except for the PED were performed using ANOVA.

RESULTS

This part of the study presents the results of the analyses performed on the data obtained from the scales. The results are classified as MLSB and engagement and are presented under the subheadings created for this purpose.

Mathematical Literacy Self-Efficacy Beliefs Results

The ANOVA results obtained from the pretest and posttest mean scores of the MLSB scale are shown in Table 6.

Table 6. One-way ANOVA results for the MLSB scale mean scores.

Dimension	F	p
Mathematical Skill	.02	.97
Scientific Modelling	.14	.86
Social Context	.40	.66
Scale Overall	.09	.91

Table 6 shows the ANOVA results for the MLSB scale data. No statistical difference was found between the pretest and posttest mean scores for the scale's mathematical skill (F=.02; p=.97>.05), scientific modelling (F=.14; p=.86>.05), social context (F=.40; p=.66>.05), and scale overall (F=.09; p=.91>.05) dimensions. Analyses of the PED were conducted using ANCOVA because the ANOVA results for the groups' pretest mean scores indicated a statistical difference.

In addition to the data set being normally distributed, the homogeneity of distributions is one of the assumptions of ANCOVA (Taşpınar, 2017). After determining that the data set was normally distributed, the homogeneity assumption was tested using the Levene Test. Table 7 shows the test results.

Table 7. Levene homogeneity test results.

F	df1	df2	p
.25	2	66	.77

Table 7 contains the values of the homogeneity test performed with the Levene test. Upon examining the table, a significance level of .77 was determined (F=.25; p=.77>.05). Since no statistical difference was found between the variances, it was determined that the data distribution was homogeneous, and it was concluded that this assumption of ANCOVA was met. Another assumption of ANCOVA is the

assumption of homogeneity of regression slopes (Taşpınar, 2017). The ANOVA method was used to test this assumption. Table 8 shows the analysis results.

Table 8. Homogeneity of regression slopes.

Source	Sum of Squares	df	Mean Square	F	p
Group	3.14	2	1.57	2.01	.14
PED	1.74	1	1.74	2.23	.14
Group * PED	1.32	2	.66	.84	.43
Sum	67.74	68			

*Control Variable: PED pretest mean scores
*Dependent Variable: Personal experience posttest mean scores

Table 8 shows the ANOVA values obtained for testing the homogeneity of regression line slopes. The significance level value of .43 in the Table 8 indicates that there is no difference between the slopes of the regression lines. In other words, it was determined that the pretest scores for this dimension in the study groups did not have a statistically significant effect on the posttest mean scores of the PED (F=.84; p=.43>.05). After this condition was also met, it was concluded that the necessary assumptions for ANCOVA were met.

The first step in ANCOVA is to control for the covariate and determine the estimated mean scores for the dependent variable (Taşpınar, 2017). In this regard, the pretest mean scores for the PED were controlled for, and the estimated means for the posttest mean scores were determined. Table 9 contains these adjusted mean values.

Table 9. Estimated marginal means.

Grup	N	Mean	Estimated Marginal Means
Intangible Element Group (E1)	23	3.55	3.57
Tangible Element Group (E2)	23	3.55	3.60
Control Group (C)	23	2.70	2.61

Table 9 shows descriptive statistics for the ANCOVA. In this regard, estimated means were calculated for the final tests of the study groups, the intangible element (3.57), tangible element (3.60), and control (2.61) groups. The one-way ANCOVA was conducted to determine whether the differences between the estimated mean scores of the groups were statistically significant (Büyüköztürk, 2018). The results obtained from the analysis are shown in Table 10.

Table 10. One-way ANCOVA results.

Source	Sum of Squares	df	Mean Squares	F	p	Partial Eta Squared
PED	1.28	1	1.28	1.65	.20	.02
Group	12.22	2	6.11	7.86	.00	.19
Error	50.53	65	.77			
Corrected Total	62.84	68				

Table 10 shows the results of the one-way ANCOVA. When the values in Table 10 are examined, the significance level value related to the differences arising from the study groups is calculated as .00. In this regard, when the pretest mean scores for the PED of the MLSB scale were controlled, it was concluded that the posttest mean scores differed statistically according to the groups (F=7.86; p=.00<.05). In order to determine the level of this statistically significant difference, the effect size value for the estimated means was examined. Since the estimated effect size was .19, it was concluded that the types of gamifications used in the study (tangible and intangible) had a high level of effect (>.14) on the PED of MLSB (Taşpınar, 2017).

The Bonferroni Test was used to determine which group or groups these statistically significant differences favoured. The Bonferroni Test is a comparison test that allows for multiple comparisons in

ANCOVA (Büyüköztürk, 2018; Taşpınar, 2017). The results of this test showed that the intangible element (3.57) and tangible element (3.60) groups differed significantly from the control group mean (2.61), while there was no difference between the mean scores for the tangible and intangible element groups. In other words, the GFL applied in the experimental groups positively affected students' personal experiences with MLSB. However, the type of gamification used (tangible and intangible) did not result in a statistically significant difference.

Engagement Results

The ANOVA results for the mean scores of the pretest and posttest applications of the course engagement scale are shown in Table 11.

Table 11. One-way ANOVA results for course engagement scale mean scores.

Dimension	F	p
Affective Engagement	.26	.76
Behavioural Engagement-Compliance	.23	.79
Behavioural Engagement-Effortful Classroom Participation	.18	.83
Cognitive Engagement	.36	.69
Disengagement	1.72	.18
Scale Overall	.42	.65

Table 11 shows the results of the ANOVA conducted on the data obtained from the engagement scale. The scale's affective engagement (F=.26; p=.76>.05), behavioural engagement-compliance (F=.23; p=.79>.05), behavioural engagement-effortful classroom participation (F=.18; p=.83>. 05), cognitive engagement (F=.36; p=.69>.05), disengagement (F=1.72; p=.18>.05), and scale overall (F=.42; p=.65>.05) dimensions.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

Gamification, whose primary goal is to increase individuals' motivation in their context, is defined as the integration of game design elements into non-game contexts (Deterding et al., 2011). The uncertainty arising from the application platforms of gamification, which is increasingly gaining prominence in contemporary educational technology literature, is noteworthy. The present study, which aims to address this uncertainty, focuses on two different approaches to gamification: tangible and intangible. The research was established based on the idea that, when designed with the characteristics of the study group in mind, tangible gamification can be as successful as intangible counterparts in learning environments. This research investigates the extent to which gamification, applied in different approaches, affects students' MLSB and engagement levels in flipped learning environments. The research results show that the flipped learning approach supported by tangible or intangible gamification elements positively affects primary school students' personal experiences with MLSB. In addition, it has been determined that the current application has no effect on students' engagement levels in the course. Based on this, this study presents a design model for the use of tangible and intangible gamification in flipped learning.

Gamification, which is frequently used to overcome motivation and engagement problems in flipped learning environments, is underlined to have strong potential due to its various elements (Candel et al., 2024; Do et al., 2023; Huang et al., 2019). Gamification, which can be incorporated into flipped learning environments through various platforms, is shown to be a popular method preferred by educators (Yu & Yu, 2024). The relevant literature includes studies evaluating gamification in flipped learning. Current studies examine the gamification effect on self-efficacy and engagement variables. In these studies, gamification has been tested to improve self-efficacy (Ahmed & Asiksoy, 2021; Yllana-Prieto et al., 2021) and engagement (Ng & Lo, 2023; Xiao & Hew, 2024; Zainuddin et al., 2022), and positive results have been reported. Although these current studies have successfully tested gamification in a flipped learning environment in the context of educational goals, the limitations of application platforms

are remarkable. Among these studies emphasising the importance of educational gamification, it can be seen that only Xiao and Hew (2024) have preferred to distinguish between tangible and intangible gamification. Although the study reported positive results from applying gamification rewards in both tangible and intangible forms, it seems that the study's focus was on the reward element only (Xiao & Hew, 2024). Focusing on the current limitations in recent studies, this research aims to determine the effect of tangible and intangible gamification in a flipped learning environment, delivering a more profound perspective on the differentiation of gamification applications.

The findings of this study should be considered in light of the current limitations in the literature on gamification in flipped learning environments. While previous research has generally reported the positive effects of gamification on variables such as self-efficacy and student engagement, most of these studies treat gamification as a uniform instructional approach and focus predominantly on digital or non-tangible forms of gamification. In particular, the distinction between tangible and intangible gamification has received limited empirical attention. Furthermore, how different gamification designs might lead to learning outcomes has rarely been examined.

In this context, the present results contribute to the literature by offering a more detailed perspective on gamification design. The absence of significant differences in the dimensions of the MLSB beyond personal experience (mathematical skill, scientific modelling, and social context) and in engagement, whether tangible or intangible, suggests that merely integrating gamification elements into the learning environment may not be sufficient to influence complex concepts such as engagement. Instead, the effectiveness of gamification may depend not merely on the forms of these elements, but on how they are pedagogically designed and aligned with learning processes. This finding also emphasises the need to move beyond element-based comparisons in gamification research and to focus more on the instructional design and contextual implementation of gamified learning environments.

This study provides critical implications for primary education as well. As primary school students are highly responsive to interactive and activity-based learning environments, integrating gamification into the flipped learning model can offer opportunities to foster MLSB and active engagement. However, the results indicate that the effectiveness of such approaches depends not only on the presence of gamification elements, but also on how these elements are designed from a pedagogical perspective and how they are implemented in the classroom.

Pedagogical Implications and Recommendations

This research provides considerable pedagogical contributions to the relevant literature by advancing the understanding of the use of gamification in flipped learning environments. Present research is the first study to examine the tangible and intangible gamification-enhanced flipped learning approach concerning MLSB and course engagement contexts. The study tested the effect of gamification elements explicitly designed for the study group, implemented through tangible and intangible platforms in a flipped learning environment. The present research draws attention to a non-digital platform-based approach to gamification. In addition, it emphasises the importance of gamification designs being applicable in educational environments with a digital and traditional pen-and-paper approach. This approach contributes to the applicability of educational gamification by paving the way for more personalised gamification designs. This study's results indicate that, within the context of personal experience, tangible gamification elements are as effective as their intangible counterparts in flipped learning environments. The tangible nature of the gamification elements may have encouraged students to interact with them more frequently. This characteristic has led to the idea that tangible gamification elements may have replaced the appeal of intangible gamification elements for students in this age group (10 years old). It is therefore estimated that tangible elements may have contributed to this research finding by providing students with an extraordinary personal experience.

The study found that the GFL approach did not affect students' MLSB in terms of mathematical skills, scientific modelling, and social context dimensions. However, in terms of the personal experience aspect, both tangible and intangible gamification applications were found to have a positive effect. This result of the study is consistent with the existing literature (Ghafouri et al., 2024; Yllana-Prieto et al.,

2021). Personal experience refers to students' individual experiences in the context of their MLSB. This result implies that tangible and intangible gamification applications positively affect students' self-efficacy beliefs acquired from experiences related to mathematical skills. In the study, gamification elements designed tangibly or intangibly were student-centred, and their compatibility with learning content was ensured. It is considered that this situation may have positively influenced students' personal experiences regarding their MLSB by directing their interest towards the learning process. This situation shows that tangible and intangible gamification applications can be used to enrich students' individual experiences in a flipped learning environment. With this feature, gamification can assist in providing students with personalised experiences in mathematical skills in a flipped learning environment. In other words, the GFL approach can be an effective strategy in providing students with quality experiences related to learning goals. In addition, the research results indicate that the context of MLSB needs to be investigated more deeply in terms of its dimensions of mathematical skills, scientific modelling, and social context. There may be several reasons why this study's gamification designs did not result in a significant difference in these dimensions of MLSB. Given the multidimensional and comprehensive nature of MLSB, it is considered that the gamification designs incorporated in the present study may have been inadequate. In other words, the tangible and intangible gamification elements included in this study may not have been qualitatively and quantitatively sufficient in terms of developing a multidimensional concept such as MLSB in all its dimensions. It is estimated that applications which could be beneficial in terms of other dimensions of MLSB could be implemented by using more enriched tangible or intangible gamification designs, tailored to the needs and characteristics of the learning environments, by teachers and researchers.

This study found that the GFL approach did not affect the dimensions of student course engagement, affective engagement, behavioural engagement-compliance, behavioural engagement-effortful classroom participation, cognitive engagement, and disengagement. In other words, both tangible and intangible gamification elements were found to be insufficient in increasing students' engagement levels in the flipped learning environment. This result is inconsistent with the existing literature, which emphasises that the GFL approach encourages student engagement (Ng & Lo, 2023; Xiao & Hew, 2024; Zainuddin et al., 2022). The fact that current applications are ineffective in increasing students' engagement levels stands out as an unexpected finding of the study. Considering that gamification has the potential to influence engagement motivation (Huang et al., 2026; Lo & Hew, 2020; Pan et al., 2026; Zou, 2020), this result can be considered surprising. It is speculated that the novelty effect is responsible for such a result. The novelty effect refers to the temporary increase in personal motivation when faced with something new, which decreases over time as it becomes familiar (Clark, 1983). It is estimated that the tangible and intangible GFL applications implemented over a period of 11 weeks may have formed habits in students over time and thus may have brought their motivation to engagement in the course back to the initial level. Besides this, the concept of engagement is multifaceted in nature, encompassing behavioural, emotional, and cognitive dimensions (Reschly & Christenson, 2022). In this context, the GFL designs (tangible and intangible) employed in this study may not have been sufficient to develop this multifaceted concept. It is considered that more suitable applications for learning environments could be developed using GFL designs specifically tailored to each aspect of engagement. It is anticipated that such applications, if they are capable of addressing all aspects of engagement specifically, could positively influence student engagement in learning objectives. It is suggested that teachers focus on more personalised and process-renewed designs when incorporating tangible and intangible gamification applications into the flipped learning environment, which may help overcome engagement problems. It is thought that the application design of the current study should be supported by more gamification elements that encourage engagement. It is believed that future studies focusing on more innovative gamification approaches that emphasise active student engagement could contribute to the literature on GFL in the context of educational technologies.

Therefore, this study shows that tangible gamification elements designed to suit the characteristics of the study group are as successful as intangible gamification in improving students' personal experiences regarding their MLSB. The study emphasises the importance of gamification being usable in a flipped

learning environment with a non-digital approach. In other words, the present study underscores that gamification can be used in learning environments with tangible designs as well as intangible ones. The research also provides important insights into how gamification can be embodied and used in learning environments. The study highlights that more effective designs can be created to improve students' active engagement in the flipped learning process. It emphasises that research on the tangible, intangible, and hybrid designs of GFL can contribute to the relevant literature if their gamification model is designed according to student preferences. Consequently, this study highlights the significance of various design approaches for gamification, serving as a guide for aligning gamification elements with learning objectives.

Validity and Limitations

The present study has several validity threats and limitations. The research was conducted using a quasi-experimental model. To prevent differences in self-confidence arising from students' previous mathematics accomplishments impacting the results, the study groups were made equivalent in terms of academic achievement in mathematics. Although a random selection was made regarding which group would be the experimental group and which would be the control group, students were not randomly assigned to groups as in experimental models. Additionally, the study group students are all from the same school and live in the same neighbourhood. Therefore, when evaluating the research results for generalisability, it should be noted that regional and cultural differences may have influenced the findings.

The study group is limited to 69 students in the fifth-grade (10 years old) in Türkiye. It should not be overlooked that the method used in this study may not yield the same results in every age group. Present results should be evaluated carefully, as participant preferences for personalisation in gamification designs may vary according to age and educational level. Although the data showed a normal distribution, it should be noted that the study group was limited to 69 students. This situation may have made the results insufficient in terms of generalisability. The research lasted 11 weeks total, including the pilot test week. It should be considered that this period may have been insufficient to affect the dependent variables of the present research. Thus, the process of the experimental implementation may have affected the validity of the study, as it may have influenced the capacity to change the variables.

The gamification elements in the present study are limited to those selected from the Pyramidal Gamification Design Model proposed by Werbach and Hunter (2012) and adapted to the study. Considering that using other elements of the model or elements from other gamification models in a similar research context may produce different results. Additionally, the study was performed within the scope of a flipped mathematics course, alongside the existing curriculum. Gamification designs integrated into different learning techniques through other curricula may produce different results in a similar implementation. The validity threats and limitations mentioned above should be considered as they may affect the generalisability of the results.

Author Contribution
This study is derived from the first author's doctoral dissertation entitled *"The Effect of the Gamification-Enhanced Flipped Learning Approach on Mathematical Literacy Self-Efficacy Beliefs and Engagement."* The second author supervised the research as the thesis advisor.

Data availability

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

Corresponding Author

Correspondence to Önder KARAMERT, onderkaramert@gmail.com

REFERENCES

Ahmed, H. D., & Asiksoy, G. (2021). The effects of gamified flipped learning method on student's innovation skills, self-efficacy towards virtual physics lab course and perceptions. *Sustainability, 13*(18), 10163. https://doi.org/10.3390/su131810163

Aldrich, J. O., & Cunningham, J. B. (2016). *Using IBM SPSS statistics: An interactive hands-on approach* (2nd ed.). Sage.

Arsyad, S., Waluyo, B., & Maisarah, I. (2024). Enhancing TOEFL performance and student motivation through integrated flipped and gamified learning in online settings. *Human Behavior and Emerging Technologies, 2024*(1), 1054242. https://doi.org/10.1155/2024/1054242

Bakker, A., Cai, J., & Zenger, L. (2021). Future themes of mathematics education research: An international survey before and during the pandemic. *Educational Studies in Mathematics, 107*(1), 1-24. https://doi.org/10.1007/s10649-021-10049-w

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, self-efficacy, and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology, 41*(3), 586-598. https://doi.org/10.1037/0022-3514.41.3.586

Baypınar, K., & Tarım, K. (2019). The development of mathematical literacy self-efficacy scale for middle school: a reliability and validity study. *Cukurova University Faculty of Education Journal, 48*(1), 878-909. https://doi.org/10.14812/cufej.415291

Behl, A., Jayawardena, N., Pereira, V., Islam, N., Del Giudice, M., & Choudrie, J. (2022). Gamification and e-learning for young learners: A systematic literature review, bibliometric analysis, and future research agenda. *Technological Forecasting and Social Change, 176*, 121445. https://doi.org/10.1016/j.techfore.2021.121445

Bergmann, J., & Sams, A. (2023). *Flip your classroom, revised edition: Reach every student in every class every day*. ASCD.

Bishop, J., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. In *2013 ASEE annual conference & exposition* (pp. 23-1200).

Bolstad, O. H. (2023). Lower secondary students' encounters with mathematical literacy. *Mathematics Education Research Journal, 35*(1), 237-253. https://doi.org/10.1007/s13394-021-00386-7

Boyd D. G., & Bee H. L. (2014) *The developing child*. Pearson Education.

Buchner, A. (2022). *Moodle 4 Administration: An administrator's guide to configuring, securing, customizing, and extending Moodle*. Packt.

Büyüköztürk, Ş. (1998). Kovaryans analizi (Varyans analizi ile karşılaştırmalı bir inceleme) [Analysis of covariance (A comparative analysis with analysis of variance).]. *Ankara University Journal of Faculty of Educational Sciences (JFES), 31*(1), 91-105. https://doi.org/10.1501/Egifak_0000000247

Büyüköztürk, Ş. (2018). *Sosyal bilimler için veri analizi el kitabı* [Data analysis handbook for the social sciences] (24th ed.). Ankara: Pegem Academy Publishing

Candel, E. C., de la Pena, C., & Yuste, B. C. (2024). Pre-service teachers' perception of active learning methodologies in history: Flipped classroom and gamification in an e-learning environment. *Education and Information Technologies, 29*(3), 3365-3387. https://doi.org/10.1007/s10639-023-11924-0

Cevikbas, M., & Kaiser, G. (2022). Student engagement in a flipped secondary mathematics classroom. International *Journal of Science and Mathematics Education, 20*(7), 1455-1480. https://doi.org/10.1007/s10763-021-10213-x

Christenson, S. L., Reschly, A. L., & Wylie, C. (2012). *Handbook of research on student engagement*. Springer.

Clark, R. E. (1983). Reconsidering research on learning from media. *Review of Educational Research, 53*(4), 445-459. https://doi.org/10.3102/00346543053004445

Cole, J., & Foster, H. (2007). *Using Moodle: Teaching with the popular open source course management system*. O'Reilly.

Conde, M. A., Aguilar, D. A. G., Pozo de Dios, A. D., & Penalvo, F. J. G. (2010). Moodle 2.0 web services layer and its new application contexts. In *International Conference on Technology Enhanced Learning* (pp. 110-116). Springer. https://doi.org/10.1007/978-3-642-13166-0_16

Costello, E. (2013). Opening up to open source: Looking at how Moodle was adopted in higher education. *Open Learning: The Journal of Open, Distance and e-Learning, 28*(3), 187–200. https://doi.org/10.1080/02680513.2013.856289

Daliranfirouz, E., Amiryousefi, M., Geld, R., & Ansari, D. N. (2024). Gamified-flipped English classes and L2 learners' achievement and perceptions. *Innovation in Language Learning and Teaching*, 1-15. https://doi.org/10.1080/17501229.2024.2374356

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Springer.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning future media environments* (pp. 9–15). ACM. https://doi.org/10.1145/2181037.2181040

Do, M., Sanford, K., Roseff, S., Hovaguimian, A., Besche, H., & Fischer, K. (2023). Gamified versus non-gamified online educational modules for teaching clinical laboratory medicine to first-year medical students at a large allopathic medical school in the United States. *BMC Medical Education, 23*(1), 959. https://doi.org/10.1186/s12909-023-04951-5

Dodero, G., Gennari, R., Melonio, A., & Torello, S. (2014). Towards tangible gamified co-design at school: two studies in primary schools. In *Proceedings of the first ACM SIGCHI annual symposium on Computer-human interaction in play* (pp. 77-86). https://doi.org/10.1145/2658537.2658688

Dominguez, A., Saenz de Navarrete, J., de Marcos, L., Fernandez-Sanz, L., Pages, C., & Martinez-Herraiz, J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education, 63*, 380-392. https://doi.org/10.1016/j.compedu.2012.12.020

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

Ekici, M. (2021). A systematic review of the use of gamification in flipped learning. *Education and Information Technologies, 26*(3), 3327-3346. https://doi.org/10.1007/s10639-020-10394-y

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2011). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109. https://doi.org/10.3102/00346543074001059

Gennari, R., Melonio, A., & Torello, S. (2017). Gamified probes for cooperative learning: A case study. *Multimedia Tools and Applications, 76*, 4925-4949. https://doi.org/10.1007/s11042-016-3543-7

Ghafouri, R., Zamanzadeh, V., & Nasiri, M. (2024). Comparison of education using the flipped class, gamification and gamification in the flipped learning environment on the performance of nursing students in a client health assessment: A randomized clinical trial. *BMC Medical Education, 24*(1), 949. https://doi.org/10.1186/s12909-024-05966-2

Graven, M., Venkat, H., & Bowie, L. (2023). Analysing the citizenship agenda in Mathematical literacy school exit assessments. *ZDM Mathematics Education, 55*(5), 1021-1036. https://doi.org/10.1007/s11858-022-01448-1

Gutierrez-Gonzalez, R., Zamarron, A., Royuela, A., & Rodriguez-Boto, G. (2023). Flipped classroom applied to Neurosurgery in undergraduate medical education. *BMC Medical Education, 23*(1), 170. https://doi.org/10.1186/s12909-023-04158-8

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? A literature review of empirical studies on gamification. In *2014 47th Hawaii International Conference on System Sciences* (pp. 3025-3034). IEEE. https://doi.org/10.1109/HICSS.2014.377

Hanus, M., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education, 80*, 152-161. https://doi.org/10.1016/j.compedu.2014.08.019

Hao, X., & Fang, F. (2024). Learners' speaking self-efficacy, self-efficacy sources and their relations in the traditional and flipped instructional modes. *Asia Pacific Journal of Education*, 1-16. https://doi.org/10.1080/02188791.2024.2414051

Hopkins, K. D., & Weeks, D. L. (1990). Tests for normality and measures of skewness and kurtosis: Their place in research reporting. *Educational and Psychological Measurement, 50*(4), 717-729. https://doi.org/10.1177/0013164490504001

Höfer, T., & Beckmann, A. (2009). Supporting mathematical literacy: examples from a cross-curricular project. *ZDM Mathematics Education, 41*(1), 223-230. https://doi.org/10.1007/s11858-008-0117-9

Huang, B., Hew, K. F., & Lo, C. K. (2019). Investigating the effects of gamification-enhanced flipped learning on undergraduate students' behavioral and cognitive engagement. *Interactive learning environments, 27*(8), 1106-1126. https://doi.org/10.1080/10494820.2018.1495653

Huang, Y. H., Hsia, L. H., & Hwang, G. J. (2026). A gamified AI movement assessment and feedback approach for university students in physical education: Effects on movement skills, learning engagement, and behavioral patterns. *Education and Information Technologies*, 1-21. https://doi.org/10.1007/s10639-026-13911-7

Hwang, G. J., Lai, C. L., & Wang, S. Y. (2015). Seamless flipped learning: a mobile technology-enhanced flipped classroom with effective learning strategies. *Journal of computers in education, 2*(4), 449-473. https://doi.org/10.1007/s40692-015-0043-0

Jablonka, E. (2015). The evolvement of numeracy and mathematical literacy curricula and the construction of hierarchies of numerate or mathematically literate subjects. *ZDM Mathematics Education, 47*, 599-609. https://doi.org/10.1007/s11858-015-0691-6

Jansen, A., Curtis, K., Mohammad-Mirzaei, A., Cullicott, C. E., Smith, E. P., & Middleton, J. A. (2023). Secondary mathematics teachers' descriptions of student engagement. *Educational Studies in Mathematics, 113*(3), 425-442. https://doi.org/10.1007/s10649-023-10228-x

Kapp, K. M. (2012). *The gamification of learning and instruction: Game-based methods and strategies for training and education*. John Wiley & Sons.

Karamert, Ö., & Kuyumcu-Vardar, A. (2021). The effect of gamification on young mathematics learners' achievements and attitudes. *Journal of Educational Technology and Online Learning, 4*(2), 96-114. https://doi.org/10.31681/jetol.904704

Kline, R.B. (2023). *Principles and practices of structural equation modeling* (5th ed.). The Guilford.

Li, Z., & Li, J. (2022). Using the flipped classroom to promote learner engagement for the sustainable development of language skills: A mixed-methods study. *Sustainability, 14*(10), 5983. https://doi.org/10.3390/su14105983

Lo, C. K., & Hew, K. F. (2020). A comparison of flipped learning with gamification, traditional learning, and online independent study: the effects on students' mathematics achievement and cognitive engagement. *Interactive Learning Environments, 28*(4), 464-481. https://doi.org/10.1080/10494820.2018.1541910

Lo, C. K., & Hew, K. F. (2021). Student engagement in mathematics flipped classrooms: Implications of journal publications from 2011 to 2020. *Frontiers in Psychology, 12*, 672610. https://doi.org/10.3389/fpsyg.2021.672610

Lo, C. K., Hew, K. F., & Chen, G. (2017). Toward a set of design principles for mathematics flipped classrooms: A synthesis of research in mathematics education. *Educational Research Review, 22*, 50-73. https://doi.org/10.1016/j.edurev.2017.08.002

Lodico, M. G., Spaulding, D. T., & Voegtle, K. H. (2010). *Methods in educational research: From theory to practice* (Vol. 28). John Wiley & Sons.

Majuri, J., Koivisto, J., & Hamari, J. (2018). Gamification of education and learning: A review of empirical literature. In *Proceedings of the 2nd international GamiFIN conference, GamiFIN 2018*. CEUR-WS (pp. 11-19).

Manzano-Leon, A., Camacho-Lazarraga, P., Guerrero, M. A., Guerrero-Puerta, L., Aguilar-Parra, J. M., Trigueros, R., & Alias, A. (2021). Between level up and game over: A systematic literature review of gamification in education. *Sustainability, 13*(2247). https://doi.org/10.3390/su13042247

Marell-Olsson, E. (2021). Using gamification as an online teaching strategy to develop students' 21st century skills. *IxD&A: Interaction Design and Architecture (s)*, (47), 69-93.

Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University.

Milli Eğitim Bakanlığı [Ministry of National Education] [MoNE]. (2018). *Matematik dersi öğretim programı (1-8. Sınıflar) [Mathematics course curriculum - 1st-8th Grades]*. MoNE. http://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=329

Ng, L. K., & Lo, C. K. (2023). Enhancing online instructional approaches for sustainable business education in the current and post-pandemic era: An action research study of student engagement. *Education Sciences, 13*(1), 42. https://doi.org/10.3390/educsci13010042

OECD - Organisation for economic co-operation and development. (2022). *The PISA 2022 mathematics framework*. OECD.

Özgen, K. (2013). An analysis of high school students' mathematical literacy self-efficacy beliefs in relation to their learning styles. *The Asia-Pacific Education Researcher, 22*, 91-100. https://doi.org/10.1007/s40299-012-0030-4

Özgen, K., & Bindak, R. (2011). Determination of self-efficacy beliefs of high school students towards math literacy. *Educational Sciences: Theory and Practice, 11*(2), 1085-1089.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology, 86*(2), 193–203. https://doi.org/10.1037/0022-0663.86.2.193

Pan, Z., Wang, K., Zhu, J., & Smith, M. (2026). Levels, stickers, and strategies: how gamified math tasks foster elementary student engagement. *Education and Information Technologies*, 1-23. https://doi.org/10.1007/s10639-025-13866-1

Pratiwi, D. I., Fitriati, S. W., Yuliasri, I., & Waluyo, B. (2024). Flipped classroom with gamified technology and paper-based method for teaching vocabulary. *Asian-Pacific Journal of Second and Foreign Language Education, 9*(1), 1. https://doi.org/10.1186/s40862-023-00222-4

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education, 93*(3), 223-231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology, 105*(3), 579–595. https://doi.org/10.1037/a0032690

Reinke, W. M., Herman, K. C., & Copeland, C. B. (2022). Student engagement: The importance of the classroom context. In A. L. Reschly, & S. L. Christenson (Eds.), *Handbook of Research on Student Engagement* (pp. 529–544). Springer International Publishing. https://doi.org/10.1007/978-3-031-07853-8_25

Reschly, A. L., & Christenson, S. L. (2022). Jingle-jangle revisited: History and further evolution of the student engagement construct. In A. L. Reschly, & S. L. Christenson (Eds.), *Handbook of Research on Student Engagement* (pp. 3–24). Springer International Publishing. https://doi.org/10.1007/978-3-031-07853-8_1

Sailer, M., & Sailer, M. (2021). Gamification of in-class activities in flipped classroom lectures. *British Journal of Educational Technology, 52*(1), 75-90. https://doi.org/10.1111/bjet.12948

Sanz-Angulo, P., Galindo-Melero, J., De-Diego-Poncela, S., & Martin, O. (2025). Promoting soft skills in higher engineering education: Assessment of the impact of a teaching methodology based on flipped learning, cooperative work and gamification. *Education and Information Technologies*, 1-44. https://doi.org/10.1007/s10639-025-13322-0

Sargent, J., & Casey, A. (2020). Flipped learning, pedagogy and digital technology: Establishing consistent practice to optimise lesson time. *European Physical Education Review, 26*(1), 70–84. https://doi.org/10.1177/1356336X19826603

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*, 207-231. https://doi.org/10.1080/00461520.1991.9653133

Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2008). *Motivation in education: Theory, research, and applications*. Pearson.

Sever, M. (2014). Adapting classroom engagement inventory into Turkish culture. *Education and Science, 39*(176), 171-182. https://doi.org/10.15390/EB.2014.3627

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement. *Educational Psychologist, 44*(4), 225–236. https://doi.org/10.1177/0013164408323233

Stipek, D., & Gralinski, H. (1996). Children's beliefs about intelligence and school performance. *Journal of Educational Psychology, 88*(3), 397-407.

Talbert, R. (2017). *Flipped learning: A guide for higher education faculty*. Stylus.

Taşpınar, M. (2017). *Sosyal Bilimlerde SPSS uygulamalı nicel veri analizi* [Applied quantitative data analysis using SPSS in social sciences]. Pegem.

Thongmak, M. (2019). The student experience of student-centered learning methods: Comparing gamification and flipped classroom. *Education for Information, 35*(2), 99-127. https://doi.org/10.3233/EFI-18018

Throndsen, J. E., Shumway, J. F., & Moyer-Packenham, P. S. (2020). The relationship between mathematical literacy at kindergarten entry and public preschool attendance, type, and quality. *Early Childhood Education Journal, 48*, 473-483. https://doi.org/10.1007/s10643-019-01014-7

Wang, Z., Bergin, C., & Bergin, D. A. (2014). Measuring engagement in fourth to twelfth grade classrooms: The classroom engagement inventory. *School Psychology Quarterly, 29*(4), 517-535. https://doi.org/10.1037/spq0000050

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Wharton Digital.

Xiao, R., Wu, Z., & Hamari, J. (2021). Internet-of-gamification: A review of literature on iot-enabled gamification for user engagement. *International Journal of Human-Computer Interaction*, 1-25. https://doi.org/10.1080/10447318.2021.1990517

Xiao, Y., & Hew, K. F. T. (2024). Intangible rewards versus tangible rewards in gamified online learning: Which promotes student intrinsic motivation, behavioural engagement, cognitive engagement and learning performance?. *British Journal of Educational Technology, 55*(1), 297-317. https://doi.org/10.1111/bjet.13361

Yllana-Prieto, F., Jeong, J. S., & Gonzalez-Gomez, D. (2021). An online-based edu-escape room: A comparison study of a multidimensional domain of PSTs with flipped sustainability-stem contents. *Sustainability, 13*(3), 1032. https://doi.org/10.3390/su13031032

Yu, Q., & Yu, K. (2024). The effects of gamified flipped classroom on student learning: evidence from a meta-analysis. *Interactive Learning Environments, 32*(9), 5126-5141. https://doi.org/10.1080/10494820.2023.2209791

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review, 30*, 100326. https://doi.org/10.1016/j.edurev.2020.100326

Zainuddin, Z., Farida, R., Keumala, C. M., Kurniawan, R., & Iskandar, H. (2022). Synchronous online flip learning with formative gamification quiz: instruction during COVID-19. *Interactive Technology and Smart Education, 19*(2), 236-259. https://doi.org/10.1108/ITSE-01-2021-0002

Zakariya, Y. F. (2022). Improving students' mathematics self-efficacy: A systematic review of intervention studies. *Frontiers in Psychology, 13*, 986622. https://doi.org/10.3389/fpsyg.2022.986622

Zeng, C. (2025). The effects of students' backgrounds, attitudes, and ICT familiarity on mathematical literacy: Latent profile analysis and lasso regression. *Education and Information Technologies, 30*(5), 5451-5475. https://doi.org/10.1007/s10639-024-13028-9

Zichermann, G., & Cunningham, C. (2011). *Gamification by design: Implementing game mechanics in web and mobile apps*. O'Reilly.

Zimmerman, B. J. (1995). Self-Efficacy and Educational Development. In A. Bandura (Ed.), *Self-efficacy in changing societies*, (pp. 202-231). Cambridge University.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology, 25*(1), 82-91. https://doi.org/10.1006/ceps.1999.1016

Zou, D. (2020). Gamified flipped EFL classroom for primary education: Student and teacher perceptions. *Journal of Computers in Education, 7*(2), 213-228. https://doi.org/10.1007/s40692-020-00153-w

About the authors:

Önder KARAMERT, Dr.

He is a doctoral academic member at the Republic of Türkiye National Education Academy, Department of Educational Technology. He teaches postgraduate courses at the same institution. His research interests include primary education, mathematics education, educational technology, and gamification. He has conducted both national and international research on the use of gamification in learning environments. His current research interest focuses on how high-quality learning experiences can be achieved by contemporary educational technologies.

Özden DEMİRKAN, Prof. Dr.

She is a doctoral faculty member at Gazi University, Faculty of Education, Department of Educational Technology. She teaches undergraduate and postgraduate courses at her affiliated university. Her research interests include classroom education, educational technology, and anchored learning. She has conducted national and international academic research into the use of technology in learning environments. Her current research interest focuses on improving educational environments using modern educational technologies.

HAREZMI EDUCATION MODEL IN PRIMARY MATHEMATICS EFFECTS ON PROBLEM-SOLVING AND CRITICAL THINKING

Tunahan FİLİZ
Dr., Bayburt University, Bayburt, Türkiye
ORCID: https://orcid.org/0000-0002-3149-8783
tunahanfiliz@bayburt.edu.tr

Bilgen DURAN EREL
Primary School Teacher, Şehit Nevzat Kaya Primary School, Bayburt, Türkiye
ORCID: https://orcid.org/0009-0003-7679-162X
bilgenerel69@gmail.com

Abstract

Interdisciplinary approaches in education play a crucial role in developing students' real-world mathematical problem-solving (MPS) skills and critical thinking (CT) skills. One such approach, the Harezmi Education Model (HEM), integrates mathematics, science, computer technologies, social sciences, the arts, and sports through data-driven, technology-supported learning environments. This research sought to explore how the HEM can be incorporated into primary mathematics teaching and to determine its effect on learners' MPS and CT skills. The study was designed according to an explanatory sequential mixed-methods approach. During the quantitative stage, a quasi-experimental pretest–posttest model was implemented with fourth-grade students, who were separated into an experimental group (n = 26) and a control group (n = 26). In the subsequent qualitative stage, semi-structured interviews were carried out with 15 primary school teachers. The quantitative data were examined through multivariate analysis of variance (MANOVA), whereas the qualitative data were interpreted using content analysis. The results demonstrated that instruction grounded in HEM produced statistically significant improvements in students' MPS and CT skills. Teacher perspectives further indicated that HEM supports interdisciplinary learning and real-world connections, although challenges related to resources, time management, and teacher preparedness were noted. Overall, the results suggest that HEM offers a promising interdisciplinary framework for enhancing mathematics instruction and 21st-century skills in primary education.

Keywords: Harezmi education model, mathematical problem-solving, critical thinking, interdisciplinary learning, primary education.

INTRODUCTION

Interdisciplinary approaches in education are critical for developing students' real-world problem-solving abilities and supporting their CT skills (Tokmak et al. 2023). One such approach, the HEM, is an innovative educational model that brings together computer technologies, science and mathematics education, social sciences, art and design, and sports sciences, while maintaining interdisciplinary integrity. This model enables students to identify real-world problems grounded in data, develop innovative solutions, and implement these solutions in technology-supported learning environments (Çimşir et al. 2022). Additionally, the model provides opportunities for teachers to develop their interdisciplinary and collaborative skills, integrate technology effectively, and create research- and development-oriented learning designs (Çimşir, 2024; Koçoğlu, 2018). Additionally, it encourages students to engage with technological learning tools—such as programming, robotics, and game design—in order to enhance their algorithmic thinking and problem-solving abilities (Çimşir, 2024).

This study investigates the impact of HEM-based problem-solving instruction on students and examines the implementation of the HEM in primary school mathematics classes through the experiences and perspectives of primary school teachers. With its interdisciplinary structure, HEM offers a framework for developing students' 21st-century skills, similar to the internationally

widespread STEM (Science, Technology, Engineering, Mathematics) and STEAM (STEM with added Arts) approaches. HEM adds a unique dimension to STEM/STEAM approaches, with a structure focused on coding, algorithmic thinking, computer science activities, and collaborative product development. As a model developed specifically within a local context, it reinterprets and contextualizes these global approaches from cultural and pedagogical perspectives. In this regard, HEM stands out for its distinctiveness among interdisciplinary teaching models implemented in Türkiye. It contributes to the international literature by presenting a different view on STEM/STEAM education. The results of this study reveal HEM's contributions to mathematics education and areas for improvement, which are expected to enhance the quality of the model at the national level and to offer an alternative model for interdisciplinary education approaches at the international level.

Interdisciplinary Approach and the HEM

An interdisciplinary approach is an instructional strategy that fosters deep and multidimensional learning by integrating the knowledge, skills, and viewpoints of multiple fields around a common theme or problem (Aydın & Balım, 2005). Through this approach, learners can recognize connections across different subject areas, transfer their learning to real-world contexts, and examine authentic problems holistically (Martinello & Cook, 2000). Thanks to this method, learners not only gain academic knowledge but also have the opportunity to develop higher-level skills such as problem solving, creativity, analytical thinking, and collaboration (Keskin et al., 2024; Erdem & Eminoğlu-Küçüktepe, 2024). Teaching abstract subjects such as mathematics and science by relating them to daily life increases students' interest, makes learning more lasting, and positively affects academic achievement (Demirel et al., 2008; Karakuş et al., 2017). Learning processes conducted with an interdisciplinary approach encourage students' active participation, foster their self-confidence, and promote positive attitudes toward school and lessons (Güder & Gürbüz, 2018; Gürkan, 2019). In this context, the contemporary understanding of education aims to develop students' 21st-century skills and equip them with competencies such as interpreting information, problem solving, making inferences, and CT (Uğraş, 2017).

HEM is an innovative model in which students identify real-world problems in a data-driven manner, develop creative, solution-oriented approaches to these problems, and teachers manage the process from an interdisciplinary perspective (Koçoğlu, 2018). The fundamental elements of the model are interdisciplinary integration, real-world problems, and the nature of the technological tools used to solve them (Ayra et al., 2025; Babayiğit-Durakcan, 2024). This model aims to integrate different disciplines and embed computational thinking into daily life (Ceylan et al., 2020; Koçoğlu, 2018). Furthermore, one of the fundamental steps of the model is for students to generate solutions through algorithmic thinking based on problems they identify (Çimşir, 2024). Developed in line with global education reforms, HEM aligns with approaches such as STEM and STEAM. Still, it stands out as an alternative model in Türkiye for its focus on interdisciplinary teacher cooperation, ethics, and safety, as well as its continuously updated structure.

Primary School Mathematics Education and MPS

Primary school mathematics education is important because it coincides with a critical period in which the foundations of individuals' cognitive development are established. Mathematics education during this period should not be limited to teaching basic operations; it should also support the development of students' higher-level skills such as reasoning, making connections, predicting, problem-solving, and communication (Filiz & Güneş, 2023). Due to its abstract nature, mathematics can be challenging for students. Therefore, teachers need to concretize mathematical concepts by relating them to students' daily lives (Orhan, 2025). In this process, students' understanding of the problems they encounter, their ability to generate solutions, and their development of alternative perspectives directly contribute to the development of their MPS skills (Çimşir & Baysal, 2019). At this point, instead of directly transferring knowledge to students, students should be supported in learning how to access information, and the teaching process should be enriched with structured, thinking-based activities (Aydoğdu & Kesercioğlu, 2005).

Effective mathematics instruction in the early years should enable students to express their thoughts through mathematical representations, thereby enhancing both the learning process and student engagement (Büyükalan Filiz & Ergan, 2020). This is possible when students can establish connections between abstract symbols and the concrete world, focus on mathematical concepts, and discover relationships among concepts (Ulu et al., 2016). In this context, teachers should not reduce mathematics teaching to technical skills alone. Instead, they should adopt an approach that aims to develop CT, reasoning, and analytical thinking skills, enabling students to understand the problems they encounter in daily life and develop practical solutions (Budak-Coşkun, 2009). Since mathematics has a constantly evolving and cumulative structure, the teaching process should also be based on the principle of structuring concepts by relating them to each other (Bingölbali & Özmantar, 2015). Although mathematics is inevitably divided into different subject areas in teaching programs, meaningful connections should be established among these areas, and mathematical knowledge should be presented to students with both intradisciplinary and interdisciplinary coherence and related to life (NCTM, 2000).

Problem solving is considered a core competency in mathematics learning (Schoenfeld, 1985). Rather than involving the mechanical application of procedures, it requires careful examination of the problem, the construction of logical solution strategies, the execution of these strategies, and the critical assessment of the outcomes (Arfé et al., 2020). In this regard, the process can be conceptualized as a sequence of steps that includes understanding the problem, generating and choosing suitable strategies, devising a plan that promotes flexible thinking, implementing the plan, and reflecting on and evaluating the results (Polya, 2014).

This Study

Recent studies have revealed that the interdisciplinary, collaborative, and problem-solving-based structure of the HEM contributes significantly to students' cognitive and affective development (Erdem & Eminoğlu-Küçüktepe, 2024; Orhan, 2025; Tokmak et al., 2023). Numerous studies have demonstrated that HEM has positive effects on students' problem-solving, CT, creativity, collaboration, and 21st-century skills (Çimşir, 2024; Derdiyok et al., 2025). Some studies have also found that the model has positive effects on social-emotional learning, self-awareness, motivation, self-confidence, and school attachment (Ayra et al., 2025; Orhan, 2025). However, findings in this area are mostly based on qualitative data derived from teacher and student opinions. Therefore, more quantitative, longitudinal, and experimental studies on the affective effects of the model are needed. Studies examining teacher opinions (Ayra et al., 2025; Erdem & Eminoğlu-Küçüktepe, 2024; Keskin et al., 2024; Seçer, 2021) generally show that teachers have positive attitudes towards HEM. Teachers have highlighted the model's strengths as its student-centered, collaborative, and interdisciplinary structure. However, they have also frequently emphasized challenges related to infrastructure, materials, time, and planning in practice (Orhan, 2025; Seçer, 2021). Most of the studies reviewed used qualitative designs. While this provides valuable information about the model's effectiveness, it makes it difficult to draw causal inferences.

The majority of studies on HEM in the literature consist of descriptive or opinion-based qualitative studies, and experimental or applied studies focusing on the concrete effects of the model in primary mathematics education are quite limited. While existing studies have shown that the model develops students' social skills such as cooperation, communication, and creative thinking, they do not provide sufficient in-depth analysis of the model's impact on mathematics teaching or the opportunities and challenges teachers encounter in classroom applications. This situation highlights the need for comprehensive, applied research that examines the effects of HEM, particularly in the context of primary school mathematics education.

This study examines how HEM is structured in mathematics education and its multifaceted effects on students' problem-solving skills. It aims to evaluate both teachers' experiences with the application process and the pedagogical contributions of the model. One of the original aspects of the research is that it addresses the integration of HEM into primary-level mathematics lessons from both the teacher

and student perspectives, revealing the impacts of the interdisciplinary method on instructional outcomes. The results are hoped to contribute to teacher instruction but also serve as a guide for practitioners and policymakers to increase the effectiveness of interdisciplinary models. Furthermore, the research provides a comprehensive assessment of the applicability of HEM at the primary education level by revealing primary school teachers' experiences with implementing the model, the difficulties they encountered, and the model's contributions to the teaching process.

The purpose of this study is to examine the integration of HEM into primary school mathematics education and to determine its effect on learners' MPS skills. Accordingly, the study seeks to answer the following research questions.

1. What are the effects of mathematics instruction integrated with HEM-based teaching activities on primary school students' MPS and CT skills?

2. What are the implications of mathematics instruction conducted with HEM-based teaching activities for the MPS teaching process?

METHOD

Research Model

Mixed-methods research refers to an approach in which both quantitative and qualitative data are gathered and analyzed using one or more data collection tools, and the results are subsequently combined and interpreted in an integrated manner (see Figure 1).
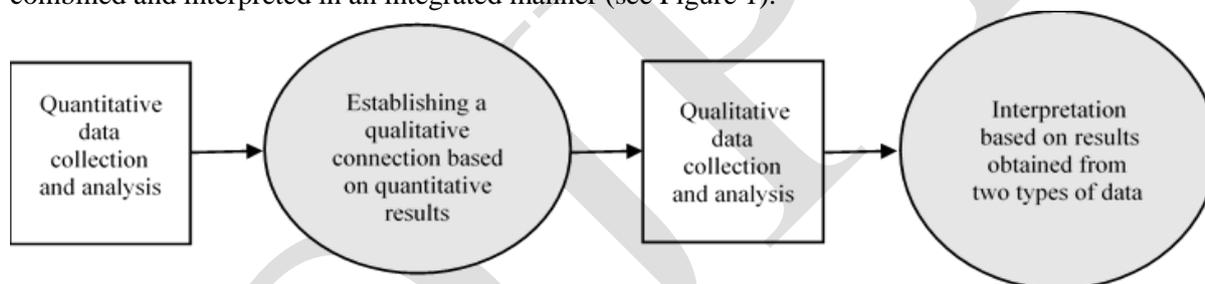
Figure 1. Explanatory sequential mixed-methods approach.

The combined use of quantitative and qualitative methods provides an opportunity to approach and examine the research problem from different perspectives (Niglas, 2010). An explanatory sequential mixed-methods design was utilized in this study. Within this framework, quantitative data were gathered and analyzed in the initial phase, after which qualitative data were collected and examined to further clarify and expand upon the quantitative results. Finally, the outcomes obtained from both phases were combined and interpreted in an integrated manner (Niglas, 2010). In line with this design, the study first focused on the collection and analysis of quantitative data, and subsequently proceeded with the collection and analysis of qualitative data based on the insights gained from the quantitative phase. Consistent with the explanatory sequential design, the qualitative phase was used to gain deeper insight into the factors underlying the quantitative results. For the quantitative component, a quasi-experimental pretest–posttest control group design was employed. The control and experimental groups were formed from intact groups that were comparable with respect to the baseline characteristics identified through pretest measures. While the experimental intervention was applied to the experimental group, the control group continued with the regular instructional process. The impact of the experimental intervention was evaluated by comparing the pretest–posttest score differences between the control and experimental groups (Fraenkel et al., 2012). The qualitative component of the study was structured using a phenomenological research design, which focuses on individuals' lived experiences and perceptions to understand and describe a particular phenomenon or event (Yin, 2016). In this study, the aim was to reveal the reflections of HEM implemented in primary school mathematics lessons on the MPS teaching process through the experiences and perceptions of primary school teachers.

Participants

The study was conducted with 52 fourth-grade students attending a public primary school in Türkiye during the 2024–2025 academic year. For the quantitative component, the sample was selected through convenience sampling, a commonly used approach that enables researchers to access participants efficiently and practically, thereby reducing time and procedural constraints during data collection (Patton, 2002). The extended duration of the HEM-based problem-solving instruction, the adequate facilities of the school where the implementation was conducted, and the preparatory requirements of the activities are among the reasons for choosing this sampling method.

One of the four branches available at the school was randomly selected as the experimental group, and another was designated as the control group. There were 26 students in the experimental group, where HEM-based instruction activities were implemented, and 26 learners in the control group, which continued with curriculum-based traditional instruction. Thus, the research group consisted of a total of 52 learners. The ages of the students in the control and experimental groups ranged from 11 to 12 years. Furthermore, according to information obtained from primary school teachers, the students in both groups shared similar characteristics in terms of socioeconomic status (income level, parents' educational level, living conditions, access to social services, and access to technological devices), as well as academic achievement. Particular attention was paid to ensuring that the experimental group (54% female; 46% male, 26 students) and the control group (42% female; 58% male, 26 students) were balanced in terms of number, gender, and the variables examined.

During the qualitative phase of the research, semi-structured interviews were conducted with 15 primary school teachers who implemented HEM-based instructional activities in MPS teaching. The teachers' perceptions of the HEM approach and their teaching experiences were explored through these interviews. To identify the teachers included in the interviews, criterion sampling -a purposive sampling strategy- was employed (Creswell & Clark, 2017). The HEM approach in the mathematics teaching process and participation in practical training related to this model were used as criteria, and the opinions of 15 primary school teachers were obtained.

All necessary official permissions were obtained prior to including students in the study, and no financial incentives or payments were provided. Participation in the study was entirely voluntary. The study adhered to the ethical principles of the Declaration of Helsinki and the guidelines established by the Turkish Council of Higher Education. Approval for both the implementation and data collection processes was obtained from the Ethics Committee of Bayburt University on May 07, 2025 (Decision No: 195; Session No: 5). Prior to data collection, participants and their legal guardians were informed about the aim of the study, the voluntary nature of participation, confidentiality procedures, and their right to withdraw at any time without any negative consequences. Following this process, written informed consent was secured from both participants and their guardians. All data were collected and used solely for scientific purposes and were analyzed anonymously.

HEM-Based Teaching Activities

In this study, the teaching process was conducted through HEM-based activities. First, based on the mathematics course curriculum, two subjects that could be associated with HEM were identified for the grade level. Two lesson plans were prepared based on these subjects (see Table 2) and the process follow-up guide (see Fig. 2). Similar studies using the HEM approach (Çimşir, 2024; Derdiyok et al., 2025; Tokmak, 2023) were examined and used as a guide in preparing the lesson plans. A process-tracking guide was prepared to implement the lesson plans systematically (see Fig. 2). The guide was shaped by considering the problem-solving stages and the Harezmi Application Guide prepared by the Ministry of National Education. In this study, Polya's problem-solving stages (understanding the problem, planning the solution, implementing the plan, and checking the solution) were considered (Polya, 2014).
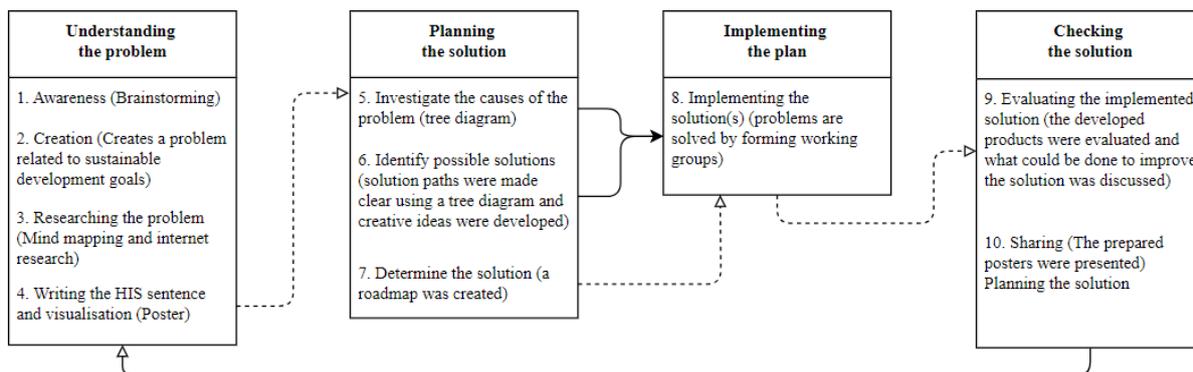
Figure 2. Process tracking guide used in the problem-solving teaching process.

Implementation Process

Before the instructional process began, a pretest was administered to examine whether the control and experimental groups differed significantly in terms of problem-solving and CT skills. The pretest data were examined using SPSS 25.0, and the results indicated that there was no statistically significant difference between the groups. To evaluate differences in group performance, an independent-samples t-test was applied. The intervention was implemented over a three-week period, comprising 12 class hours, in line with the instructional plan outlined in Table 2. Each instructional session lasted 40 minutes. The intervention procedures were carried out concurrently in both the control and experimental groups.

Two lesson plans were prepared at the fourth-grade level, taking into account the learning outcomes related to "addition" and "symmetry." Within this scope, lesson plans were prepared on solving problems requiring addition and drawing the symmetry of a given shape. When determining the learning outcomes, attention was paid to their alignment with the items in the HEM process follow-up guide. The prepared lesson plans were implemented identically in both groups. All lessons were conducted according to course plans designed in advance by the investigator and structured based on the learning outcomes. In the control group, the teaching process was conducted solely based on the textbook. The teaching activities for the control and experimental groups are presented in Table 1.

Table 1. Teaching activities implemented in the control and experimental groups.

	Experimental group	Control group
Pre-test	PSS, CTTS	
Learning process (three week)	**Addition**	
	The students brainstormed ideas on environmental issues and examined a problem situation related to the Sustainable Development Goals through group work, focusing on the damage caused to the environment by litter in the school garden. Mind maps and tree diagrams were used during the process to identify the causes of the problem, and possible solutions were discussed to develop creative ideas.	Lessons were teacher-centred; topics were explained using the textbook's explanations, sample solutions and demonstrations on the board. The addition process was reinforced through standard exercises and routine problem examples.
	Symmetry	
	Students worked in heterogeneous groups, conducting guided research, mind mapping and visualisation activities to express their love of symmetry and nature through posters, banners and slogans. Subsequently, analysis, measurement and application studies were carried out on objects found in nature; symmetry lines were drawn and geometric shapes were created.	The topic of symmetry was addressed by drawing symmetry lines on geometric shapes and examining ready-made shapes. Students worked individually, and the learning process was completed mainly through question-and-answer sessions, explanations, and workbook activities.
Post-test	PSS, CTTS, SSIF	

HEM-based instruction activities were designed using an interdisciplinary approach, with consideration of the process guide prepared by the researchers. The developed activities were reviewed by two mathematics education experts and evaluated for their alignment with HEM, the instructional content, and the characteristics of the target student group. In line with the experts' feedback, the 5E instructional model was incorporated into the design and implementation of the lesson plans. Subsequently, a pilot application of a lesson plan was carried out with a different class with similar characteristics that was not included in the study. After the pilot application, it was decided to conduct instruction in small groups rather than as a whole-class activity. Information about HEM-based teaching activities is presented below.

The application was carried out through small-group teaching led by the first researcher, with the second researcher, a primary school teacher, and two graduate students. The graduate students studying in the field of primary school education are also experienced primary school teachers. First, the learners in the experimental group were divided into four groups. The first researcher was responsible for teaching, while the other teachers served as group leaders. The implementation took place during the spring term of the academic year. Instruction was delivered through HEM-based activities in the experimental group, while the control group received traditional instruction using the mathematics teaching program. To prevent implementer bias, the measurement tools used to evaluate the process and outcome were scored objectively in accordance with standard criteria. In addition, the researcher benefited from the opinions and contributions of field experts in the analysis of qualitative data.

Table 2. HEM-based teaching activities.

Subject	Content	HEM duty
Problem solving requiring addition	Brainstorming is conducted on the question, "What are environmental problems?" A problem situation related to Sustainable Development Goals (SDG) (garbage in the schoolyard harming the environment) is presented. Students conduct research in groups, create mind maps, and express their ideas through HIS (a real-world problem) sentences, posters, or slogans.	1. Notice 2. Create 3. Research 4. Visualize
	Students first use a tree diagram to identify the root causes of the problem. They then discuss possible solutions using the diagram to develop creative ideas.	5. Identify the causes 6. Develop solutions
	Students walk around the garden on the school map, collect trash, mark the trash they find on the map, and number it. They create and solve their own math problems by measuring the distances between pieces of trash. Geometric shapes are made from the collected trash, and slogans are created.	7. Apply
	Students present the products they have developed (posters, slogans, geometric shapes) in class.	8. Check
Symmetry	Students are asked about symmetrical structures in nature and are told a story about symmetry. A problem situation is presented using the example of Elif and Mert's birdhouse design. Students conduct research in heterogeneous groups with guidance, visualize their love of nature and symmetry using mind maps, and express their ideas through banners, posters, or slogans.	1. Notice 2. Create 3. Research 4. Visualize
	Students analyze symmetrical shapes and patterns found in nature. Possible solutions and applications are determined using lines of symmetry and geometric shapes.	5. Identify the causes 6. Develop solutions
	Students go outdoors and draw symmetry lines on rocks, trees, or other objects to create geometric shapes. In the symmetry map activity, groups apply the shapes to each other using strings or drawings. In the birdhouse problem, they determine the position of the window based on the symmetry line and measurements; they draw and implement their designs.	7. Apply
	Students present their symmetry stones, drawings, and models found in nature in the exhibition area.	8. Check

Lesson plans were prepared and implemented based on the 5E teaching model. At the beginning of the lesson, students engaged in brainstorming with questions about environmental problems and symmetrical structures to capture their attention, and they became interested in the problem situation through the symmetry story and the birdhouse example (Engage). Then, in heterogeneous groups, with their instructors' guidance, they conducted research and visualized environmental pollution, love of nature, and symmetry using the mind map method (Explore).

Figure 3. Images from HEM-based teaching activities --Dünya temiz bir dairedir [The world is a clean apartment]; Çevre, Toprak, Su, Hava, ve Gürültü Kirliliği [Environmental, Soil, Water, Air, and Noise Pollution]--

Based on the information they obtained, the groups discussed the problem's causes and possible solutions, and created a plan using tree diagrams or symmetry lines (Explain). They then collected trash in the schoolyard or nature through hands-on activities, produce geometric shapes and symmetry models, and implemented the plan through symmetry map activities and mathematical measurements

(Elaborate). Finally, students presented the posters, slogans, and symmetry models they had prepared in the exhibition area, evaluated their products and solutions, and reinforced their learning by discussing shortcomings (Evaluate). Images from the implementation process are presented Figure 3.

Data Collection Instruments

Quantitative and qualitative data collection instruments were employed in a complementary way to enhance data diversity. Accordingly, a problem-solving and CT scale was utilized as the quantitative instrument, while a semi-structured interview form served as the qualitative data collection tool.

Problem solving scale (PSS)

In this study, the PSS for primary schools, developed by Değirmenci and Deringöl (2024), was used to evaluate primary school learners' problem-solving abilities. The scale, prepared to assess students' problem-solving skills, consists of a total of 16 items. The scale, consisting of three factors, covers the dimensions of "self-assessment in problem solving," "problem solving knowledge," and "metacognition in problem solving." The scale items, which have a five-point Likert-type rating, are answered with the options "Always," "Often," "Sometimes," "Rarely," and "Never." Students responded to the scale items by selecting the option that best suited them. The scale scores range from 16 to 80, with lower scores indicating weaker problem-solving skills and higher scores indicating stronger problem-solving skills. The item factor loadings of the scale range from .39 to .75. As a result of the confirmatory factor analysis (CFA) conducted to assess construct validity, it was determined that fit indices, such as χ^2/df, RMR, RMSEA, SRMR, CFI, IFI, GFI, and AGFI, were at acceptable levels. Furthermore, the Cronbach's Alpha coefficients for the scale's subscales were .85 for self-assessment in problem solving, 0.84 for problem-solving knowledge, and .75 for metacognition in problem solving. These values indicate that the scale has high reliability and is a valid measurement tool.

Critical thinking tendencies scale (CTTS)

The CTTS (Uluçinar & Akar, 2021) was used to determine students' CT skills. This scale, consisting of four factors and a total of 18 items, was prepared for primary school students and is organized in a four-point Likert scale format. The items are organized in a four-point Likert scale format with the options "Never," "Sometimes," "Most of the time," and "Always." The item factor loadings range from .35 to .74. The scores on the scale range from 18 to 72. The scale was administered to primary school students under the guidance of an instructor. A CFA was conducted to examine the goodness-of-fit of the measurement model. The findings indicated excellent fit for the χ^2/df, RMR, RMSEA, SRMR, and IFI indices, while the CFI and TLI values demonstrated an acceptable level of model fit. Furthermore, the overall reliability of the scale was assessed using Cronbach's alpha, which the researchers calculated at .74.

Semi-structured interview form (SSIF)

In the present study, SSIFs were conducted with 15 primary school teachers who implemented the HEM approach in their mathematics lessons. The interview format permits the inclusion of probing or follow-up questions alongside predetermined questions, allowing greater flexibility during data collection (Fraenkel et al., 2012). The interview questions were reviewed by two mathematics education faculty members, who confirmed that the interview form was appropriate for the participants' level, the model, and the implementation process. Furthermore, the interview form was reviewed and deemed appropriate by the primary school teachers at the school where the application was implemented. In addition, the prepared form was piloted with primary school teachers from a different school not included in the application. During the pilot study, questions that teachers found difficult to answer were revised accordingly with the support of the experts consulted during the form's preparation and supplemented with alternative questions. The interview form consists of eight open-ended questions. The interviews were conducted face-to-face with the teachers by the second researcher and lasted approximately 20 minutes each. The interviews were recorded with a voice recorder, and the recordings were transcribed into written text and prepared for analysis.

Data Analysis

Quantitative analyses were conducted using SPSS version 25. Given that multiple dependent variables were examined simultaneously, MANOVA was employed (Smith et al., 2020). Before conducting MANOVA, key assumptions—including adequate sample size, normality, the presence of outliers, linearity and multicollinearity, singularity, and the homogeneity of variance–covariance matrices— were assessed in accordance with the guidelines outlined by Pallant (2020). The analyses revealed that the data met the assumptions and that the sample sizes were sufficient for each dependent variable. Normality was assessed using histograms, skewness and kurtosis values, and the Levene test ($p >$ 0.05). Multivariate normality was assessed using Mahalanobis distance values. These values were compared against the chi-square distribution, and the results indicated that none of the observations exceeded the critical threshold (χ^2 (2, $p < .001$) = 13.82). This result indicates that the data met the assumption of multivariate normality. In addition, correlation coefficients indicated that the intercorrelations among variables remained below the .80 threshold. Visual inspection of distribution plots further supported the assumption of linearity. The results of Box's M test ($p > .05$) confirmed the homogeneity of variance–covariance matrices, indicating that the data met the assumptions required for MANOVA (Smith et al., 2020).

Qualitative data were gathered via face-to-face teacher interviews and analyzed through content analysis. Researchers coded the data and created categories and subcategories based on common characteristics. Another researcher then checked the resulting code matrix, and inter-coder reliability was calculated as .83 (Miles & Huberman, 1994). The in vivo coding method, based on direct quotations from participant statements, was preferred for reporting the obtained codes and categories (Saldana, 2021). At the outset of the study, analyses indicated that the control and experimental groups were equivalent in terms of pretest scores, with no statistically significant differences observed across any of the variables ($p > .05$). Furthermore, to protect participant confidentiality, teachers were assigned code names, and findings were presented using these code names. Fifteen primary school teachers were coded as HEM-T1, HEM-T2, HEM-T3…, HEM-T15 according to their sequence numbers.

RESULTS

A MANOVA was applied to examine the effect of HEM-based teaching activities integrated into primary school mathematics lessons on students' MPS and CT tendencies. Certain preconditions of MANOVA (linearity, normality, homogeneity of variance-covariance matrices, and multicollinearity) must be met. In this context, Box's M test was not significant ($p > .05$). This indicates that the condition of homogeneity of variance-covariance matrices was met.

According to the analysis of test results, descriptive statistics reveal that the experimental group scored higher in MPS (M = 69.23, SD = 6.19) and CT (M = 59.53, SD = 4.72). The descriptive statistics data for the control group were lower than those for the experimental group in MPS (M = 59.15, SD = 6.05) and CT (M = 44.57, SD = 7.04). To examine whether group differences were statistically significant, multivariate comparisons were conducted using MANOVA, and the results are presented below (see Table 3).

Table 3. MANOVA results related to CT and MPS.

Tests	Multiple test	Value	Mean square	*df*	*F*	*p*	Partial eta squared
Post-test	Wilks' λ	.361	-	-	43.457	.000	.639
	Dependent Variables						
	CT	-	2910.019	1	80.887	.000	.618
	MPS	-	1320.077	1	35.146	.000	.413

Analyses based on posttest scores revealed a statistically significant difference between the control and experimental groups, favoring the experimental group ($F_{(1, 50)}$ = 43.457, p = .000; Wilks' λ = .361;

$\eta^2 = .639$). In other words, the HEM-based teaching activities had been implemented had a significant effect on students' CT and MPS skills. Moreover, the experimental group demonstrated significantly higher CT levels than the control group ($F_{(1, 50)} = 80.887$, $p = .000$, $\eta^2 = .618$). Likewise, the experimental group achieved significantly higher MPS scores than the control group ($F_{(1, 50)} = 35.146$, $p = .000$, $\eta^2 = .413$). According to Cohen's (2013) classification, the calculated eta-squared (η^2) values were determined to have large effect sizes.

Results Regarding Sub-Factors of CT Tendencies

A MANOVA was performed to compare the posttest scores of the control and experimental groups across the subdimensions of CT tendencies, and the results are presented below (see Table 4).

Table 4. MANOVA results for sub-factors of CT tendencies.

Tests	Multiple test	Value	Mean square	df	F	p	Partial eta squared
Post-test	Wilks' λ	.245	-	-	36.203	.000	.755
	Dependent Variables						
	Skepticism	-	204.019	1	107.947	.000	.683
	Curiosity	-	138.942	1	19.420	.000	.280
	Open mindedness	-	129.308	1	23.308	.000	.318
	Biasness	-	272.327	1	94.331	.000	.654

The analysis results presented in Table 4 revealed statistically significant differences between the control and experimental groups on the sub-factors of the CTTS ($F_{(1, 50)} = 36.203$, Wilks' λ = .245, $p = .000$, $\eta^2 = .755$). Furthermore, the results for the doubt sub-dimension showed a significant difference in favor of the experimental group ($F_{(1, 50)} = 107.947$, $p = .000$, $\eta^2 = .683$). When examining the descriptive statistics for the doubt subscale, the experimental group (M = 13.88, SD = 1.27) had significantly higher scores than the control group (M = 9.92, SD = 1.46). Similarly, the results for the curiosity subscale showed a significant difference in favor of the experimental group ($F_{(1, 50)} = 19.420$, $p = .000$, $\eta^2 = .280$). When examining the descriptive statistics for the curiosity subscale, the experimental group (M = 16.42, SD = 2.26) had higher scores than the control group (M = 13.15, SD = 3.02). On the other hand, the results for the open-mindedness subscale showed a significant difference in favor of the experimental group ($F_{(1, 50)} = 23.308$, $p = .000$, $\eta^2 = .318$). When examining the descriptive statistics for the open-mindedness subscale, the experimental group (M = 16.15, SD = 2.18) had higher scores than the control group (M = 13.00, SD = 2.51). Finally, the results for the objectivity (Biasness) subscale showed a significant difference in favor of the experimental group ($F_{(1, 50)} = 94.331$, $p = .000$, $\eta^2 = .654$). When examining the descriptive statistics for the objectivity subscale, the experimental group (M = 13.07, SD = 1.54) had higher scores than the control group (M = 8.50, SD = 1.83).

Results Related to MPS Sub-Factors

MANOVA was conducted to examine differences between the control and experimental groups in posttest scores across the subdimensions of MPS skills, and the results are reported below (see Table 5).

Table 5. MANOVA results for subfactors of MPS.

Tests	Multiple test	Value	Mean square	df	F	p	Partial eta squared
Post-test	Wilks' λ	.542	-	-	13.503	.000	.458
	Dependent Variables						
	Self-assessment in problem-solving	-	330.019	1	39.780	.000	.443
	Problem-solving knowledge	-	76.327	1	14.287	.000	.222
	Metacognition in problem solving	-	88.923	1	16.100	.000	.244

The results displayed in Table 5 indicate statistically significant differences between the control and experimental groups across the subdimensions of the problem-solving scale ($F_{(1, 50)}$ = 13.503, Wilks' λ = .542, p = .000, η^2 = .458). Furthermore, the results for the self-assessment sub-dimension of problem solving showed a significant difference in favor of the experimental group ($F_{(1, 50)}$ = 39.780, p = .000, η^2 = .443). When examining the descriptive statistics for the self-assessment sub-dimension in problem solving, it was observed that the experimental group (M = 36.57, SD = 2.92) had significantly higher scores than the control group (M = 31.53, SD = 2.83). Similarly, the results for the problem-solving knowledge sub-dimension showed a significant difference in favor of the experimental group ($F_{(1, 50)}$ = 14.287, p = .000, η^2 = .222). When examining the descriptive statistics for the problem-solving knowledge sub-dimension, it was determined that the experimental group (M = 16.03, SD = 2.45) had higher values than the control group (M = 13.61, SD = 2.15). Finally, the results for the metacognition sub-dimension in problem solving showed a significant difference in favor of the experimental group ($F_{(1, 50)}$ = 16.100, p = .000, η^2 = .244). When examining the descriptive statistics for the metacognition sub-dimension of problem solving, the experimental group (M = 16.61, SD = 2.31) had higher scores than the control group (M = 14.00, SD = 2.38).

Results from Teacher Interviews
Findings from teacher interviews are presented under two themes: "Findings related to the HEM-supported mathematics teaching process" and "Findings related to the MPS process."

Results Related to the HEM-Supported Mathematics Teaching Process
Findings related to the HEM-supported mathematics teaching process are presented in Table 6 under three categories: "opportunities," "challenges," and "recommendations."

Table 6. Findings related to the HEM-supported mathematics teaching process.

Category	Code	Teacher	f	%
Opportunities	Develops problem-solving skills	HEM-T1, HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T6, HEM-T9, HEM-T10, HEM-T11, HEM-T12, HEM-T15	11	20
	Provides an interdisciplinary learning environment	HEM-T1, HEM-T2, HEM-T4, HEM-T5, HEM-T6, HEM-T8, HEM-T10, HEM-T13, HEM-T11, HEM-T14	10	18
	Enables connection to daily life	HEM-T1, HEM-T2, HEM-T4, HEM-T6, HEM-T7, HEM-T8, HEM-T10, HEM-T11, HEM-T13, HEM-T14	10	18
	Encourages active participation	HEM-T1, HEM-T2, HEM-T4, HEM-T5, HEM-T6, HEM-T10, HEM-T11, HEM-T13	8	14
	Enables meaningful and lasting learning	HEM-T1, HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T7, HEM-T11	7	12
	Supports social learning	HEM-T2, HEM-T3, HEM-T4, HEM-T7, HEM-T11, HEM-T14	6	11
	Enables technology-supported learning	HEM-T1, HEM-T2, HEM-T5, HEM-T6	4	7
Challenges	Lack of resources and materials	HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T6, HEM-T10, HEM-T12, HEM-T13	8	27
	Limited teacher competencies related to the model	HEM-T1, HEM-T3, HEM-T4, HEM-T5, HEM-T6, HEM-T11, HEM-T13	7	23
	Time limit	HEM-T1, HEM-T3, HEM-T5, HEM-T8, HEM-T10, HEM-T11	6	20
	Difficulty in planning lessons	HEM-T3, HEM-T6, HEM-T10, HEM-T12	4	13
	Uncertainties in the measurement and evaluation process	HEM-T1, HEM-T2, HEM-T4	3	10
	Lack of technological infrastructure	HEM-T1, HEM-T3	2	7

Table 6 (Continued). Findings related to the HEM-supported mathematics teaching process.

Category	Code	Teacher	f	%
	Delivery of teacher training	HEM-T1, HEM-T2, HEM-T5, HEM-T9, HEM-T10, HEM-T11, HEM-T12, HEM-T14	8	20
	Adaptation to the curriculum	HEM-T3, HEM-T5, HEM-T6, HEM-T7, HEM-T13, HEM-T14, HEM-T15	7	18
	Provision of resources and materials	HEM-T1, HEM-T2, HEM-T3, HEM-T10, HEM-T11, HEM-T12	6	15
	Sharing successful examples	HEM-T2, HEM-T3, HEM-T7, HEM-T11, HEM-T12	5	13
Recommendations	Increasing collaborations (universities, NGOs, private organizations)	HEM-T1, HEM-T2, HEM-T10, HEM-T11	4	10
	Implementing a flexible program	HEM-T2, HEM-T4, HEM-T9	3	8
	Strengthening technological infrastructure	HEM-T2, HEM-T12, HEM-T14	3	8
	Increasing support from school administrations	HEM-T1, HEM-T3, HEM-T8	3	8

Table 6 shows that HEM-supported mathematics instruction offers students many opportunities. The vast majority of teachers stated that the model improved students' problem-solving skills (f=11). This may be because HEM-supported mathematics instruction provides students with learning environments based on real-world, interdisciplinary problems. Furthermore, teachers indicated that HEM-supported mathematics teaching provides an interdisciplinary learning environment (f=10) and helps relate what is learned to daily life (f=10). In addition, the model was observed to ensure active student participation (f=7). Collaborative learning environments and group work within the model may have contributed to students' more effective participation in the process. According to teachers' views, HEM makes significant contributions to developing students' participation and problem-solving skills. HEM-T11 commented on this situation: *"... I have just started applying the model and noticed that its biggest advantage is increasing students' active participation.*" Similarly, HEM-T10 emphasized that the model supports students' cognitive and social skills, stating: "*The model offers great opportunities to equip students with analytical thinking, collaboration, and MPS skills in primary mathematics education.*" Furthermore, HEM-T12 stated, "*... thanks to the model, students can apply problem-solving steps and develop problem-solving habits,*" indicating that the model contributes to students' systematic problem-solving processes. HEM-T11 stated, "*Students who produce solutions by working with different disciplines become more creative not only in mathematics but also in solving problems in daily life.*"

In the difficulties category, a significant proportion of teachers reported a lack of resources and materials (f=8) during the HEM-supported mathematics teaching process. This situation can be attributed to inadequate technological infrastructure and the limited availability of materials for lessons. Another difficulty expressed by teachers was limited teacher competence regarding the model (f=7). A large proportion of teachers reported difficulties in implementation because they could not fully grasp the model's philosophy and application processes. Additionally, teachers stated that they experienced difficulties with time management (f=7). The participants' views exemplify how the difficulties encountered in implementing the model are reflected in the process. HEM-T10 drew particular attention to time management, stating, *"... but implementing the model also involves some difficulties. One of the biggest difficulties is time management. Compared to traditional teaching, process-oriented learning requires more time.*" HEM-T12 emphasized the lack of materials, stating, *"... a lack of appropriate teaching methods and tools may be among the difficulties encountered.*" Additionally, HEM-T13 emphasized that teachers experienced difficulties in implementing the model due to its novelty, stating, "*Teachers are experiencing difficulties in implementation because it is a new approach.*"

In the recommendations category, teachers offered various suggestions for more effectively implementing the model in the mathematics teaching process. The vast majority of teachers emphasized the need for teacher training (f=8) to ensure the sustainable implementation of HEM. Such training can facilitate implementation by increasing teachers' proficiency with the model. It was also noted that it is important to make the model more compatible with the current curriculum (f=7). This can prevent difficulties teachers may encounter in lesson planning. In addition, teachers stated that resource and material support should be increased (f=6) for a more efficient application in the HEM-supported mathematics teaching process. Another suggestion to support the dissemination of the model is to share successful application examples (f=5). Teachers stated that they could carry out the process more effectively by benefiting from the experiences of colleagues who have previously implemented the model successfully. These suggestions show that teachers have concrete expectations regarding increasing the applicability of HEM. An examination of the participants' suggestions reveals various views on the dissemination and development of the model. HEM-T13 emphasized that the model should be integrated into all schools, stating, "*It should be implemented not only in pilot schools but in all schools.*" HEM-T14 drew attention to the importance of curriculum-aligned integration, "*Work can be done on integrating the curriculum.*" Furthermore, HEM-T11 stated, *"...a system could be created where experienced teachers could mentor new teachers. This would help the model to be implemented correctly and effectively in the classroom,*" indicating that establishing a mentoring system among teachers would facilitate implementation.

Results Related to the MPS Process

Findings related to the MPS process are presented in Table 7 under two categories: "cognitive skills" and "social and affective skills."

Table 7. Findings related to the MPS process.

Category	Code	Teacher	f	%
Cognitive skills	Develops different strategies for solutions	HEM-T1, HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T6, HEM-T7, HEM-T8, HEM-T9, HEM-T11, HEM-T12, HEM-T13, HEM-T14	13	35
	Supports analytical thinking	HEM-T1, HEM-T2, HEM-T5, HEM-T6, HEM-T12, HEM-T14	6	16
	Encourages creative thinking	HEM-T1, HEM-T3, HEM-T4, HEM-T6, HEM-T10, HEM-T12	6	16
	Establishes cause-and-effect relationships	HEM-T1, HEM-T2, HEM-T6, HEM-T8, HEM-T11	5	14
	Develops algorithmic thinking	HEM-T1, HEM-T4, HEM-T10, HEM-T11, HEM-T14	5	14
	Provides a critical perspective	HEM-T9, HEM-T10	2	5
Social and emotional skills	Supports collaborative problem-solving	HEM-T1, HEM-T3, HEM-T4, HEM-T10, HEM-T11, HEM-T13, HEM-T15	9	26
	Increases interaction with the class and teacher	HEM-T1, HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T12, HEM-T13	9	26
	Increases interest and motivation in math class	HEM-T1, HEM-T2, HEM-T3, HEM-T4, HEM-T5, HEM-T10, HEM-T11, HEM-T13	8	24
	Facilitates communication and collaboration among students	HEM-T2, HEM-T4, HEM-T5, HEM-T10, HEM-T15	5	15
	Develops a positive attitude toward mathematics	HEM-T1, HEM-T3, HEM-T7	3	9

When Table 7 is examined, under the cognitive skills category, the majority of teachers stated that HEM-supported mathematics instruction contributed to students develop different strategies for solving problems during the problem-solving process (f=13). Furthermore, in this category, teachers indicated that the model supported students' analytical and creative thinking (f=6). The interdisciplinary and project-based structure of the model may contribute to diversifying students' thinking processes and developing a systematic approach. HEM-T10 stated, "The model supports the development of not only mathematical competencies but also essential skills such as critical thinking,

creativity, communication, and cooperation." This shows that the model supports students' multidimensional development and contributes not only to academic but also to social skill acquisition. HEM-T11 emphasized that the model increases innovative thinking and productivity skills in students, stating, "*The model encourages students to think creatively by offering them different perspectives. Especially in activities such as coding and robotics, students work to develop more innovative and original solutions.*" HEM-T13 explains the model's purpose and scope, stating: "*The HEM encourages students to solve problems collaboratively, helping them develop algorithmic thinking as well as cognitive and social skills, while also strengthening their critical thinking.*"

In the social and emotional skills category, teachers indicated that HEM-supported mathematics instruction increased classroom interaction (f=9), contributed to collaborative problem-solving (f=9), and increased students' interest and motivation in the lesson (f=8). This finding indicates that HEM-supported teaching not only promotes cognitive development but also provides a structure that supports social learning. Participant views support these findings. For example, HEM-T10 stated, "*Instead of solving problems individually, students develop different perspectives by discussing them in groups,*" indicating that students develop different ways of thinking through group discussions. Similarly, HEM-T13 emphasized that the model offers a teamwork-based learning environment, stating, "*Ideas are generated as a team to solve problems.*" Furthermore, HEM-T15: "*Students learn to relate topics to different disciplines and achieve common goals by working together*," highlighting that interdisciplinary interaction develops students' ability to achieve common goals.

DISCUSSION, CONCLUSION, and RECOMMENDATIONS

This study investigated the impact of HEM-based instructional activities incorporated into primary school mathematics lessons on students' MPS and CT dispositions. Accordingly, the experimental group received instruction through HEM-based activities, whereas the control group followed the standard curriculum. To assess the effectiveness of the instruction, pretest and posttest measurements were administered to both groups, and the pretest results indicated that the groups were comparable across all variables at the outset.

In this study, the test averages indicated that HEM-based teaching activities had a significant impact on the MPS and CT skills of primary school students. The fact that the experimental group's scores for both MPS and CT were significantly higher than those of the control group indicates that the activities implemented were effective in developing students' thinking processes. This can be explained by the HEM approach, which enables students to develop different perspectives and actively participate in the processes of interpreting and restructuring knowledge. In particular, the large effect sizes observed in experimental studies indicate that HEM activities led to substantial improvements in students' cognitive skills. Similar results have been obtained in other studies in the literature examining the effect of HEM-supported mathematics instruction on MPS and CT skills. This finding is consistent with the results of the study conducted by Tokmak et al. (2023). In that study, a significant improvement in perceptions of problem-solving skills was also observed among students who participated in the HEM process. Similarly, the themes of "personal development," "social learning," and "educational gains" that emerged in the study by Derdiyok et al. (2025) indicate that HEM applications support students' problem-solving, mental development, and idea-generation skills. Furthermore, studies conducted by Orhan (2025) and Kök (2024) also revealed that HEM positively contributes to problem-solving skills by increasing student participation. Seçer (2021) reported that teachers had positive views of the HEM application, supporting the model's applicability in teaching processes. No studies were found in the literature regarding the model's support for CT skills. In this context, when examining STEM studies similar to the model, such interdisciplinary approaches have been shown to develop the CT skills of primary school students (Chen et al., 2023; English, 2023; Küçük et al., 2023; Tang et al., 2025; Weng et al., 2022).

Mathematical Problem Solving

In the study, the subdimensions of the problem-solving scale were examined and the experimental group students scored significantly higher than the control group on the self-assessment, problem-solving knowledge, and metacognition. This finding shows that HEM-based teaching activities not only increase overall problem-solving success but also improve students' performance in different dimensions of problem-solving. This result reveals that HEM enables students to become aware of their own problem-solving processes, review their strategies, and strengthen their solution evaluation skills. Research in the literature also supports these findings. These findings largely coincide with other studies examining the effect of HEM-based applications on problem-solving skills (Ayra et al., 2025; Kök, 2024). Studies have shown that HEM applications significantly improve students' problem-solving skills (Erdem & Eminoğlu-Küçüktepe, 2024). Similarly, in the study by Çimşir et al. (2022), students stated that HEM activities improved their problem-solving and collaborative work skills; they indicated that these activities made a significant contribution to stages such as "identifying problems from real life, collecting data, forming hypotheses, and testing them." The study by Çimşir (2024) also found that the experimental group showed significant development in problem-solving skills, confidence in problem-solving skills, and avoidance subdimensions. However, the lack of a significant difference in the self-regulation subdimension in the same study suggests that the model had a more limited effect on some cognitive components. Furthermore, the study by Tokmak et al. (2023) found that HEM directly increased students' metacognitive awareness levels, which directly supports the metacognitive development findings obtained in this study. These similarities and partial differences between the studies can be explained by differences in scope, sample level, and application duration. For example, in Çimşir's (2024) study, the HEM application was conducted over a short period of eight weeks, which may have prevented the observation of meaningful changes in skills requiring longer-term experience, such as self-regulation and perception of success. In contrast, the application process in this study, structured around students' active participation, may have led to meaningful developments across different sub-dimensions of problem-solving. Furthermore, the interdisciplinary and interaction-based structure of HEM may have supported metacognitive awareness by allowing students to review and organize their own thinking patterns during the problem-solving process.

Critical Thinking

When examining the sub-dimensions of the CTTS in the study, it was observed that the experimental group students scored significantly higher than the control group in the dimensions of skepticism, curiosity, open-mindedness, and objectivity. This finding shows that HEM-based teaching activities develop students' CT tendencies not only in general terms but also in different dimensions. No study directly examining the effect of HEM on CT skills in mathematics education was found in the literature. However, results from studies using holistic, interdisciplinary, and problem-based approaches, such as STEM and STEAM, are consistent with these findings (English, 2023; Küçük et al., 2023; Weng et al., 2022). Research findings indicating that problem-based and project-based learning processes increase students' curiosity, questioning, and open-mindedness (English, 2023) are consistent with those of this study. This similarity can be explained by HEM's approach, which centers the student in the learning process and structures CT as a natural learning process. Studies using similar approaches in the literature also show that the development of CT tendencies is associated with experiences such as active student participation, group-based problem-solving activities, and the production of original projects (Charlton & Avramides, 2016; Hu et al., 2020). In this study, interdisciplinary interaction, digital tool use, and student collaboration, which are among the basic principles of HEM, may have supported the development of the skepticism, curiosity, and objectivity dimensions of CT (Chen et al., 2023; Tang et al., 2025). Furthermore, the process-oriented structure of HEM enables students not only to access information but also to develop their ability to analyze information and evaluate different perspectives.

Teacher Opinions

According to teacher opinions, this study found that HEM-supported teaching in the opportunities category improved students' problem-solving skills, provided interdisciplinary learning environments, and facilitated the connection of learned knowledge to daily life. These findings are consistent with the studies conducted by Koçoğlu (2018) and Ceylan et al. (2020). Both studies indicate that HEM enables students to learn by doing and experiencing, participate in interdisciplinary work, and use the information they learn in daily life. Similarly, other studies have also reported that HEM applications strengthen students' problem-solving skills and positively affect their approach to problems in daily life (Ayra et al., 2025; Babayiğit-Durakcan, 2024; Erdem & Eminoğlu-Küçüktepe, 2024; Keskin et al., 2024; Kök, 2024). These results are consistent with the theoretical framework of HEM. The three fundamental pillars of HEM—interdisciplinary approach, collaborative learning, and problem-solving-based learning strategies—aim to develop students' self-awareness, communication, and problem-solving skills (Çeliköz & Hastürk, 2024). Furthermore, integrating educational technologies reinforces these gains and enhances students' ability to identify and solve problems in their daily lives, thereby supporting the model's effectiveness in both theoretical and practical terms (Ceylan et al., 2020).

In the difficulties category, material and resource shortages in HEM-based teaching applications, limited teacher competencies, and time management difficulties were observed. Similar findings have been obtained in studies on the difficulties encountered in HEM applications (Ayra et al., 2025; Erdem & Eminoğlu-Küçüktepe, 2024; Keskin et al., 2024; Orhan, 2025; Seçer, 2021). In these studies, teachers reported difficulties such as a lack of materials and resources, limited technological infrastructure, limited lesson-planning time, and the need for additional time for HEM implementation. Furthermore, studies on the same subject have indicated that deficiencies in physical infrastructure and equipment negatively affect teaching processes (Seçer, 2021). It can be stated that both infrastructure problems related to the general education system and implementation difficulties arising from HEM being a relatively new model in Türkiye have contributed to these challenges. The lack of educational technologies and appropriate equipment may limit the full realization of the model's targeted learning outcomes. Therefore, teacher training, resource provision, and strengthening school infrastructure are critical for the sustainable and effective implementation of HEM (Keskin et al., 2024).

In the recommendations category, based on teacher opinions, it was determined that for HEM to be implemented sustainably and effectively, teacher training should be increased, alignment with the curriculum should be ensured, sufficient resource support should be provided, successful application examples should be shared, and mentoring systems should be developed. Similar results have been reported in studies on this subject (Erdem & Eminoğlu-Küçüktepe, 2024; Keskin et al., 2024; Koçoğlu, 2018; Seçer, 2021). In these studies, teachers emphasized the importance of increasing training, providing resources and technological infrastructure, supporting teachers in implementation, and integrating the model into the formal education curriculum for effective HEM implementation. In the study conducted by Ayra et al. (2025), teachers also stated that it is necessary to increase the number of lessons implemented, establish specialized HEM classes, provide teachers with guidance materials, and provide technological support. The planning, implementation, and technological equipment required by the model can create difficulties if teachers do not receive adequate training and support. Furthermore, infrastructure differences between schools and large class sizes are prominent factors limiting the implementation of the recommended practices. Therefore, recommendations for implementation, such as increasing teacher training, developing mentoring systems, and providing resources and technological infrastructure, can be considered critical factors that support the sustainability of the model and the development of students' problem-solving skills (Ayra et al., 2025; Ceylan et al., 2020).

This study found that HEM-supported mathematics instruction enhances students' ability to develop strategies, as well as their analytical and creative thinking skills in the problem-solving process; it also supports collaborative learning and motivation by increasing classroom interaction. This finding

demonstrates that HEM is a flexible, student-centered teaching approach that holistically develops cognitive and social-emotional dimensions. These results are consistent with studies in the literature on the subject (Ceylan et al., 2020; Çimşir, 2024; Erdem & Eminoğlu-Küçüktepe, 2024; Keskin et al., 2024; Koçoğlu, 2018). In these studies, teachers reported that HEM increased students' active participation in class, supported creativity and productivity, encouraged collaboration and teamwork, and supported meaningful learning through the use of technological tools and equipment (Erdem & Eminoğlu-Küçüktepe, 2024; Zeybek et al., 2024). Similarly, Seçer (2021) and Orhan (2025) observed in their studies that collaborative learning strengthens students' motivation, self-confidence, and collaboration skills in the social-emotional dimension. These findings are consistent with the theoretical framework of collaborative learning. While the model aims to holistically develop students' cognitive and social-emotional skills, it also supports 21st-century skills such as collaborative learning, creativity, problem solving, and motivation (Babayiğit-Durakcan, 2024; Ceylan et al., 2020). Thus, HEM can be considered a flexible, student-centered teaching approach that enhances students' academic achievement and social interactions (Ayra et al., 2025; Keskin et al., 2024).

The quantitative findings showed that the control and experimental groups were equivalent at the pretest; however, after the intervention, the experimental group demonstrated significantly higher MPS and CT scores than the control group. Significant differences were observed in favor of the experimental group in the self-assessment, problem-solving knowledge, and metacognition subdimensions of problem-solving, as well as in the skepticism, curiosity, open-mindedness, and biasness dimensions of CT. The qualitative findings supported these results by revealing that, due to the interdisciplinary structure of the HEM, students engaged in collaborative, inquiry-based, and strategy-oriented work on real-world related problems. Teacher perspectives indicated that these learning environments enabled students to become aware of their thinking processes and to evaluate different perspectives, thereby explaining the cognitive improvements observed in the quantitative findings. Nevertheless, limitations related to material and time constraints, as well as teacher competencies, emerged as factors affecting the model's effectiveness. Overall, when the quantitative and qualitative findings are considered together, the results suggest that HEM is an effective interdisciplinary model for supporting problem-solving and CT skills in mathematics education; however, pedagogical and structural support is required to ensure its sustainability.

Limitations and Implications

Notwithstanding its contributions, this study has certain limitations that should be taken into account when interpreting the results. Firstly, the research was carried out with a relatively small sample drawn from a specific regional context, which may limit the extent to which the findings can be generalized. Second, the quasi-experimental design without random assignment may limit the ability to establish strong causal inferences. Third, the data collection process relied on self-report scales, which may be subject to response bias. In addition, the qualitative findings were based on a limited number of teachers and may therefore not fully reflect diverse perspectives across different educational settings.

Despite these limitations, the findings provide important implications for both practice and research. From a practical perspective, the results suggest that integrating HEM into primary school mathematics instruction can support the development of students' MPS and CT skills. The interdisciplinary and technology-supported structure of HEM offers opportunities to design more engaging and meaningful learning environments. In this context, supporting teachers through professional development programs, improving access to instructional materials, and strengthening technological infrastructure may enhance the effectiveness and sustainability of HEM-based practices.

From a research perspective, future studies could investigate the long-term effects of HEM using larger and more diverse samples and true experimental designs. Additionally, further research may explore the impact of HEM on other variables such as students' motivation, attitudes, and

collaborative learning skills. Examining the implementation of HEM across grade levels and subject areas would also deepen understanding of its interdisciplinary potential.

Funding

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

Ethics and Conflict of Interest

The study was carried out in accordance with the principles of the Declaration of Helsinki and the ethical standards set by the Turkish Council of Higher Education. Ethical approval was granted by the Ethics Committee of Bayburt University on May 07, 2025 (Decision No: 195; Session No: 5), covering both the implementation and data collection phases. Participants' rights and confidentiality were protected throughout the study. Data were collected solely for scientific purposes, analyzed anonymously, and handled in line with institutional regulations. The authors declare that they have adhered to ethical standards at all stages and declare no conflict of interest.

Author Contributions

Tunahan Filiz contributed to conceptualization, methodology, conducting the interviews, data analysis and interpretation, and writing the original draft. Bilgen Duran Erel contributed to writing—original draft, investigation, formal analysis, data curation, resources, and conceptualization.

Data availability

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

Corresponding Author

Correspondence to Tunahan FİLİZ, tunahanfiliz@bayburt.edu.tr

REFERENCES

Arfé, B., Vardanega, T., & Ronconi, L. (2020). The effects of coding on children's planning and inhibition skills. *Computers & Education*, *148*, 103807. https://doi.org/10.1016/j.compedu.2020.103807

Aydın, G., & Balım, A. G. (2005). An interdisciplinary application based on constructivist approach: Teaching of energy topics. *Ankara University Journal of Faculty of Educational Sciences (JFES)*, *38*(2), 145–166. https://doi.org/10.1501/Egifak_0000000113

Aydoğdu, M., & Kesercioğlu, T. (2005). *Fen ve teknoloji öğretimi* [Science and technology education]. Ankara: Anı Publishing.

Ayra, M., Deliaslan, A., Berber, F., Kahvecioğlu, M., & Doğangün, S. (2025). Harezmi Eğitim Modeline yönelik öğretmen görüşleri [Teacher views on the Hârezmî Education Model]. *International Journal of Education and Science Research, 2*(1), 50-69. https://doi.org/10.5281/zenodo.15089201

Babayiğit-Durakcan, Ö. (2024). Harezmi eğitim modelinin fen bilimleri dersindeki etkilerinin çeşitli değişkenler açısından incelenmesi [An investigation of the effects of the Harezmi education model on science education in terms of various variables] (Unpublished master thesis). Marmara University.

Bingölbali, E., & Özmantar, M. F. (2015). *İlköğretimde karşılaşılan matematiksel zorluklar ve çözüm önerileri* [Mathematical difficulties encountered in primary education and suggested solutions] (5th Edition). Ankara: Pegem Academy.

Budak Coşkun, S. (2009). *An investigation of the effect of interdisciplinary approach used at 8th grade math lessons on students' marh achievement levels and critical thinking disposition inventory* (Unpublished master thesis). Yıldız Technical University, İstanbul.

Büyükalan-Filiz, S., & Ergan, S. (2*020)*. Evaluation of the primary school mathematics curriculum according to the five process standards. *Ordu University Institute of Social Sciences Journal of Social Sciences Research*, *10*(2), 464-477.

Ceylan, Ö., Öğten, M., Tüfekçi, V., & Yurttaş, M. Ö. (2020). Öğrencilerin Harezmi Eğitim Modeline yönelik metaforik algılarının belirlenmesi [Determination of students' metaphoric perceptions for Harezmi Education Model]. *Milli Egitim Journal*, *49*(225), 227-251.

Charlton, P., & Avramides, K. (2016). Knowledge construction in computer science and engineering when learning through making. *IEEE Transactions on Learning Technologies*, *9*(4), 379-390.

Chen, S. K., Yang, Y.-T. C., Lin, C., & Lin, S. S. J. (2023). Dispositions of 21st-century skills in STEM programs and their changes over time. *International Journal of Science and Mathematics Education*, *21*(4), 1363-1380. https://doi.org/10.1007/s10763-022-10288-0

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

Creswell, J. W. & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. Los Angeles: SAGE.

Çeliköz, M., & Hastürk, D. G. (2024). Evaluation of Harezmi Education Model applications according to student opinions: An exploratory sequential mixed design research. *International Journal of Educational Research Review*, *9*(3), 214–237.

Çimşir, S. (2024). Hârezmî eğitim modelinin ilkokul 3. sınıf öğrencilerinin problem çözme becerisi ve başarı algısına etkisi [The effect of Hârezmî Education Model on primary school third-grade students' problem solving skills and perception of success]. *Ahi Evran University Journal of Kırşehir Education Faculty*, 25(2), 1017-1052. https://doi.org/10.29299/kefad.1272478

Çimşir, S., & Baysal, Z. N. (2019). "Marmara Üç Aşamalı Bilişsel Karar Verme Becerilerini Geliştirme Modeli" nin akademik başarısı düşük ilkokul dördüncü sınıf öğrencilerinin problem çözme becerisine etkisi [The effect of the "Marmara Three-Stage Development Model of Cognitive Decision-Making" on the problem-solving skills of fourth grade students with low academic achievement]. *Journal of Education, Theory and Practical Research, 5*(3), 337-351.

Çimşir, S., Polat, R. D., Çaça, Ş., & Kocaman, H. (2022). İlkokul 3. sınıf öğrencilerinin ve velilerinin Hârezmî eğitim modeline ilişkin görüşlerinin incelenmesi [Investigation of primary school 3rd grade students and parents' views on the Harezmi Education Model]. *BABUR Research, 1*(1), 131-144.

Değirmenci, T., & Deringöl, Y. (2024). İlkokullar için problem çözme ölçeği'nin geçerlik ve güvenilirlik çalışması [Validity and reliability study of the problem solving scale for primary schools]. *Milli Egitim Journal*, *53*(244), 1849-1872. https://doi.org/10.37669/milliegitim.1262404

Demirel, Ö., Tuncel, İ., Demirhan, C., & Demir, K. (2008*).* Çoklu zekâ kuramı ile disiplinlerarası yaklaşımı temel alan uygulamalara ilişkin öğretmen-öğrenci görüşleri [Teacher and pupil views about activities based on multiple intelligences and the interdisciplinary approach]. *Education and Science* , *33*(147), 14–24.

Derdiyok, İ., Topal, M., & Süleyman, D. (2025). Harezmî Eğitim Modeli'nin ortaokul öğrencilerinin sınıf içi etkinliklere katılım düzeylerine etkisinin incelenmesi [The effect of the Khwarizmi Education Model on middle school students' participation levels in classroom activities]. *International Journal of Education and Science Research, 2*(1), 1-19. https://doi.org/10.5281/zenodo.15088336

English, L. D. (2023). Ways of thinking in STEM-based problem solving. *ZDM – Mathematics Education*, *55*(7), 1219-1230. https://doi.org/10.1007/s11858-023-01474-7

Erdem, Ş., & Küçüktepe, S. E. (2024). Harezmi eğitim modeli uygulanan okullardaki öğretmenlerin modele yönelik görüşleri [The opinions of teachers at schools which applied the Harezmi Education Model on the model]. *Marmara University Atatürk Education Faculty Journal of Educational Sciences, 60*(60), 1-26. https://doi.org/10.15285/maruaebd.1498995

Filiz, T., & Güneş, G. (2023). Teaching multiplication based on Realistic Mathematics Education to students at risk of mathematics learning difficulties. *Journal of Family Counseling and Education,* 8(2), 193-211. https://doi.org/10.32568/jfce.1372345

Fraenkel, J., Wallen, N. & Hyun, H. H. (2012). *How to design and evaluate research in education*. San Francisco: McGraw Hill.

Güder, Y., & Gürbüz, R. (2018*).* Interdisciplinary mathematical modeling activities as a transitional tool for STEM education: Teacher and student opinions. *Adıyaman University Journal of Educational Sciences*, *8*, 170–198.

Gürkan, B. (2019). Examination of secondary school teachers' opinions regarding interdisciplinary teaching. *Pegem Journal of Education and Instruction, 9*(1), 91-124. https://doi.org/10.14527/pegegog.2019.004

Hu, C., Yeh, H., & Chen, N. (2020). Enhancing STEM competence by making electronic musical pencil for non-engineering students. *Computers & Education*, *150*, 103840. https://doi.org/10.1016/j.compedu.2020.103840

Karakuş, M., Türkkan, B. T., & Karakuş, F. (2017). Fen bilgisi ve ilköğretim matematik öğretmenlerinin disiplinlerarası yaklaşıma yönelik görüşlerinin belirlenmesi [Determining science and elementary mathematics teachers' views on interdisciplinary approach]. *Elementary Education Online, 16*(2), 509–524. https://doi.org/10.17051/ilkonline.2017.304714

Keskin, S. C., Karaloğlu, İ., & Erdoğan, H. (2024). Harezmi eğitim modelinin uygulayıcıları olan öğretmenlerin görüşleri doğrultusunda incelenmesi [Investigation of the Harezmi Education Model in line with the views of teachers,

implementers of the model]. *Ondokuz Mayıs University Journal of Education Faculty*, *43*(1), 121-140. https://doi.org/10.7822/omuefd.1285712

Koçoğlu, E. (2018). Türkiye'de pilot uygulama sürecinde olan Harezmi eğitim modelinin alan uzmanlarının görüşleri doğrultusunda analizi [Analysis of domain expert opinion are in line with the Harezmi Education Model pilot process in Turkey]. *Electronic Turkish Studies*, *13*(19), 1187–1200. https://doi.org/10.7827/TurkishStudies.14050

Kök, F. (2024). *Harezmi eğitim modelinin hayat boyu öğrenme anahtar yetkinliklerinden; matematik, fen ve dijital okuryazarlık yetkinliklerine etkisi: Karma bir çalışma* [The effect of Harezmi Education Model on the lifelong learning key competencies; Mathematics, science and digital literacy competencies: A mixed study] (Unpublished master thesis). Marmara University.

Küçük, H., Perkan Zeki, C., İskifoğlu, G., & Caner, H. (2023). The impact of a sustainable progressive STEAM program on primary school students' critical thinking dispositions and mathematics achievements. *Sustainability*, *15*(21), 15356. https://doi.org/10.3390/su152115356

Martinello, M. L., & Cook, G. E. (2000). *Indagación interdisciplinaria en la enseñanza y el aprendizaje.* Gedisa.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook.* London: SAGE.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.

Niglas, K. (2010). The multidimensional model of research methodology: An integrated set of continua. A. Tashakkori and C. Teddlie (Ed.), *Handbook of mixed methods in social and behavioral research* In (pp. 215-236). London: SAGE.

Orhan, S. (2025). Eğitimde disiplinlerarası yaklaşım: Harezmi modeli üzerine bir döküman analizi [Interdisciplinary approach in education: A document analysis on the Harezmi model]. *International Journal of New Horizons in The Social Sciences, 2*(2), 44–51.

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge.

Patton, M. (2002). *Qualitative evaluation and research methods*. Beverly Hills, CA: SAGE.

Polya, G. (2014). *How to solve ıt: A new aspect of mathematical method*. Princeton University Press. https://doi.org/10.1515/9781400828678

Saldana, J. (2021). *The coding manual for qualitative researchers*. London: SAGE Publications.

Schoenfeld, A. H. (1985). Making sense of "out loud" problem-solving protocols. *The Journal of Mathematical Behavior*, *4*(2), 171–191. https://psycnet.apa.org/record/1986-28488-001

Seçer, T. (2021). Harezmi eğitim modelini uygulayan öğretmenlerin model hakkındaki görüşlerinin belirlenmesi [The determination of the opinions of teachers applying Harezmi Education Model] (Unpublished master thesis). Marmara University.

Smith, K. N., Lamb, K. N., & Henson, R. K. (2020). Making meaning out of MANOVA: The need for multivariate post hoc testing in gifted education research. *Gifted Child Quarterly*, *64*(1), 41-55. https://doi.org/10.1177/0016986219890352

Tang, M., Wijaya, T. T., Li, X., Cao, Y., & Yu, Q. (2025). Exploring the determinants of mathematics teachers' willingness to implement STEAM education using structural equation modeling. *Scientific Reports*, *15*(1), 6304. https://doi.org/10.1038/s41598-025-90772-z

Tokmak, A. (2023). Harezmi eğitim modelinin problem çözme becerisinin geliştirilmesine etkisi [The effect of Harezmi Education Model on the development of problem solving skills]. *Milli Egitim Journal, 52*(1), 437-456. https://doi.org/10.37669/milliegitim.1309222

Tokmak, A., Yılmaz, A., & Şeker, M. (2023). Using an alternative model in social studies course: Harezmi Education Model. *Sakarya University Journal of Education*, *13*(2), 286–325. https://doi.org/10.19126/suje.1268001

Uğraş, M. (2017). Okul öncesi öğretmenlerinin STEM uygulamalarına yönelik görüşleri [Preschool teachers' views on STEM practices]. *Journal of New Approaches in Education*, *1*(1), 39–54.

Ulu, M., Tertemiz, N., & Peker, M. (2016). Okuduğunu anlama ve problem çözme stratejileri eğitiminin ilköğretim 5. sınıf öğrencilerinin rutin olmayan problem çözme başarısına etkisi [The effect of comprehension and problem solving strategy training on 5th graders' non-routine problem solving success]. *Afyon Kocatepe University Journal of Social Sciences, 18*(2), 303-340. https://doi.org/10.5578/JSS.37331

Uluçinar, U., & Akar, C. (2021). The critical thinking dispositions scale for elementary school students: A study of scale development 1. *Third Sector Social Economic Review*, *56*(3), 2031-2047. https://doi.org/10.15659/3.sektor-sosyal-ekonomi.21.09.1673

Weng, X., Cui, Z., Ng, O.-L., Jong, M. S. Y., & Chiu, T. K. F. (2022). Characterizing students' 4C Skills development during problem-based digital making. *Journal of Science Education and Technology*, *31*(3), 372-385. https://doi.org/10.1007/s10956-022-09961-4

Yıldırım, A., & Şimşek, H. (2016). Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences]. Ankara: Seçkin Publishing.

Yin, R. K. (2016). *Qualitative research from start to finish*. NY: Guilford Publications.

Zeybek, A., Orhan, S. İ., & Aydın, A. (2024). The effect of the Harezmi education model on secondary school students' science academic achievement. *Education Quarterly Reviews,* *7*(2), 105-120. https://doi.org/10.31014/aior.1993.07.02.580

About the authors

Tunahan Filiz
He is Assistant Professor in the Department of Educational Sciences, Division of Educational Administration, Faculty of Education, at Bayburt University. He teaches both undergraduate and graduate courses at his institution. His research interests include primary school mathematics education, instructional methods for students with learning difficulties, mathematics teaching supported by intelligence games, Realistic Mathematics Education, technology-enhanced applications, and problem-solving instruction. He also develops STEAM-based activities in out-of-school learning environments and designs instructional materials to enhance students' mathematical thinking, problem-solving, and critical thinking skills.

Bilgen Duran Erel
She is currently pursuing her graduate studies in the Physical Education and Sports Master's Program (with thesis) at Bayburt University. She works as a primary school teacher at Şehit Nevzat Kaya Primary School, has 24 years of professional experience, and holds the title of headteacher. She is conducting her master's thesis entitled "The Effect of Educational Games Implemented in Physical Education and Play Lessons on Primary School Students' Mathematical Problem-Solving Skills." Her research interests include physical education and play, mathematics education, problem solving, collaborative approaches, and the development of mathematical reasoning and problem-solving skills.