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The effect of rapid automatized naming ability in elementary school on reading comprehension: the mediating role of sustained attention

Halil İbrahim Öksüz ¹, İsmail Yaşartürk ², Serpil Elalmış ³, Fatih Çetin Çetinkaya ⁴, Hasan Kağan Keskin ⁵

Abstract

The purpose of this study is to test the effect of sustained attention's mediating role on the impact of rapid automatized naming ability on reading comprehension. The participants in the study consisted of 56 third-grade elementary school students. Of the participants, 53.57% were female (n=30) and 46.43% were male (n=26). The age range of the students, who are from the same school and similar socioeconomic backgrounds, varies between 8.24 and 8.77 ($\bar{x}$ =8.41, SD= 0.19). The native language of all students participating in the study is Turkish. A structural equation model was used to analyze the data obtained in the study. SPSS 24 was used for the necessary analyses in the study, namely correlation and Sobel z-test, while SmartPLS 4 was used for the mediation test and the equality model. The results of the study show that there is a significant relationship between the sub-dimensions of rapid automatized naming (object, color, letter), reading comprehension, and sustained attention, while there is no significant relationship between reading comprehension and number naming. Another result of the study is that rapid automatized naming has a direct (β =-.19, t =3.22, p <.05) and indirect (β =-.18) effect on reading comprehension. The direct relationship between rapid automatized naming and reading comprehension was found to be significant when the mediating variable was not included in the model. However, when the mediating variable of sustained attention was added to the model, this direct effect became insignificant. Therefore, it was concluded that sustained attention completely mediated this effect.

Keywords

Rapid automatized naming
Reading comprehension
Sustained attention
Curriculum-based assessment

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Introduction

Reading comprehension (RC) is a skill that can be influenced by many cognitive, social, and emotional factors. Therefore, understanding the variables that affect RC or are related to RC is quite important. In the international literature, rapid automatized naming (RAN) and sustained attention (SA) are among the variables examined in this relationship, which has been studied for a long time.

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Studies in this field show that RAN and its subtasks are critically important for reading comprehension. Both RAN tasks and reading comprehension require sustained attention to perform well. In other words, it is thought that the role of SA needs to be understood. Therefore, this study focuses on discovering the effect of RAN on RC and how SA mediates this effect.

Reading is a mental activity in which the perspectives, events, and meanings in a written text are examined. In this process, the reader aims to achieve understanding by evaluating the author's intended purposes and relationships (Veeravagu et al., 2010). Ultimately, the main purpose of reading is understanding (Akyol, 2019). There are many mental components that are thought to be effective on RC. It is stated that RAN is related to RC (Van den Bos et al., 2002; Weng et al., 2016) and even that RAN is a strong predictor of RC (Altani et al., 2017; Bakır, 2007; Georgiou et al., 2009; Karadağ et al., 2019; Kirby et al., 2003). RAN may be a determinant of the amount and duration of information acquired during reading in working memory (Demirtaş, 2017; Norton & Wolf, 2012). Since working memory plays a critical role in information processing, students with weak RAN skills may experience difficulties in comprehension even if they pronounce the words correctly (Li et al., 2011).

Both reading and RAN tasks require continuous focus and coordination, making SA crucial for both skills (Saydam, 2020). SA provides the cognitive resources that enable focusing on the text in reading and on stimuli in RAN tasks (Karadağ et al., 2019). A review of the literature reveals studies examining the relationship between RAN and RC (Arnell et al., 2009; Karadağ et al., 2019; Tighe & Schatschneider, 2016). However, it can be said that the main focus is on the direct relationship between reading ability and RAN or on the predictive power of RAN on reading (Furnes & Samuelsson, 2011; Landerl et al., 2019; Li et al., 2009; Ozernov-Palchic et al., 2017; Taub & Szente, 2012; Wolf & Denckla, 2005). RAN skills enhance our perception of RC through their contribution to reading fluency (Norton & Wolf, 2012). The relationship between RAN and RC may be related to the shared cognitive resources used (Georgiou et al., 2008). Therefore, understanding the relationships between RAN, RC, and SA and the roles in these relationships will strengthen our perception of reading comprehension education.

RAN is defined as the ability to quickly recall visual symbols from long-term memory (Albayrak, 2023; de Jong, 2011; Warmington & Hulme, 2012; Wolf & Denckla, 2005). The RAN test consists of a series of tasks involving objects, colors, letters, and numbers that are assumed to be well recognized by the child. The child is presented with objects, colors, letters, and numbers in a mixed order, and the time taken to name them is calculated and evaluated (Araújo et al., 2015; Norton & Wolf, 2012). According to Karadağ et al. (2019), reading and RAN are based on the principle of naming images in sequence. The researchers explain this as a newly literate individual sounding out letters, while an individual who has not yet learned to read sounds out images (Karadağ et al., 2019). Consequently, it is known that it is possible to predict RC through RAN, which activates mental processes similar to reading (Karadağ et al., 2019; Tighe & Schatschneider, 2016).

Due to the continuous nature of its tasks, RAN requires the effective use of attention resources because of its impact on both speed and the automaticity of recall. Therefore, it has been suggested that attention may play a critical role in directing higher-level mental processes such as comprehension skills (Samuels, 2006). According to the literature, the effect of RAN on RC has been frequently investigated (Smallwood et al., 2008; Varizo et al., 2022). However, considering that RAN and RC tasks are actions requiring SA, it can be said that the attention variable has been overlooked in the studies conducted.

Attention is a cognitive resource that directs mental resources to various stimuli (Bizama & Chávez, 2023). While analyzing words during reading, individuals must constantly direct their attention to the written material in order to form mental representations of the meanings in the text (Alloway et al., 2014). Attention also enables the selection of correct information for reading comprehension. Therefore, it is vital for reading comprehension skills (Yıldız & Çetinkaya, 2017). When attention resources are mostly used for correct word pronunciation, problems arise in the formation of meaning (Torgesen et al., 2001). Therefore, it can be said that the continuity of attention plays a particularly important role in RC. Smallwood et al. (2008) also support this view, emphasizing that for

comprehension to occur, the individual must perceive stimuli and maintain focus on these stimuli throughout the process. Arrington et al. (2014) state that SA predicts RC. Other studies also show that SA plays an important role in the RC process (Alvarado, 2023; Öksüz & Akyol, 2023; Razza et al., 2012; Shelleby & Ogg, 2020; Stern & Shalev, 2013).

It is also necessary to understand the relationship between RAN and SA, which activate the same parts of the brain as RC. It has been suggested that RAN skills require many abilities, such as attention, memory, and motor skills (Georgiou et al., 2016; Wolf et al., 2000). In addition, the speed and accuracy of RAN tasks can be influenced by many variables (Wolf & Bowers, 1999). It is also stated that attention to the stimulus is essential in the RAN process (Karadağ et al., 2019). Individuals with developed RAN skills use fewer cognitive resources in word recognition and pronunciation. This enables the transfer of attention resources to different cognitive processes and, consequently, strengthens RC (Norton & Wolf, 2012). In this case, it can be said that SA is both a requirement and a result of the RAN process. It can be interpreted that SA has a kind of guiding function for both RC and RAN. Therefore, it is possible to say that SA acts as an mediating structure for the continuity of the process for both skills.

Current Study

When studies are examined, it is seen that the interaction between RAN and RC is frequently investigated (Karadağ et al., 2019). Connor (2016) emphasizes that reading comprehension occurs through a series of interactions between the knowledge structures possessed by the individual and certain cognitive structures. RAN refers to the rapid recall and vocalization of visual symbols (de Jong, 2011; Warmington & Hulme, 2012; Wolf & Denckla, 2005). This situation works similarly in reading (Abolafya, 2008). For meaning to be formed, visual symbols related to letters must be retrieved from memory and read. Some researchers indicate that the same regions of the brain become active in both tasks (Lervag & Hulme, 2009; Litt, 2010). Numerous studies in the field also confirm the relationship between RAN and RC (Araújo et al., 2015; Karadağ et al., 2019; Li et al., 2011). SA is quite important in tasks involving both skills (Smallwood et al., 2008).

Attention determines the selectivity of the inputs we perceive through our senses (Schunk, 2012). Attention is a skill that can be consciously directed and sustained (Bizama & Chavez, 2023). Sustainability of attention plays a decisive role in both RAN tasks (Georgiou et al., 2016) and RC tasks (Stern & Shalev, 2013). Research also shows that RAN (Araújo et al., 2015; Karadağ et al., 2019) and SA (Macdonald et al., 2021; Stern & Shalev, 2013) are important cognitive skills for RC.

Based on all this information, it is also very important to explain the model on which the study is structured. As in the current study, there are many models used to examine and explain cognitive functions in educational processes (see Baddeley, 2000; Mayer, 2005). The identified model focuses on the interaction between RAN and RC, while also explaining the role of SA. According to the model, SA mediates the relationship between RAN and RC, which is important for both. In other words, the model attempts to explain the function of SA, which is one of the determining factors of success in RAN and RC tasks. Considering its relationship with both RAN and RC skills, it is thought that important information regarding the mediating role of SA will be obtained and, therefore, this study will make a significant contribution to the field in terms of explaining the predictive relationship between RAN and RC skills. Accordingly, the aim of this study is to test the effect of SA's mediating role on the impact of RAN skills on RC skills. To this end, the hypotheses presented in Figure 1 are proposed:

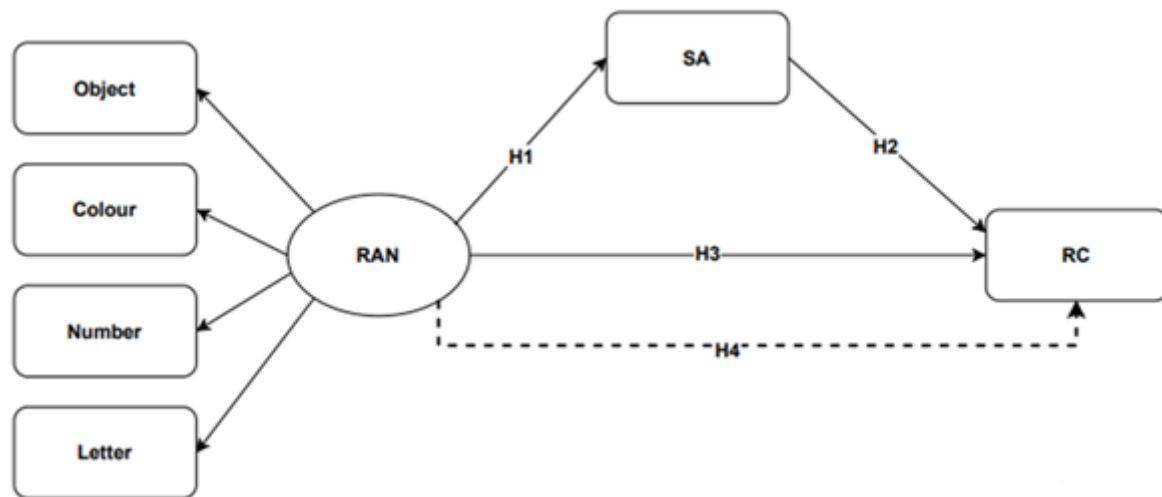


Figure 1. Theoretical Modeling of the Research

H1: Rapid automatized naming ability significantly predicts sustained attention ability.

H2: Sustained attention skills significantly predict reading comprehension skills.

H3: The ability to quickly name things automatically significantly predicts reading comprehension skills.

H4: The ability to quickly name things directly influences reading comprehension through sustained attention skills.

Method

In the study, the predictive correlational survey model, one of the quantitative research methods, was used. Correlational models are used to determine the relationships, levels of change, and effects between two or more variables (Cohen et al., 2000; Karasar, 2007). Correlational studies are divided into two types: predictive and exploratory models. Predictive studies reveal the level of prediction of one variable by another, in addition to the relationships between variables (Büyükoztürk et al., 2017).

Participants

The participants in the study consisted of 56 third-grade elementary school students. Third grade is a period when the basic reading and writing skills are largely acquired and fluent reading and writing skills are reinforced (Akyol, 2019). For this reason, the study was conducted with third-grade students. Of the participants, 53.57% were female ($n=30$) and 46.43% were male ($n=26$). The age range of the students, who were from the same school and similar socioeconomic backgrounds, varied between 8.24 and 8.77 ($\bar{x}=8.41$, $SD=0.19$). The native language of all students included in the study was Turkish.

During the data collection process conducted in the classes included in the research, integrated students and foreign students were also included in the process; however, the data of these students was not included in the analysis on the grounds that it did not fit the scope of the research. Under the exclusion criteria, students with visual impairment, color blindness, hearing loss, or any physical disability that could directly affect their reading and writing skills, as reported by teachers, were not included in the study. Furthermore, based on teacher opinions, students suspected of having dyslexia, who did not demonstrate age-appropriate reading performance, or who showed signs of attention deficit/hyperactivity disorder (ADHD) were also excluded from the study. The inclusion criteria were students who showed normal development, demonstrated age-appropriate reading and writing performance, and whose visual and auditory perception levels were deemed adequate by their classroom teachers. In short, the participants in the study consisted of Turkish students with no mental

or physical disabilities and who showed normal development. The necessary information about the students' physical and mental conditions was obtained from the opinions of their families and teachers. The sample size was determined using a power analysis performed with the G*Power 3.1 software. The analysis was based on a medium effect size ($f = 0.25$), a 95% confidence level, and 80% power ($1-\beta$), and it was found that at least 52 participants were needed. Therefore, the 56 participants in the study meet the minimum sample size requirement.

The data for this study were obtained from a school located in the Torbalı district of İzmir province. Torbalı district is a densely populated area, and the students belong to the middle/upper socioeconomic level. Socioeconomic level was determined based on the occupations and educational levels of the families and demographic information obtained from the school administration. The vast majority of the students' parents have professions that provide a regular income and have a high school education or higher. Therefore, the participants were considered to be of middle/upper socioeconomic status. The neighborhood where the school is located has a high population density. The school where the research was conducted has 19 classrooms, 27 teachers, and 678 students. Classes consist of an average of 35 students.

Data Collection Tools

Reading Comprehension (RC)

The study used curriculum-based assessment to measure RC skills. The text selected for curriculum-based assessment was chosen from the book written by Aydın and Demirel (2010) and approved by the Council of Education, which was used as the third-grade Turkish textbook in the 2010-2011 academic year. The text used to measure RC, titled "What Are Mountains Good For?", was selected from the third-grade Turkish textbook. The text consists of 842 syllables, 339 words, and 34 sentences. Using Ateşman's (1997) readability formula, the text's readability was determined to be at an easy level with a score of 73.02. The average sentence length of the text is 9.97 words, and the average word length is 2.48 syllables. This text was chosen because it is appropriate for the cognitive and language development level of third-grade students, can be related to daily life, and offers readable content. Additionally, the selection of the text from the textbook is related to its suitability for the student level, as Turkish textbooks have been approved by the Council of Education. In line with curriculum-based assessment, the taxonomy included in the question scale of the Error Analysis Inventory adapted into Turkish by Akyol (2019) was used. This inventory is one of the reliable tools used in the literature to determine students' reading comprehension levels. According to the inventory, three simple comprehension questions and three deep comprehension questions were prepared from the text to measure students' comprehension levels. For simple comprehension questions, 0 points were given for unanswered or incorrectly answered questions; 1 point for partially answered questions; and 2 points for fully answered questions. For in-depth comprehension questions, 0 points were given for questions that were not answered or answered incorrectly; 1 point for partially answered questions; 2 points for expected but incomplete answers; and 3 points for complete and effective answers (Akyol, 2019). The simple comprehension questions included in the study are as follows:

1. What percentage of the landmass consists of mountains?
2. How many types of mountains are there, and what are they called?
3. What are the benefits of mountains?

In-depth comprehension questions can also be defined as questions that require the reader to make various inferences based on the text. The in-depth comprehension questions included in the study are as follows:

1. Would you like to live at the foot of a high mountain? Why?
2. Who is the phrase "a mountain of a man" used for? Explain.
3. How would our world be affected if there were no mountains?

The reliability level of a study depends on the degree to which the study is free from errors in the data collection and analysis process (Ellez, 2014). A graded scoring key was prepared to score the responses to the questions in the study. Although there were a total of five researchers in the study, the evaluations were conducted by two independent researchers to ensure consistency in scoring. The use of two evaluators is a common practice in inter-rater reliability studies and is considered sufficient for reliability calculations (Miles & Huberman, 1994). For this reason, two researchers evaluated the participants' responses. Cohen's Kappa formula was used to determine the agreement between researchers (Miles & Huberman, 1994), and the result was determined to be .91. A score above .70 is acceptable for scoring reliability (Yıldırım & Şimşek, 2013). Furthermore, we used ICC (intraclass correlation coefficient) to calculate the inter-rater reliability coefficient. According to Koo and Li (2016), ICC is frequently used for inter-rater reliability. Therefore, in the present study, inter-rater reliability in the RC test was found to be excellent with ICC=.963 (95%).

Sustained Attention (SA)

The Bourdon Attention Test was used to measure students' SA skills. There are two types of the Bourdon Attention Test: letters and syllables. The letter form was used in the study. This test was adapted into Turkish by Karaduman (2004). This test, which is frequently used to measure SA, contains 660 letters in a mixed order. Students are expected to mark the letters "b, d, g, and p" from this mixed list. The test requires sustained attention (Bozan & Akay, 2012). There is no age limit for administering the test. However, participants must have acquired letter recognition skills. During the evaluation phase of the test, stimuli marked as correct or incorrect can be used (Karaduman, 2004). In the study, correct markings were taken into account, and one point was awarded for each correct marking.

Karaduman (2004) conducted the validity and reliability study of this test with elementary school students. The test-retest method was used for reliability, and the correlation coefficient was determined to be .78. In addition, the validity of the test was examined using the d2 attention test, and the inter-test correlation coefficient was determined to be .63.

Rapid Automatized Naming (RAN)

RAN tests involve tasks based on the rapid and accurate naming of images (Norton & Wolf, 2012; Öksüz & Akyol, 2024; Warmington & Hulme, 2012). Since speed is taken into account along with correct naming in RAN tests, time is measured and recorded as a score (Öksüz & Akyol, 2024).

The Rapid Naming Test (RNT) used in the study was developed by Ergül and Demir (2022) to assess the rapid naming performance of elementary school students. The test consists of four stages: color, letter, number, and letter sounding. In each stage, 10 items are presented to the student in five rows, and the student is expected to sound them out as quickly and accurately as possible. Factor analyses conducted to assess the validity of the test revealed that a single factor explained 67.53% of the variance. In addition, it was stated that the test was discriminative for each grade level and that the test-retest coefficients were .83 and .95. Finally, the Cronbach Alpha coefficient calculated for the reliability of the test was found to be .70.

Procedure

The ethical approval for the study, which aimed to examine the relationships between RAN, SA, and RC skills and to test the mediating effect of SA on RAN's impact on RC, was obtained from the Scientific Research and Publication Ethics Committee of Duzce University on 04.10.2024 with file number 2024/312 (Document Date and Number: 10/09/2024-485956). A "parental consent form" based on the principle of voluntariness was distributed to all students participating in the research, and completed and signed forms were requested from consenting parents. Since the ages of the students participating in the research were not appropriate for consent, consent was requested from their parents.

After obtaining all necessary permissions, the data collection process was carried out with two researchers and a guidance counselor from the school. The tests for RC and SA were completed in classrooms, while students participated in the RAN test individually. The data collection process for the study was completed in eight working days. The application of the measurement tools in the study was carried out in three stages. First, the reading comprehension test was administered over three class periods, and the next day, the sustained attention test was completed over another three class periods. In the final stage, the rapid automatized naming test was administered over a total of 18 class periods spread across six days.

Data Analysis

A structural equation model was used to analyze the data obtained in the study. In addition, SPSS 24 (IBM Corp., 2016) was used for the correlation and Sobel z test, which were necessary analyses in the study, while SmartPLS 4 (Ringle et al., 2024) was used for the mediation test and structural equation model.

The data analysis of the study began with normality and multicollinearity analyses, which are prerequisites for mediation. Multicollinearity refers to a high level of relationship between predictor/independent variables (Büyüköztürk, 2010). Multicollinearity can be detected by the correlation between independent variables. According to Büyüköztürk (2010), multicollinearity can be considered for independent variables with a correlation of .80 or higher. The analyses revealed that the data followed a normal distribution and that there was no multicollinearity problem among the variables.

Findings

This section of the study includes normality data for the variables, correlation data, and direct and indirect effects.

Table 1. Descriptive Data on Variables

Variables	n	$\bar{x}$	SD	Skewness	Kurtosis
Object	56	46.85	8.85	.869	.861
Colour	56	47.34	9.44	.410	-.293
Number	56	28.48	5.80	.371	-.634
Letter	56	27.53	6.44	1.05	1.45
SA	56	86.18	19.26	-1.10	1.14
RC	56	5.46	2.85	.367	-.330

The normality of the research data was determined based on skewness and kurtosis values. Skewness and kurtosis coefficients within the range of ± 2 indicate that the data are normally distributed (George & Mallery, 2001). Based on this, Table 1 shows that all variables in the study are normally distributed.

Since the data showed a normal distribution, the Pearson Correlation test was applied to determine the relationship between the variables, and the findings are presented in Table 2 below.

Table 2. Findings from the Pearson Correlation Test for Variables

	Object	Colour	Number	Letter	SA	RC
Object	1	-	-	-	-	-
Colour	.89**	1	-	-	-	-
Number	.63**	.58**	1	-	-	-
Letter	.51**	.48**	.79**	1	-	-
Sa	-.45**	-.42**	-.29*	-.31*	1	-
RC	-.39*	-.32*	-.22	-.27*	.47**	1

**p< .01, *p< .05

Table 2 shows that there is a positive, high-level, and significant relationship between object and color ($r=.89$, $p<.001$), object and number ($r=.63$, $p<.001$), and letter and number ($r=.79$, $p<.001$). Again, according to Table 1, there is a positive, moderate, and significant correlation between letters and objects ($r=.51$, $p<.001$), numbers and colors ($r=.58$, $p<.001$), letters and colors ($r=.48$, $p<.001$), and RC and SA ($r=.47$, $p<.001$) are positively correlated at a moderate level and are statistically significant. In addition, there is a negative, moderate, and significant relationship between SA and object ($r=-.45$, $p<.001$), between SA and color ($r=-.42$, $p<.001$), and between RC and object ($r=-.39$, $p<.001$). There is a negative, low-level, and significant relationship between RC and color ($r=-.32$, $p<.05$), between SA and number ($r=-.29$, $p<.05$), between SA and letter ($r=-.31$, $p<.05$), and between RC and letter ($r=-.27$, $p<.05$). On the other hand, there is no significant relationship between RC and numbers ($r=-.22$, $p>.05$). Furthermore, the relationships between RAN, SA, and RC were examined, and findings regarding the mediating effect of SA on RC were presented.

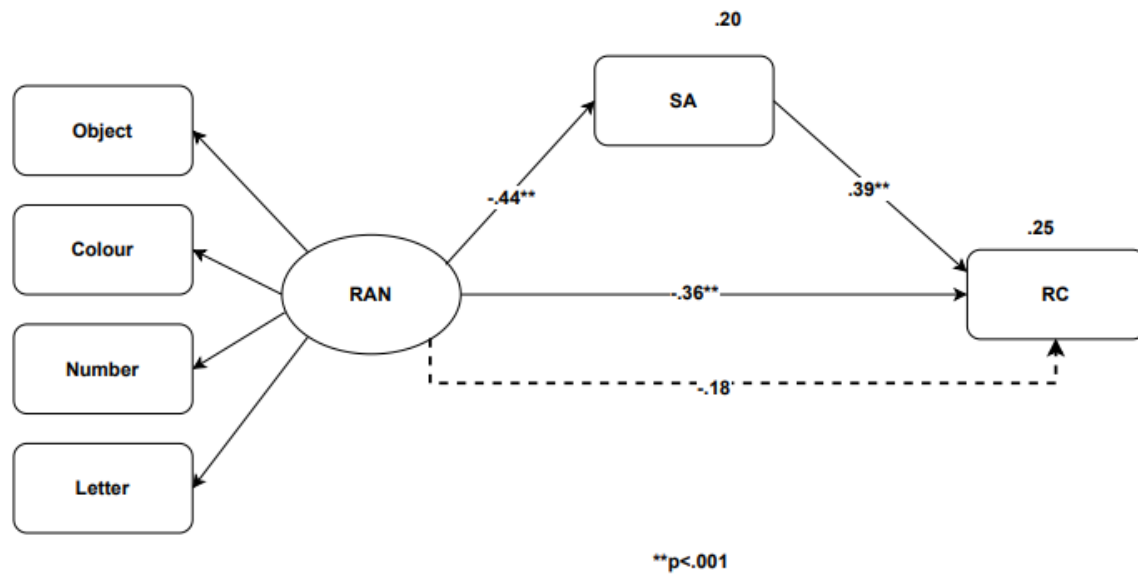


Figure 2. Standardized Regression Coefficients for the Relationships Between RAN Mediated by SA and RC

Table 3. Effects Between Variables Related to the Model

Variable 1	Variable 2	Total Impact	Direct Impact	Indirect Effect	SD	t
RAN	RC	-.364	-.188	-.176	.102	3.22*
RAN	SA	-.443	-.443	-	.137	3.23**
SA	RC	.389	.389	-	.091	4.28**

**p<.001, *p<.05

Table 3 and Figure 2 reveal that RAN has a direct ($\beta=-.19$, $t=3.22$, $p<.05$) and indirect ($\beta=-.18$) effect on RC, with SA mediating this effect. Furthermore, it was observed that RAN has a direct effect on SA ($\beta=-.44$, $t=3.23$, $p<.000$) and SA has a direct effect on RC ($\beta=.39$, $t=4.28$, $p<.000$). Therefore, these findings confirm hypotheses H1, H2, and H3. On the other hand, according to Figure 2, RAN explains 20% of the variance in SA, while RAN and SA explain 25% of the variance in RC.

Table 4. The Interaction Created Between Attention as a Variable in Reading Comprehension and Rapid Automatized Naming

Mediation	With no mediating variable	With mediating variable	Mediation type
RAN>SA>RC	-.36 (p=.000)**	-.18 (p=.070)	Complete Mediation

**p<.001

When examining Table 4, the direct effect of RAN-RC found to be significant in the RAN-SA-RC mediating relationship becomes insignificant when the mediating variable (SA) is added to the model, and therefore the SA variable completely mediates this relationship. Furthermore, it can be stated that SA (Sobel's $z = 2.10$, $p < .036$) has a significant mediating effect on RAN's effect on RC. This finding also confirms H4 hypothesis.

Tartışma

The present study examined the relationships between rapid automatized naming, sustained attention, and reading comprehension, and tested the mediating effect of sustained attention on the impact of rapid automatized naming on reading comprehension. As in various studies in the literature (Abolafya, 2008; Albayrak, 2023; Altani et al., 2017; Bakır, 2007; Demirtaş, 2017; Savage & Frederickson, 2005), this study also found a positive and significant relationship between the subscales of rapid automatized naming. Albayrak (2023) states that in a study conducted with children aged 5-7, there was a moderate and positive significant relationship between the object test and the color naming test. In the current study, it was found that there was a positive and highly significant relationship between the object and color subdimensions of rapid automatized naming. It is also stated that the relationship between numbers and letters, which are subdimensions of rapid automatized naming due to their symbol-based nature, is higher (Bakır, 2007). Similarly, in the current study, a positive and highly significant relationship between letters and numbers was found. Furthermore, while a positive and highly significant relationship was observed between the object and the number, a positive, moderately significant relationship was observed between the object and the letter, the number and the color, and the letter and the color. In this respect, the research has produced results similar to those in the literature.

The present study found a negative relationship between rapid automatized naming and reading comprehension; in other words, students who completed the rapid automatized naming test in a shorter time also scored higher on reading comprehension. This finding suggests that reading comprehension may be related to symbolic and non-symbolic stimuli at different levels. Indeed, the present study found a negative, low-level, and significant relationship between reading comprehension and color and letters, while a moderate and significant relationship was found with objects. When considered alongside Bakır's (2007) findings indicating that number and letter naming skills are more highly related to reading than color and object naming, this suggests that symbolic stimuli may be more decisive in the reading process. However, the current study found no significant relationship between reading comprehension and numbers. This finding suggests that symbolic units may be based on different cognitive processing mechanisms despite belonging to the same category. Saydam (2020), who reported no linear relationship between students' rapid automatized naming times in preschool and their reading comprehension levels in first grade, also supports this result. Therefore, the fact that their relationship with reading comprehension is not in the same direction, despite being symbolic units, may stem from this cognitive difference (Van den Bos et al., 2002).

Another finding of the present study indicates that there is a positive, moderate, and significant relationship between reading comprehension and sustained attention. Similarly, studies in the literature also show a positive and significant relationship between reading comprehension and attention (Öksüz & Akyol, 2023; Yıldız & Çetinkaya, 2017). Saydam (2020) states that there is a low-level, positive, and significant relationship between students' attention levels before school and their reading comprehension levels in first grade. When examining the relationship between sustained attention and the subdimensions of rapid automatized naming, it is concluded that there is a negative, moderate, and significant relationship between sustained attention and objects, and between sustained attention and colors. Similarly, the results indicate that there is a negative, low-level, and significant relationship between sustained attention and numbers and between sustained attention and letters. Similarly, the results of the study conducted by Saydam (2020) indicate that there is a negative, medium-level, and

significant relationship between students' attention levels in preschool and their rapid automatized naming times. According to this result, students with high levels of sustained attention also have shorter naming times for the subdimensions of rapid automatized naming. In other words, as the time for rapid automatized naming decreases, success increases; individuals with high rapid automatized naming success also have high levels of attention.

Another finding from the study indicates that rapid automatized naming has both a direct and indirect effect on reading comprehension. In a study conducted by Karadağ et al. (2019) with second-grade students, it was noted that the relationship between rapid automatized naming and reading comprehension was insignificant, and that rapid automatized naming had an indirect effect on reading comprehension. In this effect, reading skills were found to have a complete mediating role according to the results of the study. Similarly, the study conducted by Özata and Haznedar (2018) with second-grade students reported that rapid automatized naming (RAN) had no direct effect on reading comprehension but had an indirect effect through fluent word reading. Unlike the aforementioned studies, the present study was conducted with third-grade students and found that rapid automatized naming had both direct and indirect effects on reading comprehension. In this effect, sustained attention was found to have a complete mediating role. Weng et al. (2016), in a study with 58 university students aged between 19 and 21, examined the mediating role of working memory in the effect of rapid automatized naming on reading comprehension. The results of the study indicated that there was both a direct and an indirect effect between rapid automatized naming (RAN) and reading comprehension, and that working memory played a mediating role in this effect. Based on all these findings, it is suggested that the relationship between rapid automatized naming and reading comprehension varies depending on the participants' age, and that as participants grow older, the nature and strength of this relationship evolve accordingly. Li et al. (2009) stated that students are in the phase of "decoding" or "learning to read" up to the third grade; however, at higher grade levels, the focus shifts toward "reading comprehension" or "reading to learn." Therefore, they emphasized that participants from higher grade levels should be included when examining the relationship between rapid automatized naming and reading comprehension. Similarly, other studies have also reported that the predictive power of rapid automatized naming increases with age (Georgiou et al., 2009; Kirby et al., 2003).

Finally, the present study found that rapid automatized naming (RAN) had a direct effect on sustained attention, and sustained attention, in turn, had a direct effect on reading comprehension. In the mediation model of the relationship among rapid automatized naming, sustained attention, and reading comprehension, the previously significant direct effect of rapid automatized naming on reading comprehension became nonsignificant when the mediator variable—sustained attention—was included in the model. Thus, sustained attention was found to completely mediate this relationship. This finding is thought to result from the similarity between the cognitive skills involved in rapid automatized naming and those required in the reading process.

Based on all these findings, the complete mediating role of sustained attention in the effect of rapid automatized naming (RAN) on reading comprehension is considered noteworthy. This may be due to the fact that the rapid verbal access, processing speed, and visual-auditory integration skills required by rapid automatized naming are closely related to the continuous engagement of attention during reading. In other words, rather than directly predicting reading comprehension, rapid automatized naming indirectly influences it by activating students' attentional processes. Indeed, attention plays a crucial role in maintaining textual coherence, retaining information in working memory, and efficiently allocating cognitive resources throughout reading (Arrington et al., 2014). Moreover, since rapid automatized naming provides predictive insights into students' future reading performance (Ozernov-Palchik et al., 2017; Yeung, 2016), it serves an important role in the early identification of potential reading difficulties. In summary, in the relationship among rapid automatized naming, reading comprehension, and sustained attention, both the predictive power of rapid automatized naming for reading comprehension and the mediating role of attention should not be overlooked.

Results

Considering that attention—identified as a crucial factor for success in rapid automatized naming (RAN) tasks—is also closely related to reading comprehension, it appears that the mediating role of sustained attention in the effect of RAN on reading comprehension has been largely overlooked. Accordingly, the present study examined the mediating role of sustained attention in the relationship between rapid automatized naming and reading comprehension. The results revealed significant correlations among the subcomponents of rapid automatized naming (object, color, number, and letter naming), reading comprehension, and sustained attention, except for the relationship between reading comprehension and number naming, which was not significant. It has been suggested that number naming tasks involve more automatized processes, and therefore have a more limited predictive power for reading comprehension compared to other subtests (Norton & Wolf, 2012). Another key finding of the study was that rapid automatized naming had both direct and indirect effects on reading comprehension. In the mediation model involving RAN, sustained attention, and reading comprehension, the previously significant direct effect of RAN on reading comprehension became nonsignificant once the mediator variable—sustained attention—was introduced into the model. This result indicates that sustained attention is a critical cognitive resource in the reading process and that the relationship between rapid automatized naming and reading comprehension occurs largely through attentional mechanisms. In other words, success in RAN tasks reflects not only processing speed but also the ability to sustain attention. It can thus be argued that attention serves as a regulatory mechanism in reading comprehension (Alloway et al., 2014; Yıldız & Çetinkaya, 2017). Consequently, sustained attention was found to have a complete mediating role in this effect. In this context, the present study contributes theoretically by clarifying the interaction between rapid automatized naming and attentional processes in relation to reading comprehension, and practically by reminding educators that they should focus on the attention-based cognitive mechanisms underlying students' reading difficulties. Therefore, to enhance students' academic success, it is essential to identify and support those with weak reading skills or reading difficulties at an early stage. The findings also highlight the need to develop early intervention programs that include activities targeting both rapid automatized naming and sustained attention.

Limitations and Recommendations

While this study revealed that sustained attention mediates the effect of rapid automatized naming (RAN) on reading comprehension, it has several limitations. The first and most significant limitation is that the study group consisted of students from only one grade level in primary school. This situation negatively affects the generalizability of the findings. Therefore, it is recommended that future research include larger-scale studies encompassing all grade levels of primary education. In addition, teacher reports were used to determine the inclusion and exclusion criteria in the present study. Students who had visual impairments, color blindness, hearing loss, or any physical disability that could directly affect reading and writing skills, as well as those showing signs of dyslexia or attention deficit/hyperactivity disorder (ADHD), were excluded from the study. However, no formal measurement procedures were conducted for these exclusion criteria within the scope of the study; instead, the researchers relied solely on teachers' opinions. Since this identification process was based on self-report, it is open to bias and manipulation. Therefore, this represents an important limitation of the current study.

Another major limitation of the study is the singularity of the measurements used for the variables. Presenting data related to the same skill through different measurement tools with proven validity and reliability would increase the overall validity and reliability of the study. From this point of view, it is recommended that future researchers collect data related to the variables by employing multiple data collection methods.

The final limitation of the study concerns the use of the Error Analysis Inventory for obtaining reading comprehension data, as the question scale of this inventory is not a standardized comprehension test. The lack of standardization may lead to potential bias in researchers' scoring. Although two researchers independently scored the reading comprehension data to minimize this bias, it still represents a significant limitation. Therefore, the use of standardized comprehension tests or alternative measurement tools in future studies is the final recommendation based on the limitations of this research.

Independent of the study's limitations, it is primarily recommended that future researchers employ neurocognitive methods such as eye-tracking and EEG (Electroencephalography) to examine the existing relationships in greater depth.

The present research is a predictive correlational study, which falls under the category of cross-sectional research. However, especially during the primary school years, longitudinal studies could provide more detailed insights into the development of the relationships identified in this study and the causality underlying them. Therefore, it is recommended that future researchers design longitudinal studies that can more clearly reveal the effects of cognitive processes on reading comprehension.

Finally, the study revealed that sustained attention has a significant effect on reading comprehension. Based on this finding, it is recommended that teachers allocate time for short activities aimed at improving students' attention skills before classroom reading sessions, as this may enhance reading comprehension efficiency.

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The effect of the nature of science activities on 5th-grade students' scientific process skills

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Abstract

The Nature of Science (NOS) and Scientific Process Skills (SPS) are central components of science education, as they play a crucial role in fostering students' scientific reasoning, inquiry competence, and understanding of how scientific knowledge is constructed. This study aimed to investigate the effects of NOS-based activities implemented in science classes on the development of fifth-grade students' scientific process skills. The research employed a single-group pretest-posttest quasi-experimental design with fifth-grade students from a public school in Denizli/Beyağaç, Türkiye, over an eight-week period. The NOS activities were designed to introduce students to scientific processes, promote scientific thinking, and facilitate the integration of science into everyday life. Data were collected using the Basic Skills Scale and the Scientific Process Skills Evaluation Form (SPSEF). The analysis of the Basic Skills Scale indicated a significant improvement in posttest scores compared to pretest levels. In addition, the analysis of activity-based data collected through the SPSEF revealed improvements in higher-order skills, including problem identification, variable recognition, hypothesis formulation, experimental design, and data interpretation.

These findings suggest that integrating explicit-reflective NOS activities into science instruction can effectively support the development of both basic and emerging higher-order scientific process skills at early grade levels, while also enhancing students' understanding of the epistemic nature of scientific knowledge.

Keywords

Science education
Science Process Skills (SPS)
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Introduction

We are currently in a time of rapid change, not only in science but also across many other areas of human life. In this era of rapidly expanding information, technological advancements have greatly enhanced access to data (Barut, 2023). Individuals must develop the capacity to critically evaluate information, organise and apply it appropriately, and generate new insights (Yanarateş & Yılmaz, 2022). Education plays a crucial role in equipping individuals to navigate complex, constantly evolving information landscapes, both in daily life and in broader societal contexts. In this respect, science

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education should focus on how students and the general public understand scientific issues, arguments, and reasoning in various contexts (Tytler & Ferguson, 2023).

National and international initiatives aimed at reforming science education have increasingly centered on the concept of scientific literacy (Ministry of National Education [MoNE], 2024; National Research Council [NRC], 2012; NGSS Lead States, 2013). Scientific literacy includes several core components: content knowledge (e.g., astronomy, biology, chemistry, geology), understanding of scientific inquiry (methods for developing scientific knowledge), and awareness of the Nature of Science (NOS) as a systematic way of knowing (Roberts, 2008). Consequently, the Nature of Science (NOS) and Scientific Process Skills (SPS) constitute two complementary pillars of scientific literacy. A scientifically literate individual can ask questions derived from daily experiences, seek evidence-based explanations, interpret scientific texts, and participate in public discussions concerning socio-scientific issues. Such individuals evaluate the reliability of data based on its source and methodology and can construct arguments supported by empirical evidence. Within this framework, the Türkiye Yüzyılı Maarif Modeli advances a comprehensive vision of scientific literacy by prioritising learners who actively engage in inquiry, employ scientific process skills in authentic problem-solving contexts, critically interrogate information sources, and integrate scientific understanding with ethical, cultural, and societal dimensions of knowledge (MoNE, 2024).

Understanding science correctly and enhancing scientific literacy are essential responsibilities of science educators (Hodson, 1999). Therefore, teachers should consider the epistemic and cultural nature of scientific knowledge and reflect these characteristics in their teaching practices. Scientific knowledge is dynamic, tentative, creative, and influenced by social and cultural factors (Dagher & Erduran, 2017). A superficial grasp of scientific facts and procedures is insufficient for understanding how science truly operates. Instead, understanding depends on how individuals conceptualise the nature of knowledge itself (Ünal-Çoban, 2010). As social and technological transformations continue, conceptions of science have evolved from static and authoritative notions toward collaborative, theory-laden, and evidence-based perspectives. Hence, students must be equipped to critically evaluate knowledge claims through both epistemic reflection and process-oriented reasoning.

Building on this perspective, the Nature of Science (NOS) can be understood as a way of knowing that encompasses not only empirical practices and logical reasoning but also the underlying values, assumptions, and norms that guide scientific inquiry (Abd-El-Khalick & Lederman, 2000; Erduran & Dagher, 2014). It involves how scientific knowledge is produced, justified, and refined over time through evidence and theory (Ioannidou & Erduran, 2021). Understanding NOS is essential for cultivating a scientific mindset, engaging effectively in inquiry, and making informed, evidence-based decisions in everyday life (Stefanidou & Kechagias, 2018; Namakula & Akerson, 2024).

The NOS literature includes multiple paradigmatic approaches. The widely used consensus view conceptualises NOS through generalisable characteristics and is valued for its pedagogical accessibility and suitability for K-12 contexts (Lederman, 2007). However, it has been criticised for oversimplifying the complexity of scientific practice and presenting NOS as decontextualised lists of features (Allchin, 2011; Duschl & Grandy, 2013; Irzik & Nola, 2011). In response, alternative frameworks such as the Family Resemblance Approach (FRA) and its extended form (RFN) have been proposed to provide more comprehensive and discipline-sensitive accounts of science (Erduran & Dagher, 2014).

In this study, the consensus-based “Lederman Seven” framework was adopted. However, its implementation moved beyond a declarative, list-based treatment by employing explicit-reflective instructional practices that situate NOS concepts within inquiry contexts. In this way, the study benefits from the developmental appropriateness and pedagogical clarity of the framework while addressing its commonly noted limitations.

Developing an accurate understanding of how science operates also requires mastery of scientific process skills (SPS)—the procedural and cognitive tools that enable inquiry and reasoning. These skills include observing, predicting, measuring, classifying, inferring, hypothesising, designing experiments, interpreting data, and drawing conclusions (McComas et al., 1998). Martin (1997) classified them as basic skills (e.g., observation, measurement, classification) and integrated or advanced skills (e.g., variable control, hypothesis formulation, modelling, data interpretation). Since higher-order skills build upon foundational ones, they should be cultivated collectively to foster coherent scientific thinking (Aydoğdu, 2014).

Bell et al. (2012) proposed a process-skills-based approach to NOS instruction, emphasising that connecting abstract epistemic ideas to familiar procedural practices can help students internalise how science works. For example, the tentativeness of scientific knowledge reflects the ability to revise conclusions in light of new evidence, while the interplay between observation and inference mirrors how scientists construct explanations. In this sense, explicit-reflective NOS instruction integrated with process-skill practice allows learners to connect conceptual understanding with scientific reasoning and inquiry performance (Witucki et al., 2024).

Recent empirical studies have increasingly examined this intersection. Wesnawati et al. (2022) demonstrated that NOS-oriented instructional materials can lead to measurable gains in students' process skills, supporting the view that epistemic reflection and inquiry practice reinforce one another. Similarly, Khishfe and Abd-El-Khalick (2002) and Can and Şahin-Pekmez (2010) investigated NOS-based activities in middle school contexts and observed improvements in inquiry-related abilities. Despite these contributions, although numerous studies have explored the Nature of Science as a concept, empirical research directly linking NOS instruction to measurable SPS outcomes remains limited (Erduran & Dagher, 2014; Wesnawati et al., 2022). Consequently, this limited focus indicates an important gap in the literature and highlights the need for research that empirically examines how NOS-based instruction supports students' process-oriented competencies.

Moreover, the majority of previous studies have focused on students in grades six to eight or higher (Arıcı, 2025; Khishfe & Lederman, 2006; Mesci & Kartal, 2021), whereas fifth graders—representing a critical stage in which foundational process skills such as observation, prediction, and measurement are systematically developed—have received comparatively little research attention. Investigating NOS-SPS relationships at this level can provide early insights into how epistemic understanding and procedural competence co-evolve. Additionally, many previous interventions have been short—typically one to three weeks—limiting the sustainability and depth of observed outcomes (Fontes, 2025; Khishfe & Abd-El-Khalick, 2002). In response, the present study implements a long-term, eight-week intervention that enables students to repeatedly engage in explicit-reflective NOS activities and apply these concepts across multiple inquiry contexts.

Furthermore, prior research has typically treated SPS as a single composite construct, providing a limited understanding of how individual subskills respond to instruction (Arıcı, 2025). Few studies have examined specific SPS subdimensions—such as observation, inference, prediction, measurement, variable control, and data interpretation—within the context of NOS learning (Aydoğdu, 2014). Consequently, little is known about which process skills are most responsive to explicit-reflective NOS activities. By analysing each subdimension separately, this study offers a detailed understanding of how NOS instruction influences both lower-order and higher-order process skills.

Taken together, the current research fills several interrelated gaps in the literature. Although a substantial body of research has examined the effects of NOS instruction, prior studies have largely focused on students' understanding of NOS concepts rather than its direct impact on scientific process skills (Lederman, 2007; Lederman et al., 2014). Moreover, existing research has predominantly been conducted at secondary and higher education levels, with relatively limited attention given to elementary students. This limitation is particularly important given that scientific process skills develop progressively, with foundational (lower-order) skills such as observing and classifying emerging in

early years, while higher-order skills such as hypothesising, interpreting data, and drawing conclusions begin to develop during the transition to middle school (Ergin et al., 2005; Rambuda & Fraser, 2004; Rubin & Norman, 1992). In this respect, fifth grade represents a critical transitional stage in which students are expected to build upon their foundational skills while beginning to develop more complex forms of scientific reasoning (Çepni & Çil, 2009). In addition, while scientific process skills are often treated as a unified construct, few studies have systematically examined how NOS instruction differentially influences lower-order and higher-order skills. While comprehensive reviews have explored SPS development and instructional strategies, they largely address SPS in isolation without integrating the epistemic dimension of NOS, thereby leaving an important gap in understanding the mechanisms through which students develop scientific thinking (Gizaw & Sota, 2023).

Therefore, the purpose of this study is to investigate the effects of explicit-reflective NOS activities on fifth-grade students' scientific process skills. Specifically, it aims to determine whether such activities lead to measurable improvements in students' ability to observe, hypothesise, and interpret data.

In line with this aim, the central research question guiding the study is: "What is the effect of nature of science activities on fifth-grade students' scientific process skills?" To provide a more nuanced understanding, the study also addresses the following sub-question: "How do explicit-reflective NOS activities influence students' lower-order (e.g., observing, classifying) and emerging higher-order (e.g., hypothesising, interpreting data) scientific process skills?"

Method

Research Model

This study adopted a single-group pretest-posttest quasi-experimental design, in which the effect of the intervention was evaluated by comparing the group's pretest and posttest scores.

Study Group

This study was conducted with fifth-grade students ($n = 18$), consisting of 13 girls (72.2%) and 5 boys (27.7%), all attending a public school in Denizli province during the 2022-2023 academic year. The study group was selected using convenience sampling, a non-probability sampling technique in which participants are chosen based on their accessibility and willingness to participate (Sönmez, 2005).

In this context, the researcher included the only fifth-grade class available at the school where the study was carried out. Since this was the only class at that grade level at the institution, it was selected for its accessibility, appropriateness, and voluntary participation. This approach also provided practical advantages in time management and implementation feasibility.

Individuals can acquire basic skills during the preschool period, while high-level skills can be developed starting in the 5th grade of primary education (Aydoğdu & Karakuş, 2015). From this perspective, the study has acted as a bridge for 5th-grade students transitioning from basic to advanced skills.

Research Instruments

Basic Skills Scale for Primary School Students

Since the study group included 5th-grade students, the *Basic Skills Scale for Primary School Students*, developed by Padilla et al. (1985) and adapted into Turkish by Aydoğdu and Karakuş (2015), was administered as a pretest before implementation and a posttest after implementation. The study titled "*Adaptation of the Basic Skills Scale for Primary School Students into Turkish*" was conducted with 3rd-, 4th-, and 5th-grade students ($n = 447$). The dimensions and number of items of the Basic Skills Scale are presented in Table 1.

Table 1. Dimensions, Number of Items and Item Number of the Basic Skills Scale

Basic Skills	Number of Items	Item
Measurement	5	1-10-19-25-31
Observation	5	2-11-12-26-28
Prediction	6	3-7-9-13-21-27
Classification	5	4-6-8-14-30
Making Inferences	5	5-20-22-24-29
Communicating	5	15-16-17-18-23

Scientific Process Skills Evaluation Form (SPSEF)

The qualitative dimension of the research was assessed using worksheets collected from students who participated in NOS activities. This study aimed to measure scientific process skills; therefore, the 'Scientific Process Skills Evaluation Form (SPSEF)' developed by Şahin-Pekmez et al. (2010) was employed. The SPSEF, which was utilised to score the activity sheets, is presented in the appendix and is compared with the Basic Skills Scale data. Detailed descriptions of the activities and the specific skills they assessed are provided in the experimental procedures section.

In their study, Aktamış and Şahin-Pekmez (2011) developed a Scientific Process Skills Scale for the Science and Technology course, aiming to construct a valid and reliable measurement tool to assess the scientific process skills embedded in the curriculum through a combination of question types. They emphasised the importance of using both closed-ended (test-based) and open-ended questions to enable a more comprehensive and detailed evaluation of students' scientific process skills. Similarly, the literature highlights the necessity of employing diverse question formats when assessing these skills (Monica, 2005; Okey et al., 1985). In addition, the use of multiple question types allows for the identification of the formats in which students demonstrate stronger or weaker performance (Aktamış & Şahin-Pekmez, 2011). Building on this methodological perspective, the present study analysed scientific process skills by distinguishing between basic (lower-order) and higher-order skills, thereby enabling a more nuanced evaluation of students' performance across different levels of cognitive demand and question types, as well as identifying the areas in which students perform more effectively.

Scientific process skills are understood to develop progressively as students advance to higher grade levels (Çepni & Çil, 2009). The study group falls within a developmental stage in which students begin to transition from basic to more advanced skills. In this context, higher-order skills such as controlling variables, formulating hypotheses, interpreting data, and conducting experiments become measurable at this level. Furthermore, these skills should not be viewed merely as sequential steps but rather as an integrated set of competencies that collectively form a scientific mindset (Ergin et al., 2005). The structure of the SPSEF also indicates that it can be applied to individuals from middle school onwards.

When the experiment reports evaluation form (Scientific Process Skills Evaluation Form; SPSEF) is examined (Appendix 1), the boxes marked "2" and "3" represent the highest possible scores for each section. For instance, in the "What's in the Tube?" activity, if students explain how the mechanism works based on external observations, they receive full points for identifying dependent, independent, and control variables. Correctly inferring and illustrating the internal mechanism with a justified explanation yields full points for the hypothesis/preliminary idea section. Designing and illustrating an appropriate setup based on the problem and hypothesis earns full marks for experiment design and presentation. If the presented mechanism functions correctly or aligns with the data, full points are given in the results section. Finally, students receive full marks in the comments section if they accurately interpret the relationships, compare them with the original mechanism, and discuss the outcomes clearly. Each activity's implementation and evaluation were designed to be distinct and independent. The scoring criteria for all activities are detailed in the Experimental Procedures section, as outlined in the SPSEF. The SPSEF scores range from 0 to 24. Scores below 8 indicate low, 8-16

moderate, and 16-24 high levels of scientific process skills. In addition, classroom discussions were held periodically to explore and deepen students' understanding of the nature of science.

Experimental Process

In the study involving fifth-grade students, seven activities that featured Lederman's Nature of Science outcomes, as outlined in the book 'Teaching the Nature of Science' by Doğan et al. (2014), were conducted. These activities were carefully selected and organised according to the principles of teaching NOS, with some being completed in groups and others individually. At the conclusion of each activity, students' worksheets, which served as implementation data, were collected. Details about the implementation process and the activities are presented in Table 2.

Table 2. The Experimental Process of Research

Pretest	Implementation	Posttest
Basic Skills Scale	Nature of Science Activities 1. What's inside the tube? (Scientific knowledge requires evidence obtained from experiments and observations.) /18 students 2. Scientific or not? (characteristics of scientific knowledge) /16 students 3. Footprints (observations, inferences and theoretical topics in science) /16 students 4. Fossils (creative nature of scientific knowledge) / 17 students 5. Mysterious cubes (changeable nature of scientific knowledge) / 5 groups / 18 students 6. Young-Old (subjectivity) / 3 groups / 18 students 7. Card exchange (characteristics of scientific knowledge) /5 groups/ 16 students	Basic Skills Scale

First week

During the first week of implementation, the Basic Skills Scale was administered as a pretest, followed by the initiation of activities.

Activity 1: What's Inside the Tube? This activity simulates the processes scientists use in research, enabling students to *distinguish between observation and inference*, recognise that scientific knowledge relies on experimental and observational data, and understand that scientific models can evolve. Using toilet paper rolls as invisible systems, students observe that pulling one string (A) causes the other (B) to retract into the tube. They are then asked to hypothesise about the internal mechanism and illustrate their ideas. Each student formulates an individual hypothesis and drawing, then compares it with the teacher's model in the following lesson. The activity helps students grasp the role of prediction in science and that models may not always reflect reality. Evaluation includes identifying the problem, forming hypotheses through initial and revised drawings, depicting variables, designing and presenting a model, and interpreting predictions and results.

Second week

Activity 2: Scientific or not? (I) This activity is designed to help students learn how to distinguish scientific information from non-scientific information. Students are asked to consider *what characteristics make information scientific* and then to discuss and share their ideas with each other (Scharmann et al., 2005). They are given various statements that may or may not have scientific value and are tasked with ordering them from most to least scientific. Following this, students must categorise each statement in a table as 'Scientific' or 'Non-Scientific' and provide explanations for their choices. The completion and quality of this table are considered in the scoring, along with the thoroughness of the students' results and commentary.

Third Week

Activity 3: Footprints (I): The aim of this activity is to engage students in working like paleontologists—using data and creativity while grounding their predictions in scientific knowledge to generate new insights. The activity emphasises that *scientific knowledge arises from human inference and creativity, evolves with new evidence, and relies on collaboration* (Abd-El-Khalick et al., 1998). Students also learn that fossils are not limited to dinosaurs or animal remains but can include plants, shells, rocks, or resin (Doğan et al., 2014).

In this task, students examined two crab fossils and made predictions based on their observations, supporting their hypotheses with scientific reasoning. The evaluation focused on the hypothesis, results, and interpretation sections and applied the same scoring criteria used in the *Footprints* activity.

Fourth week

Activity 4: Fossils (I) The aim of this activity is for students to work like paleontologists, using their data and creativity while grounding their predictions in scientific knowledge to generate new insights. Accordingly, they are expected to understand that *scientific knowledge is derived from human inferences and creativity*, evolves with new data, and necessitates collaboration (Abd-El-Khalick et al., 1998). It is well understood that fossils are not limited to dinosaur or other animal remains; they can also include various organisms, such as trees, oyster shells, rocks, and resin (Doğan et al., 2014). In this activity, students were presented with two crab fossils. They were tasked with making predictions based on the remains they observed and grounding their hypotheses in scientific data. The evaluation of the activity involved scoring the hypothesis, results, and interpretation sections, following the same procedure used in the footprints activity.

Fifth Week

Activity 5: Mysterious Cubes (G): This activity was designed to enable students to make observations and inferences, interpret the data, and formulate predictions based on the available mathematical data. Through this process, students are expected to understand that scientists filter the data they collect through a theoretical lens and also *make inferences influenced by their social environments* (Abd-El-Khalick et al., 1998). The features of scientific models are emphasised during discussions. In groups, students participated in a game-style activity by rotating cubes they had prepared and numbered according to specific rules, as instructed. They attempted to base their predictions on documented information. In evaluating the activity, the sections on problem identification, experimental design, hypotheses, results, and comments were scored.

Sixth Week

Activity 6: Young-Old (G): In this activity, *the subjectivity of scientific knowledge* is highlighted. Through this exercise, students will come to understand how scientists' beliefs, expectations, and perspectives influence their observations and interpretations of data (Abd-El-Khalick et al., 1998). The students were shown two very similar images, yet they could be interpreted differently based on one's perspective. They expressed their thoughts about the images and discussed them in groups. The evaluation of this activity involved scoring the hypotheses, results, and comments sections.

Seventh Week

Activity 7: Card Exchange (G): This activity was designed to clarify students' perceptions of science. Cards containing statements representing different viewpoints were used to *explore the characteristics of scientific knowledge through discussion* (Cobern & Loving, 1998). Students were divided into groups, examined the information on the cards, recorded individual opinions, explained their reasoning, and supported their ideas with scientific evidence. This activity, a continuation of week 2's practice, became easier as students grew more familiar with the card-exchange method. The same evaluation procedure used in the "*Scientific or Not*" activity was applied.

Because students initially had difficulty independently linking NOS elements, additional explanations and guiding questions were provided. Each week, attention was directed to the NOS elements targeted by the activity, and students were encouraged to discuss these both in groups and as a whole class.

Data Analysis

In the study examining the effect of NOS activities on students' science process skills, the Basic Skills Scale and the SPSEF were used to assess basic and higher-level- process skills. The data were collected from students' responses to both scales. KR-21 reliability analysis was conducted to examine students' test performance. The levels of knowledge of the basic skills assessed in the study were evaluated based on the test results. Nonparametric tests were preferred since the study group consisted of 18 people. A Wilcoxon signed-rank test was performed to examine differences between pre and post-test levels. In the study, a significance level of 0.05 was set as the threshold for decision-making squared (Γ^2) magnitude calculations were calculated for significant p values and interpreted at the 0.01-0.06-0.14 levels.

Qualitative analysis, an important dimension of the research, was evaluated in accordance with the SPSEF using the worksheets collected from students' NOS activities, as stated in the data collection tools section. The appearance and content validity of the SPSEF scale were reviewed by two expert academics within the university. The statements on the working papers were matched with the items on the scale. The first and second authors re-examined these opinions and reached a consensus based on the correlation.

Validity and Reliability

On a 31-item scale, the pretest's internal consistency was calculated as KR-21 = 0.73. This generally indicates that the measurement tool is consistent in assessing participants' skill levels. For the post-test, the KR-21 was 0.76. This also suggests that the measurement tool, which consists of statements from questions based on participants' skill levels, is a reliable instrument (KR-21 > 0.70). In summary, the 'Basic Skills Scale for Primary School Students' can be considered a successful tool for measuring students' skill levels (Karakoç & Dönmez, 2014).

'Basic Skills Scale for Primary School Students' is a knowledge scale that measures student achievement. Scoring is based on the correct and incorrect options assigned to each question, based on the scale's sub-dimensions and general knowledge level. This scale is coded as true or false before analysis, initially for reliability (KR-21), and then included in the analysis based on the scoring values (correct answer = 1 point, incorrect answer = 0 points).

The evaluation criteria identified in SPSEF were prepared by examining students' worksheets. As part of the reliability study for these criteria, 18 worksheets were scored independently by two researchers to assess inter-rater reliability. The Pearson correlation analysis yielded a correlation of .89 between the two researchers, indicating consensus. In preparing the scale, Şahin-Pekmez et al. (2010) ensured the form's appearance and content validity by consulting six experts and implementing the necessary adjustments.

Findings

The findings from the analysis were discussed and interpreted in response to the question, "What is the effect of NOS activities on the science process skills of 5th-grade students?"

Basic Skills Scale Analysis Results

In the study, because of the small sample size ($n < 30$), the distributions of pretest and posttest achievement scores are unlikely to be normally distributed. For this reason, it was determined that nonparametric tests, which do not assume normality, were necessary.

In the study, participants' test success was coded as 1 for each correct answer and 0 for each incorrect answer. A paired Wilcoxon signed-rank test was applied as a dependent-measures nonparametric test for both scores. The results of the study are given in Table 3.

Table 3. Examination of pretest and posttest scores

Measurement	X $\pm$ SD	z	p	Γ^2
Pretest score	23,50 $\pm$ 2,25	-8,33	.01*	.09*
Posttest score	27,33 $\pm$ 1,32			

**Wilcoxon sign test, *significant difference at 0.05 level

The data in the table clearly show a significant increase in participants' post-test scores compared to their pretest levels ($z = -8.33$, $p = .01$, $p < .05$). Initially, the pretest scores averaged 23.50 ± 2.25 , which notably rose to an average of 27.33 ± 1.32 following NOS activities. It was observed that the effect size of the significant difference obtained in the pretest-posttest comparison was medium ($R^2 = 0.09$).

In the pretest, the item most frequently answered incorrectly was item 31, which pertained to measurement. By contrast, in the final test, only one student answered this item incorrectly. Additionally, items number 7 (prediction), 14 (classification), 18 (communication), and 20 (inference), which had posed challenges in the pretest, were answered correctly by all students in the post-test.

Table 4. Examination of Pretest and Posttest Scores of the Sub-Dimensions of the Basic Skills Scale

Measurement	X $\pm$ SD	z	p	Γ^2
Pre-Measurement	3,17 $\pm$ 0,71	-9,46	.01*	.11
Post-Measurement	4,39 $\pm$ 0,61			
Pre-Observation	4,22 $\pm$ 0,94	-2,7	.02*	.05
Post-Observation	4,72 $\pm$ 0,57			
Pre-Prediction	4,94 $\pm$ 0,87	-4,53	.01*	.07
Post-Prediction	5,83 $\pm$ 0,38			
Pre-Classification	3,89 $\pm$ 0,58	-2,36	.03*	.04
Post-Classification	4,28 $\pm$ 0,75			
Pre-Making Inferences	3,22 $\pm$ 0,94	-3,43	.01*	.06
Post-Making Inferences	3,72 $\pm$ 0,75			
Pre-Communicating	4,06 $\pm$ 0,94	-1,68	.11	-
Post-Communicating	4,39 $\pm$ 0,70			

**Wilcoxon sign test, *significant difference at .05 level

Based on the provided data, there was a noteworthy improvement in participants' post-test scores relative to their pretest scores across various skills (Table 4). Specifically, a considerable increase was observed in the posttest scores for Measurement ($z = -9.46$, $p = .01$, $p < .05$), Observation ($z = -2.70$, $p = .02$, $p < .05$), Prediction ($z = -4.53$, $p = .02$, $p < .05$), and Making Inferences ($z = -3.43$, $p = .02$, $p < .05$) in comparison to their respective pretest levels.

However, it is worth noting that there was no statistically significant difference in the pretest and posttest scores regarding Communicating ($p=.11$, $p>.05$). Hence, while there was a notable improvement in the skills relating to Measurement, Observation, Prediction, and Making Inferences post-assessment, there was no significant change in Communication skill.

The significant differences obtained for the Measurement, Prediction, and Making Inferences sub-dimensions were found to have a moderate effect ($\Gamma^2=0.06-0.14$). The significant differences obtained for the Observation and Classification sub-dimensions were found to have a low effect ($\Gamma^2=0.01-0.06$). Since the pretest and posttests of the Communication skills dimension were not significantly different, no effect size was calculated.

Qualitative Analysis Results

Table 5 presents the score evaluations for 18 students. Students absent for some weeks are marked with an (a).

Table 5. Nature of Science Activities SPSEF Scores

Student No.	Activities/SPSEF Points						
	1	2	3	4	5	6	7
1	13	12	15	16	17	17	18
2	11	14	16	18	18	17	19
3	12	13	16	18	18	17	19
4	15	14	17	17	19	18	22
5	10	12	16	17	18	19	20
6	11	14	15	17	18	18	21
7	8	10	14	16	16	19	18
8	11	12	14	17	18	19	21
9	14	15	15	18	19	20	21
10	16	16	15	17	18	20	21
11	7	8	11	14	17	15	16
12	9	(a)	(a)	12	15	16	17
13	9	10	11	14	18	20	20
14	12	14	15	17	19	18	20
15	15	16	(a)	(a)	19	21	(a)
16	12	14	16	18	17	19	21
17	9	13	16	15	18	20	21
18	8	(a)	10	12	17	18	(a)

Upon reviewing Table 5, it is apparent that the students' SPSEF scores generally improved as the activities progressed. Initially, the impact of just starting the program was evident in the scores. For instance, in the first activity, Student Number 11 scored fewer than 8 points, indicating low performance, whereas the others achieved medium performance, with scores ranging from 8 to 16 points. As the weeks progressed, there was a consistent improvement in performance; by the final week, all students demonstrated high-level scientific process skills, with scores ranging from 16 to 22 points. Notably, Student Number 4 excelled by scoring the maximum of 22 points in the last activity.

Therefore, performances can be distinctly categorised as low, medium, or high based on this data. To illustrate, students' performance levels in the first activity can serve as a benchmark for these categories.

- Students performing at a low level (7-8 points): 7, 11 and 18,0
- Students performing at an intermediate level (10-11 points): 2, 5, 6 and 8,
- Students who performed at a high level (14-16 points): 4, 9, 10 and 15.

A student from each level was sampled to analyse which skills were implicated in the questions they answered incorrectly during the pretest and posttest of the basic skills scale. Accordingly, the data for student number 11 at the low level, student number 8 at the medium level, and student number 4 at the high level are given in Table 6.

Table 6. Basic Skills Scale (Pretest and Posttest) Question Analysis

	Low Level (student number 11)	Intermediate (student number 8)	High level (student number 4)
Basic skills scale (Pretest) question numbers answered incorrectly/skills included	3, 7 and 13 (prediction) 4 and 30 (classification) 10 (measurement) 11, 12 and 28 (observation) 23 (communicating) 29 (making an inference)	2 and 12 (observation) 3 (guess) 29 (making an inference) 30 (classification) 31 (measurement)	4 (classification) 5 (making inferences) 9 (guess) 31 (measurement)
Basic skills scale (posttest) corrected questions/skills included	3 and 13 (prediction) 4 (classification) 10 (measurement)	2 (observation) 3 (guess) 30 (classification) 31 (measurement)	5th question (making an inference) 31 (measurement)

When combining the open-ended responses given by Student Number 11 with the tests in activities (Table 6), the following statements were used in the "Footprints" activity: *"In the first picture, there is a squirrel, then a beaver comes and they become friends", "In the second picture, the two might be fighting because their tracks are intertwined.", "In the third picture, as far as I understand, one is running away from the fight while the other stays, but this is just a guess; scientists make predictions too."* From these statements, it can be inferred that the student utilised their observational skills and made inferences based on previous experiences. Student Number 11, who initially answered some questions related to these skills incorrectly, answered them correctly on the final test (questions 11, 12, 28, and 29).

Similarly, the student made predictions and inferences by drawing two separate models in the "What's inside the tube?" activity. The scores show that applying prediction and inference skills in initial activities benefits the process.

When the changes observed in Student Number 8 (Table 6) are combined with the open-ended responses, significant developments in *measurement* skills are evident. In the "What's inside the Tube?" activity, the student stated, *"I tied four ropes together, but when I pulled on rope D, I realised it was short, so I made it longer to fix it."* This response may indicate improved measurement capabilities. In the "Fossils" activity conducted during the fourth week, the student described, *"I see a crab fossil. Crabs live by the sea and have hard shells. Their soft parts have rotted away, mixed with the sand, and dried up."* This observation shows the student's ability to *classify* organisms based on their physical and environmental traits.

Additionally, in the "Mysterious Cubes" activity in the fifth week, the student explained, *"Looking at the covered part of the cube in front of me, I think there is a '5' because the numbers I can see are 1, 2, 3, 4. Someone else might see a '5' or '6', so I guessed it was '5'."* This statement demonstrates the student's use of *observation* to support and *justify their predictions*. These responses showcase the student's growth in observational, predictive, and classification skills through engaging and sequential learning activities.

It was determined that student number 4 answered only the 4th and 9th items incorrectly in the post-test (Table 6). Integrating the changes observed in the student with the open-ended responses from the activities, notably from the 'What's in the Tube?' activity conducted in the first week, it is evident that she/he developed a cause-and-effect relationship through their predictive models. She/he stated, *'In my first prediction, it did not comply with the instructions; in the other, I felt the need to add a ring because when we pulled a string, according to the instructions, not all should go inside.'* This demonstrates that she/he tested and revised her hypothesis based on the instructions.

In the 'Scientific or Not?' activity conducted during the second week, student number 4 effectively ranked various statements from most scientific to least scientific. During the exercise, he/she evaluated statements from an article about vitamin C, including: *'We get vitamin C from citrus fruits, and we become more energetic,' 'Last year and this year, we learned at school that the shape of the world is a sphere,'* and *'There is no such thing as an evil eye, even if it exists, it has nothing to do with eye color.'* Her/his responses indicate a clear understanding of the characteristics of scientific knowledge.

At the 'What's Inside the Tube?' event, all students displayed their models using their own rolls. When tested, 14 students found that their initial models did not function as expected and had to revise their designs. However, four students successfully identified the correct mechanism from the start. Reviewing the worksheets of students 1, 2, 4, 9, 10, 14, 15, and 17 revealed their initial predictions, corrections of any inaccuracies, and the reasoning behind their successful or erroneous mechanisms. Some students, lacking a clear understanding of the mechanism, resorted to making random guesses. Evaluations were conducted to ascertain whether the students' hypotheses and their understanding of dependent, independent, and control variables were correctly applied and grounded in scientific knowledge.

In summary, there was a significant increase in scores from the pretest to the posttest. Almost all students who made fewer errors on the Basic Skills Scale in the post-test also achieved higher SPSEF scores (Table 5). Both qualitative and quantitative findings indicate that as students engage in NOS-based activities, their fundamental skills—such as sorting, classifying, predicting, observing, and inferring—improve substantially. At the same time, their higher-order skills, including hypothesis formulation, variable identification, and analytical reasoning, also develop. This overall progression is consistently reflected in the improvements observed on the Basic Skills Scale (Table 4).

Discussion, Conclusion and Recommendations

The nature of science (NOS) and scientific process skills (SPS) are at the heart of science education, serving as key elements that foster students' critical thinking, evidence-based reasoning, and understanding of the epistemic foundations of science (Abd-El-Khalick & Lederman, 2023; Erduran & Kaya, 2018). This study examined the impact of structured NOS activities on fifth-grade students' SPS, including their sub-dimensions. After an eight-week implementation, significant improvements were observed in measurement, observation, prediction, and inference skills. These findings indicate that NOS-based learning environments not only enhance procedural competence but also deepen students' awareness of how scientific knowledge is generated and justified.

Previous studies have shown that explicit-reflective NOS instruction strengthens students' conceptual understanding and inquiry-related attitudes (Namakula & Akerson, 2024). However, most of this research has focused on students in grades 6-8 and secondary education. By providing empirical evidence that NOS-based teaching can also support advanced SPS development at earlier grade levels, the present study helps fill an important gap in the literature. The results align with the findings of Khishfe (2021), who emphasised that inquiry- and argumentation-based activities enhance both NOS awareness and procedural competencies among younger learners.

The multidimensional pattern of improvement observed in this study is consistent with literature grounded in epistemic inquiry. Erduran and Dagher (2014) have noted that engaging students in hypothesis generation, testing ideas, and justification fosters both cognitive and epistemic awareness. The "What's in the Tube?" activity in this study encouraged students to propose multiple explanations for an unseen mechanism and to test them through evidence-based reasoning. Similarly, Koumara, et al. (2022) demonstrated in their "black box" activity that imagination plays a key role in problem-solving and that identical observations may lead to different inferences. In both contexts, students directly experienced the tentative, creative, and evidence-based nature of scientific knowledge.

Conversely, no significant improvement was observed in communication skills. This suggests that while students could perform procedural reasoning individually, opportunities for reflective and dialogic engagement were limited. The literature highlights that scientific communication skills and reasoning are best advanced through environments that promote argumentation and dialogic interaction (Akerson et al., 2019; Jiménez-Aleixandre & Crujeiras, 2017). Future implementations should therefore integrate structured peer discussions, collaborative inquiry tasks, and reflective writing activities to strengthen this dimension. The initial challenges observed in measurement and inference skills may be attributed to students' limited familiarity with test formats, as prior research has shown that exposure to multiple question types can enhance performance and measurement reliability (Aktamış & Şahin-Pekmez, 2011; Monica, 2005; Okey et al., 1985).

Unlike previous studies that focused solely on students' conceptions of NOS (Cofré et al., 2019; Gören, 2021), this research operationalised NOS principles through practical, inquiry-based activities, thereby building a tangible bridge between epistemic cognition and measurable skills. The marked progress among students from lower- to middle-socioeconomic backgrounds further demonstrates that well-designed NOS activities can mitigate resource limitations. The finding that science textbooks insufficiently address epistemic and cognitive categories (Okan & Kaya, 2023) underscores the compensatory role of experiential classroom NOS instruction in closing this curricular gap.

The teacher dimension is also critical for ensuring sustainability. Teachers often learn about NOS in contexts disconnected from their classroom practices, making it difficult for them to perceive how NOS aligns with their existing instruction. Stadermann and Goedhart (2021) argued that this contextual misalignment can be alleviated by teaching NOS through a process-skills-based approach—one that explicitly links NOS concepts to inquiry practices teachers are already accustomed to implementing. Such an approach employs engaging, critical-thinking activities that make NOS ideas concrete and pedagogically relevant, thereby increasing coherence between how teachers learn about NOS and how they later teach it. This integration ultimately strengthens both teachers' and students' meaningful engagement in scientific reasoning (Bell, 2008).

Methodologically, the single-group pretest-posttest quasi-experimental design limits causal inference. Future studies should adopt control-group designs, longitudinal tracking, and mixed methods to examine causal relationships more rigorously (Deehan et al., 2024). Although epistemic thinking was not directly assessed in this study, the interactive NOS activities engaged students in reasoning, evidence evaluation, and reflection—processes that are associated with the development and durability of epistemic awareness over time. Considering contextual and cultural diversity, incorporating perspectives that emphasise epistemic practices can also enhance inclusivity and strengthen the long-term impact of NOS instruction in diverse classrooms (Agustian, 2024; Zetterqvist & Bach, 2023).

In conclusion, the findings provide strong evidence that explicit-reflective NOS activities can significantly enhance SPS—particularly measurement, observation, prediction, and inference—at early grade levels. Integrating NOS and SPS as complementary pillars of science education, supported by evidence evaluation, hypothesis formulation, and activities that reveal the human and creative dimensions of scientific knowledge, can foster students' ability to connect scientific reasoning with real-life contexts. Such integration helps nurture reflective, evidence-oriented citizens capable of critically engaging with the complex scientific and societal challenges of the twenty-first century.

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Appendix 1. Experiment Reports Evaluation Form. (Scientific Process Skills Evaluation Form/SPSEF)

Problem	Not suitable (0)	Suitable (1)	
Dependent variable	Not Specified (0)	Not Suitable for the Problem (1)	Suitable for the Problem, incorrectly expressed (2) Correctly Expressed (3)
Independent variable	Not Specified (0)	Not Suitable for the Problem (1)	Suitable for the Problem, incorrectly expressed (2) Correctly Expressed (3)
Control variable	Not Specified (0)	Not Suitable for the Problem (1)	Suitable for the Problem, incorrectly expressed (2) Correctly Expressed (3)
Hypothesis/Preliminary idea	not based on information (0)	Knowledge-based (1)	Not suitable for the problem (0) Suitable for the Problem (1)
Experiment Design	Suitable for the problem (0)	Suitable for the Problem (1)	Not Suitable for Hypothesis (0) Suitable for Hypothesis (1)
Presentation	Table	Unused (0) All data exactly processed (2)	only dependent variable defined (1) only independent variable defined (1)
	Graphic	Unused (0) All data exactly processed (2)	only dependent variable defined (1) only independent variable defined (1)
	Other	Unused (0)	Not Suitable (1) /Suitable (2)
Conclusion	Not Specified or Not related to the Problem (0)	Not expressed according to data (1)	Expressed according to the data (2)
Comment	Not done or not related to the problem (0)	Not properly expressed (1)	Associated with the data obtained (2)



Evaluating the effectiveness of reading comprehension-based instruction supported by flipped learning model in the 7th grade science course *

Dilek Hastürk Güven ¹, Banu Yücel Toy ²

Abstract

Reading comprehension is a crucial skill that underpins the understanding of scientific concepts and processes, facilitates the integration of conceptual knowledge with analytical thinking, and thereby enhances scientific literacy. In this context, the flipped learning model allows students to explore essential concepts at home through digital resources, thus freeing classroom time for targeted interventions. In this study, it was aimed to evaluate the effect of reading comprehension-based science instruction, supported by a flipped learning model, on the learning and reading comprehension skills of 7th-grade students during the 2022-2023 academic year in a boys-only public middle school in Istanbul. By employing an embedded mixed design, the effectiveness of reading comprehension-based instruction was evaluated during and after the implementation stage by conducting an experimental design and collecting both qualitative and quantitative data. In total, 67 students participated. In the experimental groups, students learned basic concepts at home through assignments from the Education Science Network before class, while in-class activities focused on applying reading comprehension skills to scientific content. Data were gathered through various measurement tools, including a reading comprehension skills scale, an achievement test, teacher reflection notes, and semi-structured interviews. The findings showed that students significantly showed improvement in their reading comprehension and science performance. Students stated that they achieved better understanding and learning through reading strategies that they could apply in other courses. In addition, the instruction contributed to their social-emotional development, including self-awareness, social skills and academic motivation.

Keywords

Science course
Teaching science
Reading comprehension
Flipped learning
Instructional design

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Introduction

In today's rapidly evolving world, the emphasis has shifted from merely acquiring knowledge to transforming that knowledge into practical skills. In essence, it's no longer sufficient to simply know facts or theories; individuals must be able to effectively apply their knowledge in various contexts. This entails the ability to navigate through diverse sources of information, evaluate their credibility, and adapt quickly to ongoing changes in society and technology. Therefore, it is crucial for students to master a diverse set of skills—abilities and competencies that empower them to effectively engage in cognitive, social, and physical processes in a coordinated manner (Bakırcıoğlu, 2016; Slavin, 2018). In this context, the Organization for Economic Cooperation and Development (OECD) introduced a learning framework highlighting the importance of skill acquisition within educational frameworks (OECD, 2018) and has been supporting countries in enhancing their education system to meet the demands of the 21st century through the 2030 Future of Education and Skills project (OECD, n.d.). This emphasis on skills has been further supported by the design of international and national assessments such as the Trends in International Mathematics and Science Study (TIMSS), the Programme for International Student Assessment (PISA), and national High School Entrance Exams (HSEE), all of which include questions that assess students' skills rather than just their factual knowledge.

It is well-established that official curricula play an active role in developing essential skills (Green, 2011). Science curriculum is one of the main factors that significantly influence students' performances in national and international assessments. An analysis of the science curricula from countries that performed well in the Trends in International Mathematics and Science Study (TIMSS) reveals an emphasis on skills such as interpretation, inference, experimental design, and classification (Derman, 2019). Given that 35% of the questions in the TIMSS exam relate to reasoning skills (Yıldırım et al., 2016) and that 50-70% of PISA science questions require the ability to design and interpret experiments (Ministry of National Education [MoNE], 2019), it is unsurprising that countries with a skill-based educational system tend to excel in these assessments. Despite the emphasis on skill development in Turkish national curricula since 2004, aimed at helping students acquire essential skills for application in daily life (MoNE, 2005), Turkey's performance in PISA assessments remains below the OECD average. The PISA 2022 results indicate that Turkish students scored an average of 456 in reading and 476 in science, which is lower than the OECD average (OECD, 2023). Even, there has been a decline of 10 points in the reading score compared to the 2018 PISA results (OECD, 2019; 2023). This points out the problems in operational curriculum, which is related to how teachers implement the curriculum and what they teach in classrooms within student and school contexts (Posner, 2004).

Various studies are unveiling the challenges teachers face regarding teaching skills, such as the intensity of content and objectives, ineffective guidance of curriculum or textbooks, insufficient materials and infrastructure, lack of time, and inadequacy of teacher education (e.g. Barası & Erdamar, 2021; Baysal et al., 2017; Erden, 2020). In 2024, Turkish national curricula were renewed based on the K12 skills framework developed with the support of OECD (MoNE, 2023) and learning outcomes, teaching-learning and assessment processes were structured as skill-oriented to achieve the aim of fully realizing skill-based teaching that will respond to the problems mentioned above (MoNE, 2024). The renewed curricula started to be implemented at 1st, 5th, and 9th grade in the 2024-2025 academic year, but the 2018 curricula continue to be practiced at other grade levels. In this regard, while the 2018 Science Curriculum includes life skills, innovative thinking and scientific process skills (MoNE, 2018), the 2024 Science Curriculum, which is much more comprehensive, contains discipline-specific skills, conceptual skills, social-emotional learning skills, literacy skills, dispositions and values (MoNE, 2024).

Teaching skills effectively that the renewed curricula emphasize requires a pedagogical approach that differs significantly from traditional, knowledge-based instruction. Instead of focusing solely on rote memorization and factual recall, educators must adopt strategies that promote critical thinking, problem-solving, collaboration, and hands-on experiences (Saavedra & Opfer, 2012; Snyder &

Snyder, 2008). This shift in teaching methodology is essential to prepare students for the complexities of the modern world, where skillful application of knowledge is key to success in both personal and professional realms. In skill-based instruction, it is important to explain the skills and techniques needed for skill development. However, rather than simply providing this information, it is essential to create opportunities for students to apply these techniques in various situations (Güneş, 2012). Additionally, when teaching skills, it is crucial to develop materials and a learning environment that enhances students' abilities and maximizes their potential, taking into account their differences (Tomlinson & Imbeau, 2010). Furthermore, the measurement and assessment processes should utilize appropriate tools that can serve as evidence of skill attainment. These tools should be designed to assess the transfer of skills to different contexts and real-life situations (Çelik, 2020; Ünlü & Yıldırım, 2017).

Reading comprehension encompasses the cognitive skills necessary to understand, analyze, and synthesize information (Demirel & Şahinel, 2019; Perfetti & Stafura, 2014). It involves making inferences about the text, analyzing relationships within it, and integrating new information with prior knowledge (Cain et al., 2001; Imam et al., 2014; Özbay & Özdemir, 2012; Roman et al., 2016). As a result, interpretation and inference skills are essential components of reading comprehension. These skills are also evident in the HSEE questions in Türkiye, where students are tasked with making comments or inferences based on texts related to real-life scenarios (Şan & İlhan, 2022). Moreover, visualization—the ability to mentally create graphics and diagrams from a reading text—is recommended as an effective reading strategy (Epçacan & Erzen, 2010). Therefore, visuals, diagrams, tables are frequently included alongside texts to enhance comprehension. Understanding these visuals, graphics, and figures is also considered a sub-skill of reading comprehension and called as visual reading, table reading, graphic reading. The reading comprehension skills assessed in PISA exams reflect students' capabilities to interpret real-life situations derived from texts, graphics, tables, and visuals presented in the assessments (Yıldız et al., 2019). In summary, reading comprehension encompasses not only the ability to read a text but also the ability to interpret figures, graphs, tables, and visuals.

Reading comprehension is a crucial component of science education and has become an essential skill highlighted in both national and international exams. Scientific texts are often dense and filled with specialized terminology, making it challenging for many students to comprehend them. Moreover, factors such as unfamiliar vocabulary and the multimodal structure of scientific writing—which includes text, diagrams, charts, visuals, formulas, and mathematics—can hinder students' learning and retention of scientific knowledge; consequently, students need support from their science teachers to effectively engage with and understand these texts (National Research Council, 2014). Therefore, developing students' reading comprehension skills is essential for helping them grasp complex scientific concepts and texts (van den Broek, 2010).

Reading comprehension-based instruction, which is an approach focused on helping students actively construct meaning from texts by using reading comprehension strategies, rather than passively absorbing information, can address the abovementioned challenges and enable students to better navigate complex scientific texts (Dole et al., 1991; Pearson & Cervetti, 2017). To teach reading comprehension skills, various reading comprehension strategies have been developed. Some of the frequently used strategies are questioning the text, rephrasing content, utilizing graphic organizers, drawing mind mapping, posing questions, visualization of text, and summarizing the text (Herman et al., 2010; Roman et al., 2016; Spörer et al., 2009). Herman et al. (2010) also suggest text annotation or text marking, such as underlining or circling important information, unknown vocabulary, and main ideas.

There are two main approaches in reading comprehension-based instruction: *strategies* and *content* approaches (Liang & Dole, 2006; McKeown et al., 2009). The *strategies approach*, focusing on understanding strategic cognitive processes, entails explicit instruction in specific methods for engaging with a text—such as summarizing, making inferences, and posing questions—while prompting students to reflect on their own thinking processes. In contrast, the *content approach* directs students' attention primarily to the meaning of the text, encouraging them to build mental representations of

ideas through discussion without overt guidance on reading strategies. Research shows that discussions focused on content often lead to more text-based dialogue, encourage longer responses from students, and can match or even exceed the effectiveness of strategy-focused instruction in terms of memory recall (McKeown et al., 2009). In this context, Liang and Dole (2006) present the *combined approach* that combines these two methods by teaching comprehension strategies while learning about a specific topic. Similarly, Duke et al. (2021) highlight the effectiveness of embedding strategy approach when applied in a context that builds content knowledge. Whichever approach is implemented, Dewitz et al. (2009) and Ortlieb and Norris (2012) state that teachers should explain strategies explicitly, use scaffolding methods, be role models, and think aloud while practicing these strategies.

Research suggests that elementary school students frequently perceive reading as tedious or challenging due to the numerous new concepts they encounter (Johnson & Zabrocky, 2011; National Research Council, 2014). This observation underscores the necessity of developing instructional strategies that involve teachers actively guiding these students in the acquisition and application of reading comprehension strategies. Such an approach is essential for enhancing reading comprehension skills and fostering reading among young learners. Research on reading comprehension highlights its importance across all disciplines, even decades ago. In the 80s, Adams (1980) stressed that its deficiency causes low performance in any discipline, and Bloom (1976) introduced reading comprehension as a generalized cognitive entry measure of his mastery learning theory and revealed its significant correlation with literature, science and mathematics. Further studies indicated a notable relationship between reading comprehension and academic achievement in science (e.g. Bayat et al., 2014; Cano et al., 2014; Karasu & Haşiloğlu, 2020; Reed et al., 2017). However, there is evidence of insufficient reading comprehension skills at the secondary school level. For example, Handayani et al. (2018) found that students' science-related reading skills were alarmingly low due to inadequate reading practice in the curriculum, particularly in Physics. Similarly, a study by Ozuru et al. (2009) in a Biology course, along with another study by Imam et al. (2014) in high school science courses, revealed that students exhibited weak reading comprehension skills and these deficiencies had a negative impact on their academic performance. These results highlight the necessity of introducing reading comprehension skills at an early age, particularly in primary education (Käsper et al., 2020).

In examining studies conducted in Türkiye, it is evident that reading comprehension skills are primarily linked to the Turkish language course (e.g. Anılan, 2004; Belet & Yaşar, 2007; Yılmaz, 2008), students' attitudes toward reading (e.g. Sallabaş, 2008; Ürün Karahan & Taşdan, 2015), reading anxiety (e.g. Esen Aygün, 2021; Katrancı & Kuşdemir, 2016; Türkben, 2020; Yamaç & Sezgin, 2018) and reading comprehension strategies (e.g. Bayram & Kanmaz, 2022; Tok & Beyazıt, 2007). Within the realm of science education, most research tends to be correlational, focusing on its relationship with science and mathematics scores on national or international exams (e.g. Bayat et al., 2014; Günaydın & Başaran, 2022; Karacaoğlu & Kasap, 2023) or achievement tests and scales (e.g. Durgun & Önder, 2019; Karasu & Haşiloğlu, 2020), while there is a noticeable lack of experimental studies (e.g. Koray & Çetinkılıç, 2020). This situation highlights the need for experimental research in this area, especially considering that the new 2024 curricula are skill-based. It is anticipated that practical studies in this area will provide essential guidance for educators and contribute significantly to the existing literature on science education in Türkiye.

Although studies show the benefits of reading comprehension-based instruction, research indicates that teachers in Türkiye often express concerns about the time constraints imposed by the intensive Science Curriculum, which hinder the implementation of any innovations (Avci et al., 2014; Elmas et al., 2014; Semercioğlu, 2025). The flipped learning model serves as an effective solution in this context. This approach encourages students to explore essential concepts at home through digital resources, thereby allowing classroom time to be dedicated to active participation, collaboration, and activities that foster higher-order thinking (Delanoy et al., 2024; Erbil, 2020; Tucker, 2012; Zeybek, 2021). This student-centered method not only enhances engagement and personalizes the learning experience but is also recognized as an effective form of blended learning (Erbil, 2020; Lo & Hew, 2017). Moreover,

research has shown that applying the flipped learning model in science education positively influences both students' academic achievement and their motivation (Al-Momani, 2022; Anjass et al., 2025; Delanoy et al., 2024).

In light of this information, it was hypothesized that a reading comprehension-based instruction supported by flipped learning model significantly improves learning and reading comprehension skills. To this end, a reading comprehension-based instructional design supported by flipped learning model was developed and implemented for the "Reproduction, Growth, and Development in Living Things" unit of the 7th-grade Science course. The objective was to evaluate the effects of teaching science through reading comprehension skills on students' learning and their reading comprehension abilities. The following research questions guided this study:

1. What is the effect of reading comprehension-based instruction supported by flipped learning model on learning?
 - a. Is there a significant difference between the experimental and control groups in terms of academic achievement?
 - b. How is the development of students' learning during the instruction according to the teacher's reflections?
2. What is the effect of reading comprehension-based instruction supported by flipped learning model on students' reading comprehension skills?
 - a. Is there a significant difference between the reading comprehension pre and post-test scores of students in the experimental group?
 - b. How is the development of students' reading comprehension skills during the instruction according to the teacher's reflections?
3. What are the students' opinions about reading comprehension-based instruction supported by flipped learning model in the Science course?

Methods

Research Design

Mixed method research that aims to elaborate and deepen research through qualitative and quantitative research approaches was used in the study. The research design was an embedded mixed design in which both qualitative and quantitative research methods are used, and one method is embedded in another method (Creswell & Plano Clark, 2017). In this study, qualitative methods are used as a supplementary stand to the main quasi-experimental design. The research process presented in Figure 1 consisted of three main stages: planning, implementation, and evaluation. During the planning and implementation stage, a reading comprehension-based instructional design was developed and implemented for four weeks (15 hours). The effectiveness of reading comprehension-based instruction in science teaching was evaluated during and after the implementation stage by conducting a quasi-experimental design with a control group and collecting both qualitative and quantitative data.

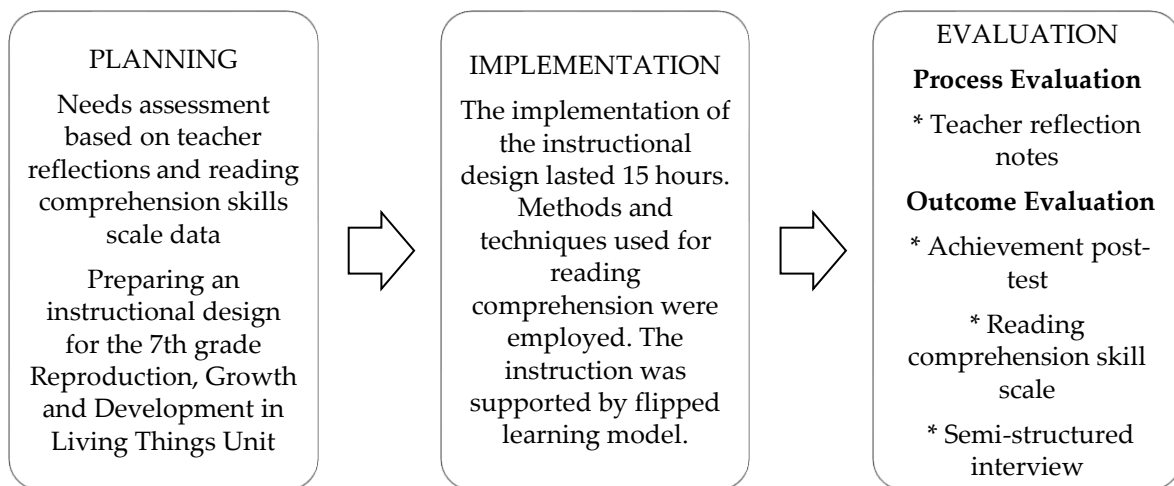


Figure 1. Research Process

Participants

The study utilized a convenient sampling method, which is an easy and quick way to reach participants (Patton, 2014). The study group comprised 67 7th-grade students from a boys-only public middle school in Istanbul and was conducted during the 2022-2023 academic year. There were two seventh-grade classes at the school. The names of the classes were written on pieces of paper, and one piece of paper was randomly selected to determine the experimental group. One class, designated as the control group, included 33 male students, while the other class, the experimental group, consisted of 34 male students. All students were aged 12 to 13 years. The students' academic achievement and socio-economic status were similar, and there were no students with special needs.

To evaluate the effectiveness of the teaching science based on reading comprehension skills, face-to-face interviews were also conducted with students selected through a criterion sampling method. The criteria for selection were being in the experimental group, actively participating in all lessons and class activities and being a volunteer. In this way, six students were selected for face-to-face interviews.

Procedure

The 2018 Science curriculum was in effect when this study was implemented. Initially, the 7th-grade Science Curriculum was examined to identify the topics and their durations. For the "Reproduction, Growth, and Development in Living Things" unit, a four-week (15 hours in total) reading comprehension-based instructional design was prepared based on a needs assessment, which was gathered through science teachers' reflections and the reading comprehension scale pre-test results. In designing instruction, the *combined* approach that integrates both strategy and content approaches was utilized. Two types of learning outcomes, one related to the Unit objectives in Science Curriculum and one related to reading comprehension skills were determined. Details regarding the four week-lesson flow are given in Table 1.

Table 1. Lesson Flow in the Experimental Group

Week	Hour	Learning Outcomes	Material	Teaching Methods/ Techniques and Reading Comprehension Strategies
1	1	Pretest and Introduction to Reading Comprehension Skills		
1	1	Reading comprehension skills: • Aware of the importance of reading comprehension skills • Text reading and comprehension • Inference making	In-class materials; • News on newspaper • Text about technological development in the TUBITAK Science and Child magazine • Text analysis worksheet	Teaching methods: • Discussion Reading comprehension strategies: • Text analysis • Underlining important parts and put asterisks etc. • Showing evidence based on scientific studies
2	2	• Explains the structures and organs that enable human reproduction by showing them on a diagram. • Explains the relationship between sperm, egg, zygote, embryo, fetus and baby. Reading comprehension skills: • Visual reading and comprehension • Text reading and comprehension • Inference making • Interpretation	Watching videos before class In-class materials; • Development Process worksheet • Reproductive System Diseases worksheet	Teaching methods: • Thinking aloud • Question and answer • Case study method Reading comprehension strategies: • Silent reading • Text analysis • Defining unknown words based on the text • Extracting information given in the text • Interpreting visuals • Making inferences from visuals
2	2	• Discusses the precautions that must be taken for the healthy development of the embryo, based on research data. Reading comprehension skills: • Table reading and comprehension • Graphics reading and comprehension • Interpretation	Watching videos before class In-class materials; • Birth statistics 2020 documents • Birth statistics worksheet	Teaching methods: • Thinking aloud • Question and answer • Discussion • Fishbone technique for problem solving Reading comprehension strategies: • Silent reading • Text analysis • Defining unknown words based on the text • Extracting information given in the text • Interpreting the table • Interpret data on the graphics • Relating verbal information with tabular and graphical data

Table 1. Continued

Week	Hour	Learning Outcomes	Material	Teaching Methods/ Techniques and Reading Comprehension Strategies
3	2	• Explain the process of sexual reproduction in plants. • Draws the growth cycle in plants. • Compares sexual reproduction in plants and animals. Reading comprehension skills: • Visual reading and comprehension • Text reading and comprehension • Classification • Inference making • Interpretation	Watching videos before class In-class materials; • Reproduction, Growth and Development in Flowering Plants worksheet • Reproduction, Growth and Development in Animals worksheet	Teaching methods: • Thinking aloud • Question and answer • Discussion Reading comprehension strategies: • Silent reading • Text analysis • Transform verbal expression into visual • Fill in the missing part logically • Interpreting the text • Creating a similar image by interpreting the given images • Classifying the given data
3	2	• Compares the types of reproduction in plants and animals. • Explains the growth and development processes in plants and animals by giving examples. • Explains the basic factors affecting growth and development in plants and animals. Reading comprehension skills: • Text reading and comprehension • Classification • Inference making • Interpretation	Watching videos before class In-class materials; • Asexual Reproduction Characteristics and Types worksheet • Genetic and Environmental Factors in the Growth of Living Things worksheet	Teaching methods: • Thinking aloud • Question and answer • Discussion • Brainstorming Reading comprehension strategies: • Silent reading • Text analysis • Filling in the missing part logically • Classifying the given data • Matching visual with verbal expression • Making inferences from the text
4	2	All objectives in the Unit Reading comprehension skills: • Text creation skills • Visual expression skill	• Group Work Performance Task Worksheet	Teaching methods: • Cooperative learning Reading comprehension strategies: • Collaborative reading • Text analysis • Creating a visual or text based on their readings
4	2	Presentation of performance tasks, general evaluation of course, and administration of post tests		

- **The first week:** As suggested by Ortlieb and Norris (2012), the lesson began by highlighting the importance and necessity of reading comprehension skills, along with explaining strategies that students could use to improve these skills. Following the guidance of Dewitz et al. (2009), the teacher served as a role model during this process.
- **Second-to-fourth weeks:** A flipped learning model was implemented, which shifts the traditional lecture format to at-home activities, allowing class time for hands-on activities (Talbert, 2017). This model ensured that students learned the basic concepts related to the subject before arriving in the classroom, providing ample time for studying science through reading comprehension skills in the class. All assignments were given to students for completion at home from the Education Science Network (EBA), an online learning platform for teachers and students in Türkiye. The teacher monitored students to ensure they watched videos or read presentations.

In the classroom, teaching methods and reading comprehension strategies proposed by the National Research Council (2014) and Herman et al. (2010), such as text analysis, in-class discussions, think aloud, cooperative learning, brainstorming, question-answer sessions, think-pair-share activities, silent reading, and mind mapping were employed. Worksheets were prepared in alignment with the teaching methods and reading comprehension strategies outlined for each session, as detailed in Table 1. Initially, these worksheets were guided by the teacher but later transitioned to activities involving both individual and group work. The worksheets including reading materials (texts, visuals, graphs, tables) were used for applying specific reading comprehension strategies, answering related questions and discussing answers. Each reading materials was designed to correspond with the topics and objectives in the Science Curriculum. Additionally, open-ended questions stimulating reading comprehension strategies were formulated based on the reading materials. The reading materials were developed from scientific sources, tailored to the students' proficiency levels, and underwent an expert review process. The reading materials and questions were evaluated by two science teachers: one with 20 years of experience and another who holds a master's degree in Curriculum and Instruction in terms of congruence with the objectives of the unit and scientific accuracy. A Turkish teacher also evaluated these worksheets in terms of readability and understandability.

In all lessons, students engaged in text analysis. During these analyses, they used various reading comprehension strategies, such as identifying the main idea, inferring cause-and-effect relationships, distinguishing between information that is included in the text and information that is not, and determining which statements are true or false based on the text. In some texts, students were also asked to classify, interpret, and infer the information presented, as suggested by Spörer et al. (2009). Additionally, they were encouraged to graph and visualize the information as recommended by Roman et al. (2016). Beyond written texts, tables, graphs, and visuals were utilized to enhance graphic and visual reading comprehension. After completing worksheets, students participated in discussions to share their responses. Through these class discussions, students were encouraged to express their thought processes and share the strategies they used to deepen their understanding.

In the fourth week, students were assigned a performance task. They were divided into groups of four or five and given the opportunity to choose a task that aligned with their interests. Options included writing a news article, composing poetry or a story, creating a concept map, or designing a cartoon. Each group was responsible for selecting a specific learning outcome they would use to complete their task and had to finish it within the allotted time.

- **The last week:** Each group presented their products to their classmates. Lastly, the reading comprehension-based instruction was evaluated in class.

Data collection

Reading Comprehension Skill Scale

A scale was developed by the researchers to measure students' reading comprehension skills such as making inferences about the text, analyzing relationships within it, integrating new information with prior knowledge, interpretation, create graphics and diagrams from a reading text, and visual, graph, table reading. It was initially used before implementation to prepare instructional design, and then it was applied as a pretest and posttest comparison to obtain information about the progress of students' reading comprehension skills. It consisted of 20 items graded on a 5-point Likert scale (1: never, 2: rarely, 3: sometimes, 4: often, 5: always). The scale items were reviewed by two experts for content validity and were evaluated by two students for their intelligibility, and revisions were made in line with their comments. Some of the items included in the scale are as follows: "I am able to divide the text into sections that are appropriate to its meaning.", "I am able to establish a relationship between text and graphics.", "I am able to predict how the text will continue." etc.

For the construct validity of the scale, the scale was administered to two groups: 102 students in the first and 105 students in the second study group. Exploratory Factor Analysis (EFA) was done with data obtained from the first study group. As a result of EFA, the KMO value was found to be .920, and Barlett's test was significant ($\chi^2=1585.592$ $p<.001$). This showed that the data set was suitable for factor analysis. As a result of the principal components analysis performed with Varimax rotation, it was seen that the one-factor structure was appropriate. The factor loadings ranged between .62 and .85, and the total variance explained was .58. The Cronbach-alpha value of this scale was .98. Afterwards, Confirmatory Factor Analysis (CFA) was conducted with the second study group data. The fit indices values obtained from CFA ($\chi^2/sd = 1.08 < 2$; RMSEA = .028 < .05; SRMR = .050 < .05; GFI = .958 > .95; CFI = .992 > .95; IFI = .992 > .95; NNFI = .998 > .95) showed that the one-factor model showed excellent fit (Byrne, 1998; Hu & Bentler, 1999; Tabachnick & Fidell, 2001). Cronbach-alpha value was .94, and item-total correlation values ranged between .47 and .77. As a result, the 20-item, 5-point Likert scale with a single factor was found to be valid and reliable (Büyüköztürk, 2024; Field, 2018).

Achievement Test

In this study, a skill-based achievement test related to "Reproduction, Growth, and Development in Living Things" unit was developed by three science teachers. While writing items, reading comprehension skills such as table reading and comprehension, visual reading and comprehension, text reading and comprehension, classification, inference-making, and interpretation skills were also taken into account, as well as the Unit objectives given in the Science Curriculum. For content validity, two science teachers reviewed the item-objective consistency, two science teachers checked item-skill coherence, one measurement and evaluation expert evaluated their suitability for measurement, and finally, two students evaluated the intelligibility of the questions. After making revisions based on their comments, the test was administered to 320 students. According to item analysis results, the difficulties of the items ranged between 0.21 and 0.86, indicating heterogeneity of the items' difficulties. The discrimination indices were calculated between 0.20 and 0.70. As acceptable value is higher than 0.30, the items with a discrimination index value between 0.20 and 0.30 were edited (Finch & French, 2019). The reliability of the final achievement test, KR-20, was found to be .75, which is acceptable (Nunnally & Bernstein, 1994).

Teacher Reflection Notes

These reflection notes were recorded by the teacher after each session regarding the lesson and the students' participation, performance, and reactions. It also consisted of the teacher's notes about students' progress on the worksheets.

Semi-structured Interview Form

A nine-question interview form was prepared by the researchers. The questions were about how students evaluate the science instruction based on reading comprehension skills and whether they can transfer reading comprehension strategies gained in this course to other courses and their lives. Opinions of experts in curriculum and instruction and science teaching were obtained, and some

probing questions were added. A pilot study was conducted with one student to get an idea about the duration, the clarity of the questions and the determination of the probing questions. The final form was used in the semi-structured individual interviews with students.

Data analysis

Data analysis was conducted separately for quantitative and qualitative data. To evaluate whether significant differences existed between the control and experimental groups regarding achievement test scores, an independent samples t-test was employed. Additionally, a dependent samples t-test was used to assess the differences between reading comprehension pre-test and post-test scores within the experimental group. Before the analyses, the normality assumption was checked. For the reading comprehension scale, the results of skewness, kurtosis, and the Shapiro-Wilk test were .319, .010, and .984 ($p > .05$) for the pre-test, and .048, -.013, and .975 ($p > .05$) for the post-test. Concerning the achievement test, the values obtained were .518, -.123, and .957 ($p > .05$) for the control group and -1.917, .551, and .918 ($p < .05$) for the experimental group. It is notable that the Shapiro-Wilk test yielded significant results solely for the achievement test scores of the experimental group; however, all skewness and kurtosis values remained within the acceptable range of -1 to 1 (Büyüköztürk et al., 2014). Consequently, it was determined that the normality assumption was satisfied. Furthermore, the independent samples t-test met the assumption of equality of variances as indicated by Levene's test result ($F = .552$, $p > .05$).

The qualitative data obtained from semi-structured interviews were subjected to analysis using content analysis. This method allows for a comprehensive and deep examination of the data (Bryman, 2016). During this process, the interviews were transcribed and subsequently coded utilizing open coding. The interrelationships among these codes were then established through axial coding, leading to the formation of categories from which overarching themes were extracted. A sample of this analysis is presented in Table 2. Additionally, the teacher's reflective notes were examined through descriptive analysis.

Table 2. Sample table of content analysis

Data	Code	Category	Theme
S4: Previously, you were writing on the board and we were writing in the notebook, and there were many unknown words/terms. But when those terms were given in the text, it was better understood and become more permanent in my mind.	Better understanding Permanent learning	Effective learning	Contribution to cognitive development
S4: The preliminary work we did before coming to class was effective, and success increased when we came to class ready.	Coming to class prepared		
S1: Since reading books allows our brain to think more, our vocabulary improves and we can speak better. The best part was that our vocabulary improved first.	Vocabulary improvement Effective communication	Social skills	Contribution to social-emotion development
S2: Long-text skill-based questions were scary. Now I understand and I can do them. My fear passed and my interest increased.	Increased academic self-efficacy Reduced test anxiety Increased interest in solving questions	Increase in academic attitudes	

Table 2. Continued

Data	Code	Category	Theme
S3: Active brainstorming created a fun and curious environment.	Brainstorming Fun environment Curious environment	Active learning methods Positive learning environment	Teaching- learning process
S3: ...We learned a lot from the questions and answers in the discussion environment....	Question-answer Discussion	Active learning methods	
S4: I think the time was short. It was not enough to analyze and discuss the texts. It wasn't enough for you to talk longer either.	More time for activities	Duration	Recommendation

Internal and External Validity

Both qualitative and quantitative data were collected to ensure triangulation. Expert opinions were taken in all steps of the study. Content validity was ensured through a pilot study and expert opinions. One of the researchers entered both groups as a teacher to prevent the teacher effect. The transferability of the study was strengthened by presenting a thick description of the methodology.

Ethical Issues

Ethical considerations were taken into account during interviews. For the students to feel safe, interviews were held in a quiet environment. To eliminate the impact of possible grading anxiety among participants, interviews were conducted after the grading process. Students were allowed to express themselves impartially. In addition, information about the experimental process was given to the students and their parents in detail, and their informed consent was obtained. In the presentation of qualitative data, student names were kept confidential and coded as S1...S6. An approval from the Ethical Committee indicating that the research is following ethical rules was also obtained.

Results

Findings regarding The Effect of Reading Comprehension Skill-Based Instruction on Learning

At the end of the implementation, an achievement test for the "Reproduction, Growth, and Development in Living Organisms" unit, was administered to both the experimental and control groups. In order to answer research question related to the sub-objective of the effect of reading comprehension-based instruction on students' learning, the difference between groups was compared by independent samples t-test. The findings are presented in Table 3.

Table 3. Independent sample t-test results

Groups	<i>n</i>	$\bar{X}$	<i>ss</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>Cohen's d</i>
Experiment	34	14.794	3.023	4.314	65	<.001*	1.054
Control	33	11.879	2.472				

* $p < .05$

According to Table 3, the mean score of the experimental group on the achievement test ($\bar{X}$ = 14.51) was higher than the mean score of the control group ($\bar{X}$ = 11.88). Independent samples t-test showed a significant difference in favor of the experimental group ($t = 4.314$, $p < .05$). Additionally, the effect size, Cohen's $d = 1.054$, indicated that the instruction has a large effect (Cohen, 1988) on achievement. In other words, students who were exposed to reading comprehension-based instruction attained the objectives significantly better than those who did not.

According to the teacher's notes, having students come to class prepared by watching videos and reading texts facilitated the use of time in class efficiently for applying a variety of teaching methods

to acquire the Science Curriculum objectives. Techniques such as brainstorming, think-pair-share, and frequent use of large group discussions in the classroom allowed students to pose questions about anything they didn't understand or were curious about. This enabled the unit to be presented in a rich, detailed manner, reflecting various perspectives and highlighting its relevance to everyday life. As a result, students had the chance to learn the unit comprehensively. The students' questions posed during discussions, and the products students created throughout the unit showed their progress in learning in a variety of ways. Examples of student products about the topic of reproduction from the "Reproduction, Growth, and Development in Living Organisms" unit are presented in Table 4.

Table 4. Students' products

	An example of a poem written by students about reproduction	Example of a newspaper article written by students about reproduction in plants
Turkish-original version	Kimi canlı tek şekilde, Kimisi ise çeşit çeşit ürer. Bitkiler ürer ister tohumla ister dalla, Hayvanlar ürer ister içte ister dışta. Kimisi bakar yavrusuna, yedirir, korur, Kimisi bilmez, kendi yavrusunu yer. Hepsi küçük başlar yola büyür, gelişir, Ama bazıları bar başkalaşır da gelişir. İşte böyledir canlılık, Yoktur tek bir yol hayatta kalmak için.	"ŞOK! ŞOK! ŞOK! Bitkiler çift cinsiyetliymiş! Botanikçilerin yapmış olduğu araştırmalar neticesinde bitkilerin dişi veya erkek olabileceği gibi hem dişi hem de erkek üreme organlarını beraber taşıyabilecekleri kanıtlanmıştır. Bu tip bitkilere tam çiçek denirken, tek cinsiyetli olanlar kusurlu çiçek olarak adlandırılmıştır. Aman diyelim, insanlara da kusurlu sıfatı ilerleyen yıllarda kullanılsın."
English-translated version	Some living things reproduce in a single way, Some reproduce in various ways. Plants reproduce by seed or by branches, Animals reproduce both internally and externally. Some care for their young, feed them, and protect them, Some, unaware, eat their own young. All start small and grow and develop along the way, But some become different and develop as well. This is how life is. There is no single path to survival.	SHOCKING! SHOCKING! SHOCKING! Plants are hermaphrodites! As a result of studies conducted by botanists, it has been proven that plants can be either male or female, or they can carry both male and female reproductive organs at the same time. Such plants are called perfect flowers , while those with only one sex organ are referred to as imperfect flowers . Just a heads-up — let's hope the term "imperfect" won't be used for humans in the years to come!

The poem given in Table 4 shows that students learned about sexual and asexual reproduction, internal and external fertilization, metamorphosis, and the existence of organisms capable of multiple reproductive methods. Another example of a newspaper article written by students about reproduction in plants in Table 4 indicates that students acquired knowledge about the reproductive organs of plants. The slogans created by students to promote healthy development are as follows: "Mother, stay healthy so your baby can be healthy too." and "Remember, harmful foods, radiation, and chemicals are your enemies!". These slogans suggest that students were able to gain knowledge about maternal and infant health and concisely summarize this understanding.

The visuals of the cartoons created by the students on the subject of reproduction in humans are given in Figure 2. In these cartoons, it is seen that students acquired the knowledge of metamorphosis, external fertilization and reproduction by division. As can be seen from these studies, students not only acquired information but also were able to produce different products by interpreting them.

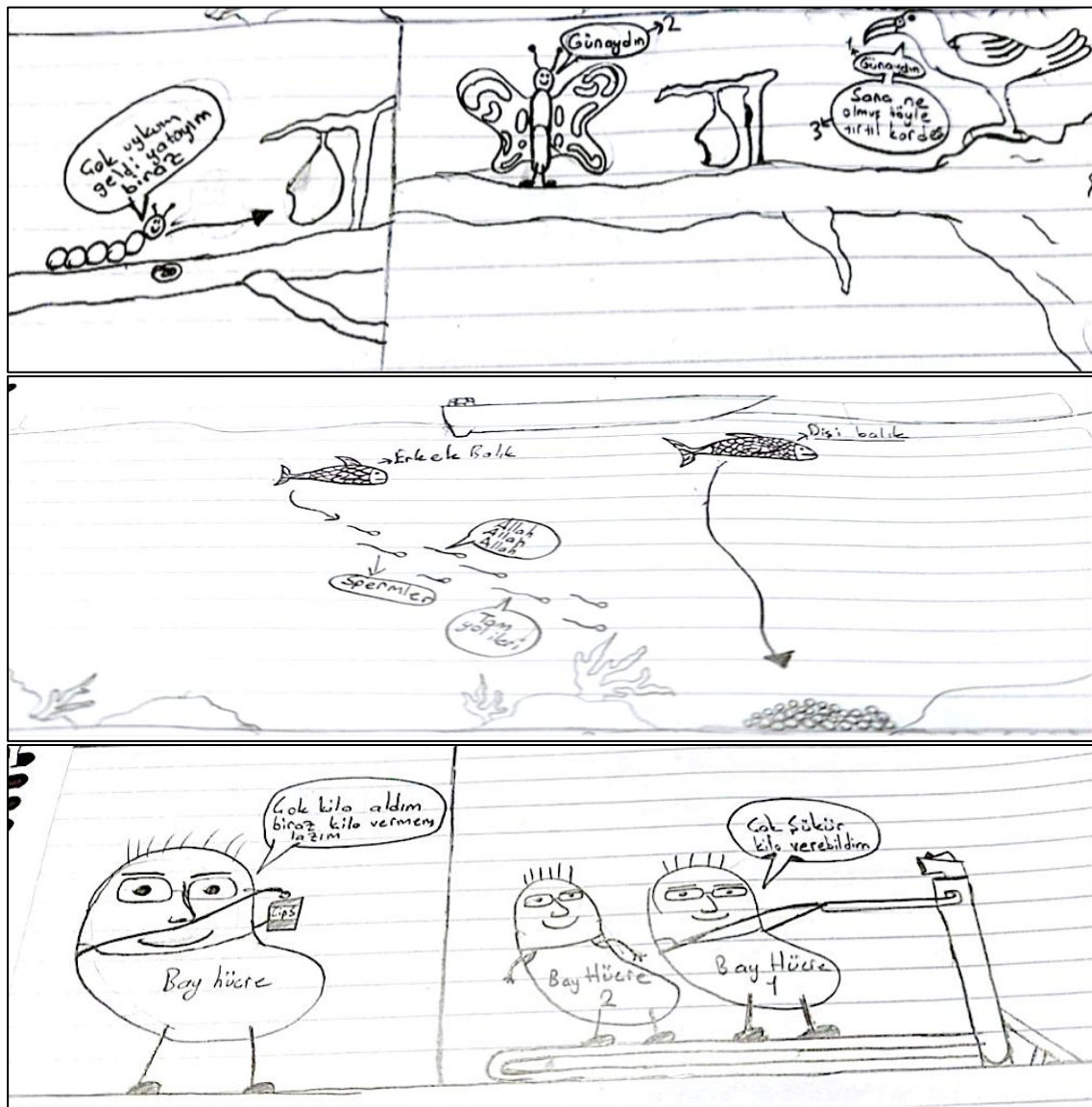


Figure 2. Examples of cartoons on human reproduction

Findings regarding The Effect of Reading Comprehension Skill-Based Instruction on Students' Reading Comprehension Skills

Before the implementation, the reading comprehension skills scale was administered to the students for needs analysis. Moreover, this data was utilized as a pretest and at the end of the implementation, this scale was administered as a posttest. To answer research question related to the effect of reading comprehension-based instruction on students' reading comprehension skills, a dependent sample t-test was conducted, and the results are presented in Table 5.

Table 5. Dependent sample t-test results

Group	Posttest		Pretest		t	p	Cohen's d
	$\bar{X}$	ss	$\bar{X}$	ss			
Experiment	68.5	6.146	43.5	7.597	21.585	.000*	3.502

*p<.05

As it can be seen from Table 5, the analysis results indicated a significant improvement in reading comprehension skills ($t = 21.585$, $p < .05$). The effect size, measured by Cohen's $d = 3.502$, demonstrated a positive and huge impact of the instruction on students' development, following Cohen's (1988) criteria.

Table 6. Codes and categories related to the theme of contribution to cognitive development

Theme	Category	Code
Contribution to cognitive development	Improvement in reading comprehension skills and strategies	Identify important place in text
		Guessing the unknown word
		Converting written text to visual
		Convert table to text
		Predicting the meaning of unknown words
		Associating information within the text
		Making inferences
		Interpretating
		Analyzing
		Predicting
	Effective learning	Better understanding
		Permanent learning
		Understanding exam questions
		Coming to class prepared
		Becoming successful
	Learning new information	Relating to existing knowledge and experience
		Obtaining information about daily life
		Accessing scientific information not in the book
	Transfer of knowledge and skills	Use reading strategies in courses other than science
		Ability to transfer to daily life

As can be seen from Table 6, students have reported notable cognitive developments in both reading comprehension and science learning. They indicated enhancements in their reading comprehension strategies, which include the capacity to infer the meanings of unfamiliar words, identify key points, and transform written texts into visual representations or convert tables into written formats. Some students indicated that they used these skills in other courses. Interviews highlighted that the utilization of these strategies also contributed to improvement of analyze, inference, interpretation and prediction skills among students. Students underscored that the acquisition of reading comprehension strategies has resulted in a better understanding of topic and exam questions, academic success and more enduring learning. They noted that arriving in class prepared by engaging with instructional videos assigned by the teacher significantly enhanced their academic performance and facilitated their recognition of key components of the material during class sessions. In terms of scientific learning outcomes, they stated that they gained valuable knowledge concerning various diseases and the anatomical structures of plants. They articulated that they were able to relate their newly acquired knowledge to prior information and experiences. Furthermore, they indicated that their understanding of plant structures could be effectively applied in rural contexts.

"S1: My skills have improved with this lesson. When we read the text and answered the questions in every lesson, our skills improved. For example, while I could not answer the questions well in the first text study, I got better in the last text study. I learned some strategies. First, I read the question then I read the text and underlined them. I try to guess the words I don't know if they are not proper nouns. Now, questions with text are easier."

"S4: I used to forget what I read, but in this lesson, we were constantly exposed, we read, we discussed, and thus the retention rate increased. The preliminary studies we did before coming to the lesson were effective, and my success increased when I came to the lesson ready. I can identify important points more easily now. I had difficulty in determining the subject and main idea of the reading texts. For example, I had difficulty in setting up equations in equation questions. After this study, I realized that I could do it more easily in both Turkish and mathematics. When the functions of organs are written in the form of notes, they remain memorized, but when they are given about the text, it is easier to understand and easier to relate them. We practiced making inferences and interpretations."

"S3: If you were to give a simple lecture, you would only tell us the things on the exams. After this study, I started to make fewer mistakes in the skill-based book. But now what I read started to retain in my mind. We analyzed what we read and discussed the questions. We learned what we should pay attention to, so the parts that we need to keep in mind remain in our minds, and I can solve the questions with a single reading."

"S4: The preliminary work we did before coming to the lesson was effective, and my success increased when I came to the lesson ready. I can identify important places more easily now."

Theme 2. Contribution to social-emotional development

Interview results showed that the instruction aimed at improving reading comprehension skills resulted not only in cognitive gains but also contributed to the social-emotional development of the students. Table 7 shows the categories and codes related to the contribution to social-emotional development.

Table 7. Codes and categories related to the theme of contribution to social-emotional development

Theme	Category	Code
Contribution to social-emotional development	Awareness of reading comprehension	Aware of its impact on understanding the question posed
		Aware of its impact on solving exam questions
		Aware of its impact on understanding what is listened
		Aware of its impact on understanding the books you read
	Increase in academic attitudes	Reduced exam anxiety
		Increased academic self-efficacy
		Increased interest in solving questions
		Motivated to learn
		Enjoy the lesson
		Positive attitude towards the course
	Improvement in social skills	Socialization
		Effective communication
		Vocabulary development
		Participate in different conversations
		Effective listening

As can be seen from Table 7, students reported an increased awareness of the importance of reading comprehension in both academic and social contexts. Academically, they recognized the significance of understanding the questions posed in lessons and in exams to answer them correctly. They realized that they did not fully grasp the books they read or the conversations they had before, which underscored the value of reading comprehension in their interactions with others. Furthermore, students indicated a reduction in exam anxiety, attributing this to their enhanced understanding of both the course material and the questions they faced. Their interest in problem-solving, motivation to learn, and overall attitudes toward the course improved as a result. Additionally, they noted that active teaching methods, such as group work and discussions, made them more socially engaged. These methods encouraged greater participation in class activities, as well as improved listening and speaking skills. One student specifically mentioned that their vocabulary expansion contributed to better communication skills, particularly in speaking.

"S2: I thought I understood what I was reading, but I realized that I did not, I noticed the points I missed. My awareness has improved."

"S6: We have HSEE ahead of us, and 2/3 of this exam is reading comprehension. If you don't understand the text, if you don't understand the question, you can't solve the question, so it was useful to be successful in that exam, it was a skill that had to be learned"

"S5: Your activities were interesting. This activity made me like it."

"S3: Group work and discussions socialized me, and this increased my love."

"S1: Since reading books allows our brain to think more, our vocabulary improves, and we can speak better. The best part was that our vocabulary improved first..."

Theme 3. Teaching-learning process

Regarding the teaching-learning process of reading comprehension-based instruction, students' opinions were classified under three categories: active learning methods, positive learning environment and instructional materials. The codes and categories obtained are given in Table 8.

Table 8. Codes and categories related to the teaching-learning process theme

Theme	Category	Code
Teaching - learning process	Active learning methods	Brainstorming
		Discussion
		Group activities
		Question and answer
	Positive learning environment	Fun environment
		Curious environment
		Diversity of methods and materials
		Active participation
		Attracting attention
	Effective instructional materials	Articles with different information from book
		Texts about current life
		Attractive
		Diversity

The codes presented in Table 8 indicated that students highlighted that brainstorming, discussion, group work, and question-and-answer methods used in the class were highly effective, leading to their active participation in the lessons. They reported that this active engagement created a positive learning environment, enhanced by various activities and materials that fostered curiosity and made learning enjoyable. It is clear that this supportive atmosphere significantly impacted their learning, skill development, and attitudes toward the course. Furthermore, students mentioned that the information in the provided materials was current and interesting, which contributed to the overall effectiveness of the learning process.

"S5: ... It was not a boring, classical lesson anymore. We both solved questions and had fun, so I think it was useful, and my success improved."

"S3: If you have a simple lesson, you would only tell us the things that appear in the exams. But the fact that we came with the knowledge of the subject because we had studied it beforehand gave you time to share the thoughts of scientists with us in this study, and we learned."

"S1: The papers were interesting. There was information on the paper that was not in the book. There were two sources."

"S2: We were reading texts every lesson, but we were turning them into different activities. We were either drawing, interpreting graphics or discussing. Especially in the last activity, we had a lot of fun together. I came wondering about the text of the next lesson, and I saw things that there were not in school or test books."

Theme 4. Suggestions

Although students indicated that this course improved their reading comprehension skills and enhanced their overall learning, they also provided suggestions for making the instruction more effective and efficient. The codes and categories obtained in this context are presented in Table 9.

Table 9. Codes and categories related to the suggestions theme

Theme	Category	Code
Suggestions	Duration	More time for activities
		Interdisciplinary approach
	Activities	Cooperative learning
		Drama
		More read aloud
	Materials	Material with more different information
		Material with more discussion questions

Suggestions given in Table 9 show that according to students, the duration of the sessions was insufficient, indicating a preference for extended discussions and additional time dedicated to the development of reading comprehension skills. Moreover, they proposed the implementation of an interdisciplinary approach to enhance these skills, suggesting the integration of reading comprehension with mathematics instruction. Additionally, students recommended the incorporation of diverse teaching methods related to reading comprehension, such as drama, collaborative learning, and strategies that involve reading aloud with emphasis to facilitate the understanding of key concepts. They acknowledged that the materials provided information not typically found in school textbooks, but they also articulated a desire for an even greater variety of content. Furthermore, they advocated for an increase in the number of questions posed during discussions to deepen engagement and enrich the overall learning experience.

"S6: It would have been better if there was a study that included other subjects. It could have been a text in which numbers could be included in different subjects. We could have been more active. For example, we could have written like a drama, and we could have played it. It could have been more understandable when it was active. I think the last group work was very good, and more work like that could have been done."

"S5: We learned from the information on the paper there were interesting texts, and they were memorable. There could have been more questions related to the texts, questions that would lead to different discussions."

On the other hand, it was also stated that in-class discussions can sometimes distract attention and cause disengagement from the subject. For this reason, one of the students, who was easily distracted, suggested that the lesson should be taught and summarized by the teacher.

"S2: The bad thing is that you do not have time to explain, so it can be difficult to understand. Our work may be insufficient. Even if you explain after the text, we cannot catch the integrity...I needed it to be explained holistically by you."

Discussions

This study was conducted to evaluate the effects of reading comprehension-based instruction supported by flipped learning model in the 7th-grade Science curriculum, specifically in the unit on "Reproduction, Growth, and Development in Living Organisms." The findings indicated that the reading comprehension-based instruction supported by flipped learning not only contributed to the attainment of the unit objectives but also improved their reading comprehension skills. The academic success of students in the class where reading comprehension skills were embedded was significantly higher than that of students in the class with traditional teaching methods. Additionally, teacher's reflection notes and student products demonstrated that learners could showcase their understanding in various ways. Indeed, students' opinions gathered through interviews also supported these results and also provided insight underlying them.

Numerous studies have convincingly demonstrated a strong link between students' academic success in science and their reading comprehension skills (Akbaşlı et al., 2016; Baştuğ, 2014; Bayat et al., 2014; Cano et al., 2014; Imam et al., 2014; Karasu & Haşıloğlu, 2020; Meneses et al., 2018; Reed et al., 2017). Engaging students in reading comprehension activities that utilize scientific texts, combined with

the strategies highlighted in this study, can effectively boost student performance, not only in science but across all verbal-content subjects (Holliday & Cain, 2012). This approach is crucial because it has been shown that understanding scientific texts is often more difficult than interpreting non-scientific ones (Cromley et al., 2010; Handayani et al., 2018; Johnson & Zabrocky, 2011). In this context, Fang (2006) points out that as students transition from elementary to middle school, they shift from “learning to read” with the language of ordinary life to “reading to learn” through expository language found in the curriculum. This shift can lead to significant linguistic challenges for students encountering middle school science texts. Moreover, Fang emphasizes the vital connection between reading comprehension skills and scientific process skills, suggesting that mastering reading comprehension skills is key to achieving greater academic success in science classes. Consequently, as this study has demonstrated, it can be inferred that the implementation of reading comprehension strategies enhances the clarity of scientific texts, thereby facilitating the learning process.

Reading comprehension encompasses more than vocabulary knowledge, fluent reading, and awareness of the topic; it also involves the ability to relate information to personal experiences, make inferences, interpret, classify, and summarize (Lyon, 1998; McCarthy & Yan, 2024). In this study, the findings indicate that the positive effects of the implemented instruction extend beyond academic success to also encompass enhancements in reading comprehension skills. Students indicated improvement in their reading comprehension skills, including visual, text, and table reading, converting table to text and vice versa, and making inferences, interpretations and predictions. There are also studies indicating that the strategies used in teaching reading comprehension effectively enhance these skills. Kanmaz (2012) conducted a study in a Turkish language course aimed at improving reading comprehension and unveiled that students acquired and retained this skill. Furthermore, students reported that they applied the strategies in other subjects, indicating that they were able to transfer these strategies. Obalı (2009) also demonstrated that students who used reading comprehension skills in Turkish and Mathematics were able to transfer these skills to comprehend reading in science.

This study underscores that, in addition to promoting cognitive development, enhancing academic achievement, and improving reading comprehension skills, reading comprehension-based instruction significantly contributes to students' social-emotional development. Research by Sparapani et al. (2018) indicates a noteworthy correlation between social-emotional skills and reading proficiency. Participants in this study articulated the multifaceted benefits of reading comprehension instruction on their overall growth, particularly highlighting enhancements in their social skills, such as listening and communication abilities. In this context, Epçaçan (2018) points out that the cultivation of reading comprehension skills not only improves language use and self-expression but also enhances the ability to understand oral communication and appreciate diverse perspectives. Another significant finding indicates that although students may initially believe they possess a strong understanding of the material they read or hear, their experiences during instruction focused on reading comprehension reveal that their actual comprehension was not as robust as they initially perceived. This reflects an increase in their self-awareness, aligning with literature that supports the notion that reading comprehension skills contribute to enhanced self-awareness (Fisher & Frey, 2014; Kanmaz, 2012). In this regard, Bandura (1997) further explained that individuals who possess strong reading comprehension skills tend to evaluate their self-efficacy more effectively. Additionally, responses from students revealed that instruction focused on reading comprehension decreased exam anxiety, increased academic self-efficacy, stimulated interest in problem-solving, motivated them to learn, and encouraged active participation in class activities. These behaviors that foster a desire for learning among students serve as indicators of academic motivation (Long et al., 2007). This motivation is one of the underlying factors elucidating the reason for students' positive attitudes toward their courses or school (Gülle, 2021), as demonstrated in the current study. According to the students' responses, their academic motivation increased because they could understand what they read and successfully solved the questions by using reading comprehension strategies. This demonstrates positive improvement in students' perception regarding their self-efficacy, defined as individuals' judgments about their potential to succeed or fail (Bandura & National Inst. of Mental Health, 1986). Self-efficacy significantly

influences students' effort in various activities, their perseverance, their interest, and ultimately their success (Schunk & DiBenedetto, 2020); and therefore, possessing high self-efficacy results in rise in academic motivation (Haidari et al., 2023; Li et al., 2024).

Students have also shared their opinions regarding the teaching-learning process of reading comprehension-based instruction. They expressed that the learning environment was engaging due to active teaching methods, diverse materials, and the use of various texts. Specifically, methods and techniques such as question-and-answer sessions, brainstorming, discussions, think aloud and group work were emphasized as underlying reason for active participation. The findings show that these methods contributing to a positive teaching environment enhanced students' learning, reading comprehension, and affective skills. Similar results are evident in the literature, indicating that active teaching methods, such as brainstorming, question-and-answer, discussions, and group work, positively contribute to reading comprehension skills (Galimpin, 2024; Ghabanchi & Behrooznia, 2014; Jalilifar, 2010; Syamsir et al., 2021). Regarding question-and-answer technique, which was used in all lessons, it is stated that its use for texts in the Science curriculum can impact both reading comprehension and academic achievement (Gudelos, 2023; Kinniburgh & Shaw, 2009). Another reading strategies employed in this study was think-aloud reading; each reading text was approached first through silent reading, followed by think-aloud activities. Similarly, studies conducting think-aloud analyses on texts showed its positive impact on the development of students' reading comprehension skills (Kucan & Beck, 1997; Kumar & Dhar, 2023).

Furthermore, it is important to acknowledge that the implementation of the flipped learning model has contributed to the abovementioned favorable results associated with reading comprehension-based instruction. The primary objective of benefitting from this model was to allocate sufficient time for effective reading comprehension instruction, particularly given the curriculum's demanding content. The findings showed that the model allowed educators to utilize classroom time more efficiently, while prior preparation by students facilitated enhanced focus and comprehension during lessons. Existing literature also underscores several advantages of the flipped learning model, including increased time for engaging in tasks, improved classroom interaction, and the promotion of active, deeper learning (Horn, 2013; McLean et al., 2016; Michaelsen, 2020). Empirical research further reinforces that this instructional approach positively impacts students' attitudes toward the classroom environment, boosts motivation, and contributes to overall academic achievement (Alsancak Sirakaya, 2015; Duman, 2019; Kaya, 2018).

The students interviewed not only recognized the value of reading comprehension-based instruction in science but also proposed several recommendations to enhance the effectiveness of the course. They particularly stressed the importance of allocating additional time for various activities. Furthermore, they call for more reading materials and more diverse activities such as read-aloud sessions, drama, and interdisciplinary approaches. This demand signifies their motivation to learn and their favorable disposition towards reading comprehension-based instruction.

The findings from this study suggest that reading comprehension-based instruction, supported by the flipped learning model in science, can enhance the holistic development of students across academic, cognitive, social, and emotional dimensions. Furthermore, it has a positive impact on the overall teaching and learning processes. However, it is important to acknowledge certain limitations regarding the generalization of these results. This research was conducted in a boys-only middle school setting, which indicates that testing this approach in mixed-gender or girls-only schools would be beneficial for the generalization of the findings and enabling a comparative analysis between genders. Additionally, this study examines only a single unit within the 7th grade Science curriculum. Therefore, implementing this methodology on a larger scale is essential for a more comprehensive investigation of its effects and outcomes. In response to the feedback provided by students, it is recommended that future researchers consider conducting this study across multiple subjects simultaneously and enriching the educational experience with diverse activities, such as drama. This approach could further enhance the learning environment and outcomes for students. The results of this study, in conjunction

with relevant literature, underscore the necessity of disseminating reading comprehension-based instruction beyond the realm of science to other academic disciplines. Additionally, the adoption of a flipped learning model may be proposed to create more time for reading comprehension tasks. In this context, the development of pre-service or in-service teacher training programs, as well as guidebooks, could be instrumental in establishing instruction that incorporates reading comprehension-based instruction and the suggested activities. These resources would empower educators to utilize methods and techniques that effectively support the enhancement of reading comprehension skills across various subjects.

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Adjustment map of secondary schools in Türkiye: examining the adjustment of secondary school students to school in terms of gender, class and region *

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Abstract

The aim of this study is to examine the school adjustment of middle school students in Türkiye based on gender, class and region. The population of the research consists of secondary school students studying in public schools in Türkiye. The sample consists of 26,962 students selected from 24 provinces and 104 schools, representing 12 regions according to Türkiye's NUTS. The School Adjustment Scale for Secondary School Students developed by Gençtanırım Kurt et al. (2023) was used to measure the adjustment of secondary school students to school. Factorial ANOVA was applied to the comparisons made by taking into account the gender, grade level and region of residence of the secondary school students. Data analysis was carried out with the Jamovi statistical package program. The results of the research revealed that secondary school students' total school adjustment scores and the academic, social and behavioral adjustment scores, which are the sub-dimensions of school adjustment, showed significant differences according to gender, grade level and statistical regions. Accordingly, the highest average in terms of academic adjustment dimension is in the

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Northeastern Anatolia Region; the lowest average is in the Eastern Marmara Region; the highest average in the social adjustment dimension is in the Western Black Sea Region; the lowest average is in the Central Anatolia Region; it was determined that the highest average in the behavioral adjustment dimension was in the Western Anatolia Region and the lowest average was in the Istanbul Region. When looked at by region in terms of school adjustment total scores, it is seen that the highest average is in the Northeastern Anatolia Region and the lowest average is in the Western Marmara Region. To reduce these disparities, it is recommended to expand psychosocial support programs for students, particularly in regions with low levels of adjustment, and to strengthen the training processes of teachers so that they can develop sensitive and inclusive educational strategies for students.

Introduction

In accordance with the current legislation in Türkiye, 12 years of compulsory education — covering primary, secondary, and high school levels, ensures that most children between the ages of 6-18 are included in the education system, thereby offering equal educational opportunities for all. The secondary school level, which often covers the age range of 10-14, constitutes the second stage of compulsory education and covers the transition from primary school to high school. This process is considered as a critical period in which students form their academic identity and shape their future educational life (National Middle School Association [NMSA], 2003). At this level, 5,524,117 students are studying in a total of 18,907 educational institutions and 32.5% of the students attending compulsory education are secondary school students (Ministry of National Education [MoNE], 2023). These figures provide a significant indicator of the scope and prevalence of lower secondary education.

Secondary school students, who are often between the ages of 10-14, make critical and complex choices that shape their lives to a large extent during this period. Secondary school period plays an important role in students' social, emotional and career development. In this period, children's personality formation and social-emotional development accelerate, while their career expectations begin to take shape (Gökdeniz, 2008; Oğuz Duran & Kaya Memiş, 2017). Students attempt to adjust to the school environment as a reflection of their academic and career development. In this process, which progresses with the difficulties brought by adolescence, the fact that secondary school has different characteristics from primary school and the difficulties adolescents experience in meeting their needs can lead to various problems including academic failure, violence, bullying or other behavioral issues as well as school adjustment problems (Kingery et al., 2011). In this context, it is important to focus on the causes of the difficulties experienced by students in the process of school adjustment in order to formulate educational policies. Therefore, the concept of 'school adjustment', described as a multidimensional phenomenon involving the match between the expectations of the educational environment and the student's ability to meet these expectations, becomes remarkable (Craighead & Nemeoff, 2001).

School Adjustment in Secondary School

Examining school adjustment in secondary school is essential for understanding the challenges mentioned above and for developing effective solutions. This is because middle school is a **critical period** when children are at risk of disengaging from education (OECD, 2021). It is also a stage during which problem behaviors—such as smoking, alcohol and substance use, and antisocial conduct—emerge and increase (Jessor, 1998), often leading to socially and developmentally undesirable outcomes. Furthermore, this period is associated with elevated levels of depressive symptoms and school-related difficulties (Fite et al., 2019). Given these challenges, focusing on studies related to school adjustment during middle school is considered significant in the literature. Supporting students' adjustment to

school should be a priority during this phase, as such adjustment positively influences both their academic achievement (Rydell Altermatt, 2011) and psychosocial well-being (Park & Kang, 2011).

When the studies conducted in Türkiye on school adjustment are analysed; it is seen that it is mostly focused on pre-school (Arabacıoğlu & Bağçeli Kahraman, 2021; Çelik, 2021; Erten, 2012; Gülay, 2011; Gülay & Erten, 2011; Gökteş & Gülay-Ogelman, 2019; Güler, 2016; Kar, 2022; Şebitçi Sarıbaş & Gültekin Akduman, 2019; Yalçın, 2016) and primary school period (Demirtaş-Zorbaz & Ergene, 2019; Kurtuluş Çalışkan & Canbulat, 2023; Özaslan & Baba-Öztürk, 2022; Özer et al, 2022; Temel & Sapsağlam, 2018; Yoleri & Tanış, 2014). In contrast, relatively fewer studies have been conducted with high school students (Aslan & Küçük, 2022; Durnalı et al., 2018; Kaynak, 2021; Makas, 2020; Makas & Düşünceli, 2021; Özbilen et al., 2018), while recent years have seen increasing interest in adjustment during higher education (Avcı, 2019; Erzen, 2018; Karakuş & Akay, 2020; Öktem, 2023; Savaşan & Meriç, 2021). Although research has largely concentrated on early educational levels, school adjustment in middle school—an important transitional period with unique academic and developmental challenges—has received limited scholarly attention (Demirkalp Kaya, 2022; Gençtanırım Kurt, 2022; Usta et al., 2021).

In recent years, it is observed that studies have been carried out by MoNE in Türkiye to support the school adjustment of first-grade students, especially in the transition phase (MoNE, 2024), and when it comes to school adjustment, orientation services offered to new students are emphasised. In the literature, the transition to secondary school is accepted as a period of increased risk for students' academic, behavioural and social adjustment difficulties (Dawes et al., 2021). At the same time, it has been observed that the transition from primary to secondary school causes significant decreases in academic achievement and this effect continues in the following grade levels (Rockoff & Lockwood, 2010). For this reason, school adjustment studies are considered necessary not only for students in transition but also for all students in the education system to ensure their emotional, social and cognitive development and to increase their academic success. At this point, there is a need for a comprehensive and accurate definition of the concept of school adjustment, which has a complex structure (Reich & Flanagan, 2010). Tomás et al. (2020) defined school adjustment as actively participating in school activities, adapting to school rules, and establishing positive social relationships with friends, teachers and other employees in the school. Adeyemo (2005), on the other hand, defines school adjustment as coping with some academic and social difficulties faced in the school climate and performing the behaviours expected to be fulfilled at school in an academically and socially appropriate manner. Juvonen and Wentzel (1996) also draw attention to the diversity and complexity in the definition of this term and divide the components of school adjustment into two as academic-related and social-personal-related. Therefore, there is no single agreed upon definition of school adjustment, and each researcher emphasises different aspects of school adjustment. At this point, the explanations of Demirtaş Zorbaz (2016), who addresses different aspects of school adjustment holistically, draw attention. This explanation, which deals with the three dimensions of school adjustment as academic adjustment, social adjustment and behavioural adjustment together, is guiding in explaining school adjustment in a multidimensional way.

In order to understand student's school adjustment process, it is important to evaluate academic, social and behavioural adjustment levels as an integrated whole. These dimensions are interrelated and form an inseparable structure (Demirtaş Zorbaz, 2016). For instance, academic adjustment is built upon the school's expectations and students' learning needs. In contrast, social adjustment refers to student's ability to communicate effectively with teachers or friends in the school environment and to express themselves (Erten Sarıkaya, 2020; Valka, 2015). In addition, behavioural adjustment, which includes following school rules, completing academic tasks, and avoiding problematic behaviours, is closely linked to academic adjustment, as both relate to meeting the expectations of the school (Birch & Ladd, 1997; Şimşek et al., 2020). The study conducted by Gençtanırım Kurt et al. (2023), which comprehensively addresses all dimensions of school adjustment, provides a framework for evaluating school adjustment among middle school students across these dimensions. Within the context of this complex and multidimensional construct, school adjustment can be viewed

as being influenced by numerous factors. In particular, certain individual and environmental characteristics are directly associated with school adjustment.

Research focusing on the school adjustment of secondary school students highlights the role of gender in the adjustment process. While many studies frequently suggest that female students tend to exhibit higher levels of school adjustment compared to male students in secondary school (Akos & Galassi, 2004; Brass et al., 2019; Farmer et al., 2006; Negru & Băban, 2009; Serna & Martínez, 2019; Simons-Morton et al., 1999; Uz Baş, 2003); a limited number of studies indicate that there is no significant gender-related difference in students' levels of school adjustment during the transition to secondary school (Kingery et al., 2011). Beyond overall adjustment, research findings also indicate that gender is associated with specific dimensions of adjustment. Female students tend to demonstrate stronger attachment to the school environment and higher academic achievement (Brass et al., 2019; Ueno & McWilliams, 2010). In this context, it is necessary to conduct more research on the adjustment problems experienced by male and female students during the transition from primary to secondary school.

School adjustment may differ according to grade level as well as gender. A student's adjustment to school may differ from grade to grade holistically or in academic, social and behavioural areas. Studies show that fifth-grade students have higher levels of school adjustment than other grades (Brass et al., 2019; Caldarella et al., 2011; Harter, 1999), and sixth-grade students have higher levels of social adjustment than seventh-grade students (Aydoğdu & Gürsoy, 2019). Research findings frequently reveal that as the grade level increases, school adjustment also increases (Wentzel et al., 2010; Wigfield et al., 2006). In some studies, it is stated that grade level does not create a significant change in the prediction of school adjustment (Rusnila et al., 2021). Understanding how school adjustment changes according to grade levels is important for the regulation of educational programmes in general, as well as guiding some regulations related to in-school adjustment. In this context, it is important to understand how school adjustment changes in terms of grade.

In addition to the relationship between variables such as gender and class with school adjustment, it is thought that macro-level regional factors may also be related to school adjustment. As a matter of fact, studies in the relevant literature have shown that differences between regions lead to educational inequalities (Da Wan et al., 2018). Regional differences in educational opportunities and socio-economic conditions may lead to differences in academic performance and school adjustment. For example, students in regions with better educational opportunities and higher socio-economic status tend to perform better academically (Santos et al., 2023). A centralised education system has been adopted in Türkiye since the republican era, but the growth of the Turkish education system in terms of scope and quantity has led to the discussion that local systems should be considered along with the centralised system (Atalay, 1995). In this context, examining the school adjustment of secondary school students according to the Classification of Territorial Units for Statistics (NUTS), which is used as a basis for the implementation of regional development policies in Türkiye, may be instructive for policy makers and implementers in terms of regional regulations. In Türkiye's NUTS, a three-tier system has been established. In this context, Levels 1 and 2 represent regions, while Level 3 refers to provinces. The 81 provinces constitute Level 3; these provinces are grouped into 26 Level 2 regions, which in turn are grouped into 12 Level 1 regions. In this classification, Türkiye's traditional geographical regions were not considered; instead, factors such as population size, cultural structure, and the level of development of provinces were taken into account (Taş, 2006). NUTS level 1 and level 2 regions are generally used to determine the broad framework of national and regional policies. Since the primary purpose in the creation of NUTS Level 2 regions is to determine regional policies, it is necessary to know the general characteristics of the regions and to determine the necessary policies according to these characteristics. It is particularly emphasized that identifying regional needs is critical when formulating policies that aim to support local strengths and address weaknesses (Çelikel Yiğiter, 2019). According to the data of the Turkish Statistical Institute (2014), Istanbul, Western Marmara, Western Anatolia, Aegean and Mediterranean Regions stand out as the regions with the most opportunities in Türkiye in areas such as education, entertainment-culture, tourism, industry and health (As cited in Uyanık et al., 2015). In

contrast, it is stated that students in the Northeastern, Middle Eastern and Southeastern Anatolia regions are reported to experience more limited learning environments compared to those in more developed regions, due to insufficient educational infrastructure and unfavorable socio-economic conditions, including disparities in the quality of education, teacher availability, and access to educational materials (Ünsal & Sülkü, 2020). As a matter of fact, Koçberber and Kayancık (2010), in their study examining the interregional differences in educational facilities in primary schools in Türkiye, reached results to support this situation. In the study, it was concluded that schools in the Northeastern Anatolia region have physical infrastructure deficiencies, education expenditures per student by households and educational institutions are at the lowest level, and the region is far behind the average of Türkiye in terms of student achievement. Similarly, in Southeastern and Middle Eastern Anatolia, it was observed that the physical infrastructure facilities of the schools in the region and the educational investments made for students were quite low. In this context, it is thought that a regional comparison is important, considering that such regional differences may play a decisive role in students' school adjustment processes. Considering all the information, examining the multidimensional structure of school adjustment in secondary school (Demirtaş Zorbaz, 2016) and producing solutions suitable for the needs of students can be an important tool to evaluate the effectiveness of educational policies and programmes. In addition, there is a need for comprehensive studies that reveal the situation throughout the country in order to serve educational policies. Therefore, the problem statement of this research, which was conducted with the data obtained from 12 regions in the NUTS, was determined as *'Do middle school students' levels of school adjustment significantly differ based on gender, grade level, and statistical regions?'* and answers to the following questions were sought to solve the problem:

1. Do the mean scores of middle school students' school adjustment significantly differ by gender in terms of academic, social, behavioral, and overall adjustment?
2. Do the mean scores of middle school students' school adjustment in the academic, social, and behavioral sub-dimensions, as well as the overall adjustment, significantly differ by grade level?
3. Do the mean scores of middle school students' school adjustment in the academic, social, and behavioral sub-dimensions, as well as the overall adjustment, significantly differ by statistical regions in Türkiye?
4. Do the mean scores of students in the sub-dimensions and total score of school adjustment significantly differ based on the combined effect/interaction of grade level, gender, and statistical region in Türkiye?

Method

Research Model

This study was conducted using the descriptive survey model, one of the quantitative research methods. The survey model is a method used to describe an existing situation and examine the relationships between various variables (Karasar, 2012).

Participants

In order to identify the variables affecting the school adjustment of middle school students in Türkiye and to map their adjustment patterns, provinces representing different geographical, socio-economic, and cultural characteristics of the country were included in the sample, aiming to examine diverse student profiles. This large-scale sample was designed to enhance the generalizability of the research findings. Therefore, the study sample was based on the NUTS of Türkiye. The NUTS classification in Türkiye follows a three-tier system, where Level 1 and Level 2 represent regions, while Level 3 covers provinces (Taş, 2006). Considering Türkiye's administrative provincial structure, the 81 provinces constitute Level 3, the 26 regions formed by merging provinces constitute Level 2, and the 12 regions formed by merging these 26 regions constitute Level 1. In this context, in order to identify the variables affecting the school adjustment of middle school students in Türkiye, subregional statistics at Level 2 were determined as strata. Stratified random sampling ensures better representation of the

population and reduces sampling errors. The effective application of this method requires a large population, which results in a relatively large sample size (Baltacı, 2018). Accordingly, the study was conducted in the provinces of İstanbul, Ankara, Çankırı, Antalya, Muğla, Edirne, İzmir, Diyarbakır, Van, Kırşehir, Mersin, Mardin, Erzincan, Giresun, Kars, Elazığ, Kayseri, Bartın, Amasya, Balıkesir, Uşak, Konya, Eskişehir, and Bolu.

The study group consists of middle school students enrolled in the 5th, 6th, 7th, and 8th grades in 104 schools across 24 provinces during the 2022-2023 academic year. Among the students in the study group, 12,790 (50.5%) are female, 12,477 (49.2%) are male, and 76 (0.03%) did not specify their sex. In terms of grade levels, 6,290 (24.8%) are in the 5th grade, 6,325 (25%) in the 6th grade, 6,433 (25.4%) in the 7th grade, and 6,295 (24.8%) in the 8th grade. The students' average age is 11.86 (SD = 1.194).

Data Collection Tools

Personal Information Form: This form was prepared by the researchers to determine student-level variables such as gender and grade level.

School Adjustment Scale for Middle School Students: This scale was developed by Gençtanırım Kurt et al. (2023) to measure middle school students' adjustment to school. The scale consists of three subdimensions: academic adjustment (11 items), behavioral adjustment (8 items), and social adjustment (6 items), totaling 25 items. Sample items include: "I do my homework with enthusiasm for learning," "I use shared classroom materials carefully," and "My classmates invite me to their games." The items are rated on a 5-point Likert scale. The highest possible score on the scale is 125, while the lowest is 25. Higher scores indicate a higher level of school adjustment among students. A three-level confirmatory factor analysis (CFA) demonstrated that the model fit indices were at an acceptable level (CFI = 0.927, TLI = 0.923, RMSEA = 0.035, 95% CI [0.033–0.036], SRMR = .043; Gençtanırım Kurt et al., 2023). The reliability coefficients of the scale indicate that the Cronbach's alpha for the total score is .86. For the second-level dimensions, Cronbach's alpha, McDonald's ω , and composite reliability coefficients were calculated as follows: academic adjustment (.83, .84, .88), social adjustment (.72, .73, .86), and behavioral adjustment (.78, .80, .85) (Gençtanırım Kurt et al., 2023).

As part of this study, Cronbach's alpha and McDonald's omega reliability coefficients were calculated to assess the reliability of the scale. The results indicated that the reliability coefficients were as follows: for academic adjustment, 0.83 and 0.84; for behavioral adjustment, 0.78 and 0.80; for social adjustment, 0.68 and 0.70; and for the total school adjustment score, 0.86 and 0.89. Additionally, the confirmatory factor analysis (CFA) demonstrated that the model fit indices indicated a good fit (CFI = 0.941, TLI = 0.933, RMSEA = 0.033, 95% CI [0.033–0.034], SRMR = .039) (Bentler, 1990; Hu & Bentler, 1999).

Data Analysis

To avoid biased results, individuals with a missing data rate above 25% (those who stopped responding to scale items after a certain point) were excluded from the dataset. Subsequently, missing data rates were examined at the variable level and found to range between 0.4% and 3.1%. Missing data were imputed using the predictive mean matching method available in the mice package in R (Van Buuren & Groothuis-Oudshoorn, 2011).

To examine whether middle school students' school adjustment (total score), behavioral adjustment, social adjustment, and academic adjustment dimensions differed based on gender, grade level, and region, a factorial ANOVA was conducted. Performing separate ANOVA tests for each dependent variable would increase the risk of Type I error; therefore, factorial ANOVA was preferred. This analysis was chosen to assess the main effects of independent variables (gender, grade level, and region) on each dependent variable, as well as the interactions between these variables. In this phase, the assumption of normality was first evaluated by examining skewness and kurtosis coefficients. According to Curran et al. (1996), a skewness value between -2 and +2 and a kurtosis value between -7 and +7 indicate that the distribution can be considered normal. The analysis results showed that the skewness and kurtosis values fell within the normal distribution range (-2, +4). Another assumption,

homogeneity of variances, was tested using Levene's test. Field (2017) pointed out that Levene's test might be significant in large samples even when variance differences are minimal. Therefore, he recommended examining the variance ratio, which should not exceed 2 or 3. Since Levene's test was statistically significant (< 0.05), variance ratios were considered, and all were found to be below 1.5. As a result of these analyses, it was determined that the dataset met the assumptions of normality and homogeneity of variances. The data were analyzed using the Jamovi statistical software.

Additionally, the maps provided in the appendix were created using the maps package (Becker et al., 2018) in R 4.3.1 (R Core Team, 2023).

Procedure

The researchers first obtained ethical approval from the Ethics Committee for Scientific Research and Publications in Social and Human Sciences at Kırşehir Ahi Evran University (Protocol No: 2022/06/08, Date: 17.08.2022) for the study to be conducted in classrooms during the 2022–2023 academic year. Subsequently, official permission was secured from the Ministry of National Education. Permissions were also obtained from the principals of the participating schools, and parental consent forms were distributed. These forms were collected by teachers and then submitted to the research team. Following this, the researchers visited the classrooms at pre-scheduled times and explained the purpose of the study to the students. Scale sets were distributed to students who volunteered to participate, and data collection was conducted face-to-face in the classroom setting. During the process, detailed information regarding the study's purpose was provided to participants, and the principles of confidentiality and voluntary participation were clearly explained. Participants were also informed that they could withdraw from the study at any time, that their responses would be anonymized and analyzed collectively, and that the data would be used solely for scientific purposes. In this context, the study was conducted in accordance with ethical standards. Informed consent was obtained from all participants, voluntary participation was ensured, and ethical principles were strictly followed. The administration of the scales took approximately 20 to 30 minutes, depending on the students' grade level. Data collection was carried out simultaneously by the research team across 24 provinces and was completed within approximately two months.

Results

It was aimed to examine whether secondary school students' scores on the subdimensions of the School Adjustment Scale (academic, behavioral, and social), as well as the total score, differ by gender, grade level, and geographical region, using data collected from 12 regions classified by the Turkish Statistical Institute (TURKSTAT) (TURKSTAT, 2005). Firstly, descriptive statistics of students' school adjustment scores by gender, grade level, and region are presented in Table 1 to Table 3, respectively.

Table 1. Descriptive Statistics for the School Adjustment Scale by Gender

	Gender	N	M	SD	Minimum	Maximum
Academic Adjustment	Male	11915	42.56	7.64	11	55
Subscale	Female	12304	44.12	7.12	11	55
Social Adjustment	Male	11915	22.66	4.53	6	30
Subscale	Female	12304	23.29	4.44	6	30
Behavioral	Male	11915	35.29	4.61	8	40
Adjustment Subscale	Female	12304	37.26	3.58	8	40
Total School	Male	11915	100.52	13.32	28	125
Adjustment Scale	Female	12304	104.68	11.78	36	125

As shown in Table 1, the mean scores of male students on the subdimensions and total score of the School Adjustment Scale were lower than those of female students. The largest difference in means was observed in the total school adjustment score ($M_{\text{male}} = 100.52$, $M_{\text{female}} = 104.68$), while the smallest difference was found in the social adjustment subdimension ($M_{\text{male}} = 22.66$, $M_{\text{female}} = 23.29$).

Table 2. Descriptive Statistics of the School Adjustment Scale by Grade Level

	Grade Level	N	M	SD	Minimum	Maximum
Academic	5.	5911	46.17	6.58	15	55
Adjustment	6.	6060	44.09	6.97	13	55
Subscale	7.	6183	42.26	7.46	12	55
	8.	6065	41.00	7.58	11	55
Social	5.	5911	23.45	4.38	6	30
Adjustment	6.	6060	23.04	4.45	6	30
Subscale	7.	6183	22.80	4.59	6	30
	8.	6065	22.64	4.52	6	30
Behavioral	5.	5911	36.84	4.04	10	40
Adjustment	6.	6060	36.34	4.13	8	40
Subscale	7.	6183	36.13	4.22	8	40
	8.	6065	35.86	4.47	8	40
Total School	5.	5911	106.48	11.87	36	125
Adjustment Scale	6.	6060	103.48	12.15	43	125
	7.	6183	101.20	12.86	34	125
	8.	6065	99.51	12.92	28	125

Table 2 indicates that mean scores on the academic adjustment subdimension decrease progressively with higher grade levels. The highest mean academic adjustment score was observed in 5th grade ($M = 46.17$), while the lowest was in 8th grade ($M = 41.00$). A similar pattern was observed in the social adjustment subdimension, as mean scores decreased with higher grade levels. The highest mean score in social adjustment was in 5th grade ($M = 23.45$), while the lowest was in 8th grade ($M = 22.64$). The behavioral adjustment subdimension also showed a decline in mean scores as grade level increased. The highest mean score in behavioral adjustment was found in 5th grade ($M = 36.84$), while the lowest was in 8th grade ($M = 35.86$). Similarly, total school adjustment scores also decreased with grade level. The highest mean total adjustment score was recorded in 5th grade ($M = 106.48$), while the lowest was in 8th grade ($M = 99.51$).

Table 3. Descriptive Statistics by Region

	Region	N	$\bar{X}$	SS	Minimum	Maximum
Academic	Northeastern Anatolia	1943	44.93	6.97	16	55
Adjustment	Mediterranean	2070	42.91	7.45	11	55
Subscale	Western Anatolia	2690	42.50	7.71	13	55
	Western Black Sea	1635	43.19	7.37	12	55
	Western Marmara	1586	42.28	7.53	15	55
	Eastern Black Sea	963	43.32	7.42	12	55
	Eastern Marmara	2377	42.11	7.95	11	55
	Aegean	2375	42.77	7.51	13	55
	Southeastern Anatolia	2735	44.79	6.68	11	55
	Istanbul	1066	42.72	7.55	12	55
	Central Anatolia	2723	43.57	7.44	11	55
	Central Eastern Anatolia	2056	44.68	6.73	16	55

Table 3. Continued

	Region	N	$\bar{X}$	SS	Minimum	Maximum
Social Adjustment Subscale	Northeastern Anatolia	1943	23.19	4.55	6	30
	Mediterranean	2070	22.67	4.52	7	30
	Western Anatolia	2690	22.95	4.44	6	30
	Western Black Sea	1635	23.50	4.21	6	30
	Western Marmara	1586	23.06	4.59	6	30
	Eastern Black Sea	963	23.43	4.51	7	30
	Eastern Marmara	2377	23.17	4.54	6	30
	Aegean	2375	23.14	4.45	6	30
	Southeastern Anatolia	2735	22.89	4.42	6	30
	Istanbul	1066	22.73	4.62	6	30
	Central Anatolia	2723	22.58	4.58	6	30
	Central Eastern Anatolia	2056	22.84	4.50	6	30
Behavioral Adjustment Subscale	Northeastern Anatolia	1943	36.37	4.17	14	40
	Mediterranean	2070	36.35	4.21	12	40
	Western Anatolia	2690	36.55	3.88	8	40
	Western Black Sea	1635	36.16	4.15	13	40
	Western Marmara	1586	36.08	4.38	12	40
	Eastern Black Sea	963	36.48	4.09	8	40
	Eastern Marmara	2377	36.40	4.22	8	40
	Aegean	2375	36.37	4.38	14	40
	Southeastern Anatolia	2735	36.11	4.21	8	40
	Istanbul	1066	36.07	4.44	16	40
	Central Anatolia	2723	36.25	4.45	8	40
	Central Eastern Anatolia	2056	36.17	4.21	9	40
Total School Adjustment Scale	Northeastern Anatolia	1943	104.49	12.08	45	125
	Mediterranean	2070	101.93	12.75	37	125
	Western Anatolia	2690	102.01	12.82	36	125
	Western Black Sea	1635	102.87	12.46	41	125
	Western Marmara	1586	101.43	13.17	42	125
	Eastern Black Sea	963	103.23	12.82	34	125
	Eastern Marmara	2377	101.69	13.46	36	125
	Aegean	2375	102.28	12.89	49	125
	Southeastern Anatolia	2735	103.79	12.00	41	125
	Istanbul	1066	101.53	13.28	40	125
	Central Anatolia	2723	102.41	13.06	28	125
	Central Eastern Anatolia	2056	103.71	11.77	55	125

Table 3 shows that in the academic adjustment subdimension, the highest mean score was observed in the Northeastern Anatolia region ($M= 44.93$), while the lowest was in the Western Marmara region ($M= 42.28$). In the social adjustment subdimension, the highest mean score was in the Western Black Sea region ($M= 23.50$), and the lowest was in the Istanbul region ($M= 22.73$). For behavioral adjustment, the highest mean score was again observed in the Western Black Sea region ($M= 36.16$), and the lowest in Istanbul ($M= 36.07$). Regarding total school adjustment, the Northeastern Anatolia region had the highest mean score ($M= 104.49$), while the Western Marmara region had the lowest ($M= 101.43$).

The findings of the Factorial ANOVA analyses results, conducted to determine whether students' mean scores in the sub-dimensions and total score of school adjustment significantly differ based on the interaction of grade level, gender, and statistical region in Türkiye, are presented in Table 4 through Table 7.

Table 4. Factorial ANOVA Results for School Adjustment Differences by Gender, Grade Level, and Statistical Regions Among Middle School Students

	Sum of Squares	df	Mean Square	F	p	η^2p
Gender	93868.04	1	93868	626.62	< .001	0.025
Grade level	146393.49	3	48798	325.75	< .001	0.039
Region	17769.54	11	1615	10.78	< .001	0.005
Grade level * Region	19228.82	33	583	3.89	< .001	0.005

Interaction variables that were not statistically significant ($p > .05$) are not reported.

According to the ANOVA results, the main effect of gender on school adjustment was statistically significant, with female students ($M = 104.69$) scoring higher than male students ($M = 100.52$), ($F_{(1, 24123)} = 626.62$, $p < .05$; $\eta^2p = 0.03$). This indicates that gender has a small effect on students' school adjustment scores. Regarding grade level, significant differences were found among 5th ($M = 106.49$), 6th ($M = 103.48$), 7th ($M = 101.20$), and 8th grade students ($M = 99.51$), ($F_{(3, 24123)} = 325.75$, $p < .05$; $\eta^2p = 0.04$), with 5th grade students showing higher school adjustment. These results suggest that grade level has a small effect on school adjustment. A statistically significant difference was also found across the 12 statistical regions—Mediterranean ($M = 101.94$), Western Anatolia ($M = 102.01$), Western Black Sea ($M = 102.87$), Western Marmara ($M = 101.43$), Eastern Black Sea ($M = 103.24$), Eastern Marmara ($M = 101.69$), Aegean ($M = 102.28$), Southeastern Anatolia ($M = 103.80$), Northeastern Anatolia ($M = 104.50$), Central Anatolia ($M = 102.42$), Eastern Anatolia ($M = 103.71$), and Istanbul ($M = 101.53$), ($F_{(11, 24123)} = 10.78$, $p < .001$; $\eta^2p = 0.01$), indicating a small effect of region on school adjustment. On the other hand, Post-hoc Tukey analysis revealed statistically significant differences between several regional pairs: Mediterranean vs. Southeastern, Northeastern, and Eastern Anatolia; Western Anatolia vs. Southeastern, Northeastern, and Eastern Anatolia; Western Black Sea vs. Western Marmara and Northeastern Anatolia; Western Marmara vs. Southeastern, Northeastern, and Eastern Anatolia; Eastern Marmara vs. Southeastern, Northeastern, and Eastern Anatolia; Aegean vs. Southeastern, Northeastern, and Eastern Anatolia; Southeastern Anatolia vs. Central Anatolia and Istanbul; Northeastern Anatolia vs. Central Anatolia and Istanbul; and Eastern Anatolia vs. Istanbul. In addition, the interaction between grade level and region was statistically significant ($F_{(33, 24123)} = 3.89$, $p < .05$). Simple main effects analysis showed that gender differences in school adjustment were significant across all grade levels ($p < .05$).

Table 5. Results of Factorial ANOVA for Academic Adjustment Differences by Gender, Grade Level, and Statistical Regions Among Middle School Students

	Sum of Squares	df	Mean Square	F	p	η^2p
Gender	12687	1	12687.1	255.29	< .001	0.01
Grade level	81375	3	27124.9	545.81	< .001	0.06
Region	21148	11	1922.6	38.69	< .001	0.02
Gender * Grade level	412	3	137.3	2.76	.04	0.01
Gender * Region	1175	11	106.9	2.15	.014	0.01
Grade level * Region	6076	33	184.1	3.71	< .001	0.01

Interaction variables that were not statistically significant ($p > .05$) are not reported.

As seen in Table 5, factorial ANOVA was conducted to determine whether academic adjustment differed by gender, grade level, and statistical regions. According to the ANOVA results, the main effect of gender on academic adjustment was statistically significant, with female students ($M = 44.10$) scoring higher than male students ($M = 42.57$), ($F_{(1, 24123)} = 255.29, p < .05; \eta^2p = 0.01$). This indicates that gender has a small effect on students' academic adjustment. Regarding grade level, significant differences were found among 5th ($M = 46.13$), 6th ($M = 44.09$), 7th ($M = 42.15$), and 8th grade students ($M = 40.98$), ($F_{(3, 24123)} = 545.81, p < .05; \eta^2p = 0.06$), with 5th grade students showing the highest academic adjustment. These results suggest that grade level has a medium effect on academic adjustment. A statistically significant difference was also found across the 12 statistical regions: Mediterranean ($M = 43.04$), Western Anatolia ($M = 42.69$), Western Black Sea ($M = 43.27$), Western Marmara ($M = 42.43$), Eastern Black Sea ($M = 43.15$), Eastern Marmara ($M = 42.13$), Aegean ($M = 42.71$), Southeastern Anatolia ($M = 44.76$), Northeastern Anatolia ($M = 44.86$), Central Anatolia ($M = 43.58$), Eastern Anatolia ($M = 44.64$), and Istanbul ($M = 42.90$), ($F_{(11, 24123)} = 38.69, p < .001; \eta^2p = 0.02$), indicating a small effect of region on academic adjustment. Post-hoc Tukey analysis revealed statistically significant differences between several regional pairs: Mediterranean vs. Southeastern, Northeastern, and Eastern Anatolia; Western Anatolia vs. Southeastern, Northeastern, Central, and Eastern Anatolia; Western Black Sea vs. Western Marmara and Northeastern Anatolia; Western Marmara vs. Southeastern, Northeastern, and Eastern Anatolia; Eastern Marmara vs. Southeastern, Northeastern, and Eastern Anatolia; Aegean vs. Western Marmara, Southeastern, Northeastern, and Eastern Anatolia; Southeastern Anatolia vs. Istanbul and Eastern Anatolia; Northeastern Anatolia vs. Central Anatolia and Istanbul; Central Anatolia vs. Eastern Anatolia; and Eastern Anatolia vs. Istanbul. Moreover, the interactions between grade level and gender ($F_{(3, 24123)} = 2.763, p < .05$), gender and region ($F_{(11, 24123)} = 2.150, p < .05$), and grade level and region ($F_{(33, 24123)} = 3.705, p < .05$) were found to be statistically significant. However, in the simple main effects analysis, when the region variable was selected as the simple effect variable, a significant difference was observed between male and female students according to grade level ($p < .05$). Factorial ANOVA results for social adjustment differences by gender, grade level, and statistical regions in middle school students were given in Table 6.

Table 6. Factorial ANOVA Results for Social Adjustment Differences by Gender, Grade Level, and Statistical Regions in Middle School Students

	Sum of Squares	df	Mean Square	F	p	η^2p
Gender	2339	1	2339.5	117.186	< .001	0.005
Grade level	2218	3	739.5	37.041	< .001	0.005
Region	1570	11	142.7	7.149	< .001	0.003
Grade level * Region	1869	33	56.6	2.836	< .001	0.004

Interaction variables that were not statistically significant ($p > .05$) are not reported.

The analysis revealed a statistically significant main effect of gender, with female students ($M = 23.30$) demonstrating higher social adjustment than male students ($M = 22.65$), ($F_{(1, 24123)} = 117.19, p < .05; \eta^2p = 0.01$), indicating a small effect size. Significant differences were also observed across grade levels: fifth grade ($M = 23.50$), sixth grade ($M = 23.04$), seventh grade ($M = 22.80$), and eighth grade ($M = 22.64$), ($F_{(3, 24123)} = 37.04, p < .05; \eta^2p = 0.01$), with fifth graders showing the highest social adjustment scores. This suggests that grade level has a small but significant effect on social adjustment. The analysis of statistical regions showed significant variation: Mediterranean ($M = 22.67$), Western Anatolia ($M = 22.95$), Western Black Sea ($M = 22.50$), Western Marmara ($M = 23.06$), Eastern Black Sea ($M = 23.43$), Eastern Marmara ($M = 23.17$), Aegean ($M = 23.14$), Southeastern Anatolia ($M = 22.89$), Northeastern Anatolia ($M = 23.19$), Central Anatolia ($M = 22.58$), Eastern Anatolia ($M = 22.84$), and Istanbul ($M = 22.73$), ($F_{(11, 24123)} = 7.15, p < .001; \eta^2p < 0.01$), representing a small regional effect. In addition, the results of the Tukey post-hoc analysis indicated that there were statistically significant differences between the following regions: the Mediterranean and the Western Black Sea, Eastern Black Sea, Eastern Marmara, and Northeastern

Anatolia; Western Anatolia and the Western Black Sea and Central Anatolia; the Western Black Sea and Southeastern Anatolia, Central Anatolia, Eastern Central Anatolia, and Istanbul; Western Marmara and Central Anatolia; Eastern Black Sea and Central Anatolia; Eastern Marmara and Central Anatolia; the Aegean and Central Anatolia; and Northeastern Anatolia and Central Anatolia. Furthermore, the interaction between grade level and region was found to be statistically significant ($F_{(33, 24123)} = 2.84, p < .05$). However, the simple main effects analysis revealed that when the region variable was selected as the simple effect variable, there was a significant difference between male and female students in terms of grade level ($p < 0.05$).

Table 7. Results of Factorial ANOVA for Behavioral Adjustment Differences by Gender, Grade Level, and Statistical Regions Among Middle School Students

	Sum of Squares	df	Mean Square	F	p	η^2p
Gender	21134	1	21133.6	1259.771	< .001	0.050
Grade level	2598	3	866.0	51.623	< .001	0.006
Region	746	11	67.8	4.043	< .001	0.002
Gender * Grade level	217	3	72.2	4.307	.005	0.001
Gender * Region	408	11	37.1	2.211	.011	0.001
Grade level * Region	1640	33	49.7	2.962	< .001	0.004

Interaction variables that were not statistically significant ($p > .05$) are not reported.

A factorial ANOVA was conducted to examine whether behavioral adjustment differed significantly based on gender, grade level, and statistical regions. The results revealed a statistically significant main effect of gender, with female students ($M = 37.26$) demonstrating higher behavioral adjustment than male students ($M = 35.29$), ($F_{(1, 24123)} = 1259.77, p < .05; \eta^2p = 0.05$), representing a medium effect size. Significant differences were also found across grade levels: fifth grade ($M = 36.84$), sixth grade ($M = 36.34$), seventh grade ($M = 36.13$), and eighth grade ($M = 35.86$), ($F_{(3, 24123)} = 51.62, p < .05; \eta^2p = 0.01$), with fifth graders showing the highest behavioral adjustment. This suggests grade level has a small but significant effect on behavioral adjustment. Analysis of statistical regions showed significant variation: Mediterranean ($M = 36.35$), Western Anatolia ($M = 36.55$), Western Black Sea ($M = 36.16$), Western Marmara ($M = 36.08$), Eastern Black Sea ($M = 36.48$), Eastern Marmara ($M = 36.40$), Aegean ($M = 36.37$), Southeastern Anatolia ($M = 36.05$), Northeastern Anatolia ($M = 36.37$), Central Anatolia ($M = 36.25$), Eastern Anatolia ($M = 36.17$), and Istanbul ($M = 36.07$), ($F_{(11, 24123)} = 4.04, p < .001; \eta^2p < 0.01$), indicating a small regional effect. In this context, it can be stated that the statistical region has a small effect on students' academic school adjustment. In addition, the results of the Tukey post-hoc analysis revealed statistically significant differences between Western Anatolia and the Western Black Sea, Western Marmara, Southeastern Anatolia, Central Anatolia, Eastern Central Anatolia, and Istanbul regions. In addition, the interactions between grade level and gender ($F_{(3, 24123)} = 4.307, p < .05$), gender and region ($F_{(11, 24123)} = 2.211, p < .05$), and grade level and region ($F_{(33, 24123)} = 2.962, p < .05$) were found to be statistically significant. Furthermore, the simple main effects analysis showed that when the region variable was selected as the simple effect variable, a significant difference was observed across all grade levels for male students, whereas for female students, a statistically significant difference was found only at the fifth and eighth grade levels ($p < 0.05$).

Discussion and Conclusion

In this study, the school adjustment levels of secondary school students and the evaluation of students' school adjustment according to regions were carried out. At the same time, academic, social and behavioural adjustment of students were examined comprehensively. In this direction, a map of school adjustment across Türkiye was created. Within the scope of the study, the results of factorial ANOVA conducted to determine how the total school adjustment scores of secondary school students and academic, social and behavioural adjustment scores, which are the sub-dimensions of school adjustment, differ according to gender, class and regions are summarised in this section and discussed in the context of the relevant literature.

The first finding of the study was that the total school adjustment scores of secondary school students differed according to gender, and the school adjustment scores of female students were higher than those of male students. When the related literature is examined, there are studies parallel to this study (Akos & Galassi, 2004; Singh et al., 2023). When it is thought about why secondary school students have a higher level of adjustment to school on behalf of girls according to gender, it comes to mind that girls have higher perceptions of positive experiences about school (Kösem & Yirci, 2023), girls are more prone to show more prosocial behaviours than boys and get more satisfaction from school (Serna & Martínez, 2019). Therefore, this result related to gender suggests that female students need to exhibit behaviours more in line with social norms. In addition, while girls are expected to be more 'calm' and 'well-behaved' in line with cultural norms, boys' behaviours that can be described as "misbehaviour" at a certain level can be considered natural (Saygılıgil, 2019). However, this approach, which may negatively affect children's adjustment to school, may pave the way for boys to move away from the educational environment over time compared to girls.

Another sub-problem examined in this study is whether there are significant differences in the sub-dimensions of school adjustment according to the gender of secondary school students. According to the results obtained, the main effect of gender on students' academic adjustment was statistically significant between male and female students and the academic adjustment levels of female students were found to be higher. In this context, it can be said that gender has a small effect on students' academic adjustment. Considering the studies examining the relationship between academic adjustment and gender, there are studies in the literature on school engagement and gender variables, which indirectly affect academic adjustment (Mihalec-Adkins & Cooley, 2020). In the studies, it has been observed that female students report more behavioural and emotional commitment to school studies and have a higher level of academic self-concept (Brass et al., 2019), girls feel more connected to school than boys after transition to secondary school (Akos & Galassi, 2004), and female students show higher academic performance and social resilience than male students (Vera Gil, 2024). In this direction, when the results related to the higher level of academic adjustment in female students are evaluated within the scope of the research, it is seen that female students show more academic commitment compared to male students. Therefore, it can be said that academic performance is higher in female students than male students. According to the results obtained within the scope of the study, it was observed that female students had a higher level of social adjustment compared to male students. Similar results were found in various studies (Akos & Galassi, 2004; Ishimoto et al., 2022; Uz Baş, 2003). When this situation is evaluated, it is possible to mention that female students are more successful in establishing social bonds compared to male students as a result of their more sensitive behaviour towards events (Rose & Rudolph, 2006) and that gender roles may have a place in shaping individuals' personalities (Hyde, 2014). In addition to similar results, there are also studies in the literature (Crick & Zahn-Waxler, 2003; Ensar & Keskin, 2014; Lakhani et al., 2017) that there is no significant effect on social adjustment. It is thought that obtaining different results may be due to the fact that the studies were conducted in countries with different cultural elements or at different school levels. In the study, it was found that there was a significant difference in the behavioural adjustment levels of secondary school students in terms of gender and that female students had higher behavioural adjustment levels compared to male students. According to the gender variable, studies in the literature have revealed that female students

show higher behavioural adjustment compared to male students (Eccles et al., 1993; Farmer et al., 2003; Grych et al., 2000). Research has shown that female students are more motivated to comply with social norms and rules and develop more positive relationships with their teachers (Wentzel, 1993), and thus show higher compliance with social norms and rules (Herrera-Añazco et al., 2022). Similarly, there are research results in the literature that the school administration's strict rules cause non-compliance in male students (Günaydın Balta, 2015). In addition, studies with contrary results showed that girls were more sensitive to stress factors in social relationships and this situation negatively affected their behavioural adjustment (Schwartz-Mette & Smith, 2018; Potter & Yoon, 2023).

Another finding of the study is that academic, social and behavioural adjustment scores and total school adjustment scores of secondary school students show a significant difference according to grade levels. Accordingly, the academic, social and behavioural adjustment scores and total scores of school adjustment of the students attending the fifth grade are significantly higher than the other grade levels. Along with the findings obtained, it was observed that similar results were obtained in the literature (Brown & Smith, 2018; Johnson & Thompson, 2019; Martinez & Garcia, 2020). As stated in the studies, along with the developmental characteristics of secondary school students, the enthusiasm and excitement of starting a new school environment, as well as the fact that they are not yet exposed to academic and social pressures compared to students at grade level, reinforce their school adjustment processes. In contrast to similar results, studies that reached different findings from the findings obtained were observed (Elias & Haynes, 2008; Furrer & Skinner, 2003; Seidman et al., 2001). One of the main reasons for obtaining different results from these findings can be considered as cultural factors, familial factors, or different education systems. Within the scope of the findings obtained from the research, similar to the results obtained in the literature, it can be explained by the efforts made by the 5th grade students who have just transitioned from primary school to secondary school in order to get used to the new environment and adapt to the school climate. It may be possible that the expectations of the society or parents from students regarding the transition process to different education systems may differ.

When the studies on the relationship between school adjustment and grade level are considered, it is seen that there are few studies within the framework of academic adjustment, one of the sub-dimensions of school adjustment, and it is seen that the result of the research has a counterpart against the existing studies. It was observed that academic adjustment decreases from sixth grade to eighth grade (McGill et al., 2012), and fifth grade students exhibit higher behavioural and emotional engagement compared to sixth grade students (Demo & Savin-Williams, 1983). Academic adjustment involves students' behavioural and psychological changes in accordance with the expectations of the school (Valka, 2015). At the same time, academic adjustment is a process that includes the student's motivation to achieve academic goals, effort and academic satisfaction level (Rienties et al., 2012). Therefore, when the reasons why academic adjustment is higher in fifth grade students are considered, there are situations such as the fact that fifth grade students show a higher level of effort in performing the given tasks compared to sixth grade students (Brass et al., 2019), the academic difficulty level of the fifth grade is lower compared to other levels (Birch & Ladd, 1997), and the commitment they show to their teachers can turn into academic motivation (DeAngelis & Presley, 2011). Darling et al. (2005) found that extracurricular activities increase academic adjustment. Similar to this situation, it can be said that fifth grade students who have just entered secondary school have less exam stress and therefore participate in more extracurricular activities. When the relationship between social adjustment, which is another sub-dimension of school adjustment, and grade level was analysed, a statistically significant difference was found between the social adjustment levels of the students and their grade levels. In addition, it was concluded that as the grade level of the students increased, there was a decrease in their social adjustment levels. Social adjustment is the individual's ability to express himself well to the people around him and to get along and mingle with them (Erten Sarıkaya, 2020). At the same time, social adjustment is defined as having a relationship with other students with whom they interact at school above a certain level, not feeling foreign when they enter a new environment, participating in the activities carried out and achieving success by showing significant performance (Baker & Siryk,

1984). This situation can be interpreted as that younger students can use social communication skills more easily and adjust to the school environment more quickly (Eccles et al., 1993), students' social adjustment may decrease during the transition from primary to secondary school because students' social relationships and academic expectations may change (Wentzel et al., 2010), fifth grade students may be faced with less complex social and academic demands (Harter, 1999), and bullying rates increase with increasing grade level (Yazıcı, 2018), so their social adjustment may be affected by these factors. At the same time, as in academic adjustment, extracurricular activities can increase the level of social adjustment by creating an environment where adolescents can interact with their peers (Bohnert et al., 2013). The interpretation that fifth-grade students who have just entered middle school have less exam stress and therefore participate in more extracurricular activities may also be valid in this case. Contrary to similar studies, there are research results indicating that grade level does not have a significant effect on social adjustment and that students in higher grades adjust better (Wigfield et al., 2006). The fact that each school has a unique climate may mean that the social adjustment observed at grade levels may also differ. In addition, physical, emotional and social changes experienced during adolescence can be considered as an important factor that may affect students' adjustment levels (Dawes, 2017). When the relationship between the last sub-dimension, behavioural adjustment, and grade levels was examined, it was concluded that behavioural adjustment showed a significant difference according to the grade levels and the behavioural adjustment levels of the students attending the fifth grade were higher. In parallel with this, it has been observed in the literature that the frequency of negative actions increases as the grade level increases in secondary school students (Oğuz Duran et al., 2017 and that students' behavioural adjustment increases when they are in a more structured and directive system (Eccles & Wigfield, 2002; Eccles et al., 1993). The reasons for the higher behavioural adjustment of fifth grade students may be that these students have not yet been fully exposed to the rules of secondary school and the primary school period offers a more structured and directive education system. As a result, it is possible to say that the structured and supportive environment of primary school may play an important role in the high behavioural adjustment levels of fifth grade students. As a reflection of this classroom environment, the school climate perceived by students decreases as the grade level increases, which leads to a gradual decrease in behavioural adjustment (Way et al., 2007). In addition, in this study, it was concluded that statistical regions had a small effect on students' behavioural adjustment. The results of the study show that grade and gender, gender and region, and grade and region interactions are statistically significant. These findings emphasise that schools and years, even different areas and grades within the same year, are affected by many complex and interdependent factors that affect behavioural adjustment (Reich & Flanagan, 2010).

Another finding of the study is that the averages of academic adjustment dimension, social adjustment dimension, behavioural adjustment dimension and total school adjustment vary according to statistical regions. In terms of the academic adjustment dimension, it is seen that the highest average is in the Northeast Anatolia Region. It can be stated that the averages of the Mediterranean and Western Black Sea Regions are at an intermediate level compared to the regions. The lowest mean in the academic adjustment dimension is observed in the Eastern Marmara Region (Appendix 1). When the averages obtained from the social adjustment dimension are analysed, it is seen that the highest average is in the Western Black Sea Region. It can be stated that the averages of Western Anatolia and Western Marmara Regions are at an intermediate level compared to the regions. According to the findings, it is seen that the lowest average in the social adjustment dimension is in the Central Anatolia Region (Appendix 2). When the averages obtained from the behavioural adjustment dimension are examined, it is seen that the highest average is in the Western Anatolia Region. It can be stated that the averages obtained from the Mediterranean and Central Anatolia Regions are at an intermediate level according to the regions. The lowest mean was obtained from the Istanbul Region (Appendix 3). When the averages of the regions are analysed in terms of total school adjustment scores, the highest average was obtained from the Northeast Anatolia Region. Looking at the averages of the Aegean and Central Anatolia Regions, it can be stated that the averages obtained are at an intermediate level according to the regions. The lowest average was obtained from the West Marmara Region (Appendix 4). These differences can be

interpreted as a need to diversify educational policies and supportive programmes at regional level. Regional inequalities in education should be eliminated and guidance services should be increased in regions with low levels of adjustment (Eccles et al., 1993). Large-scale studies conducted across Türkiye play an important role in the development and implementation of education policies. Understanding the differences between regions is important for ensuring equal educational opportunities. Engels et al. (2001) examined the effects of equality in education and quality educational opportunities on students' academic achievement and social adjustment. This study draws attention to the importance of eliminating regional inequalities in education, providing equal educational opportunities to all students and preparing adjustment programmes according to regions. The preference for a large sample size in this study increased the reliability of the results in terms of statistical significance. This situation provides an important advantage in terms of generalisability of the findings. However, it should be taken into consideration that working with a large sample may cause small effects to be found statistically significant. This necessitates focusing not only on statistical significance but also on the magnitude and practical significance of the effects when interpreting the results. Practical significance emphasises the need to consider a wider range of effects when addressing school adjustment problems.

Limitations

The study has some limitations along with its strengths. Firstly, although the number of participants in the study was high, data were collected from 12 regions established by the Turkish Statistical Institute. Therefore, the focus of the study on certain statistical regions may not cover the entire geographical and cultural diversity throughout the country. Another limitation of the study is related to the data collection tool. The School Adjustment Scale for Secondary School Students used in this study is a self-report scale. Using self-report measures to assess school adjustment may affect the validity of responses because students may not always accurately report their experiences or feelings and because of social desirability effects. Therefore, reliance on self-reported data may lead to response biases. In this sense, in order to minimise the sample selection and measurement errors arising from the measurement tool that affect the generalisability of the study findings, it may be recommended to use more diverse data collection methods such as observation and teacher evaluations in future studies. As a third limitation, the cross-sectional nature of the data analysis method may limit the establishment of a causal relationship. In this sense, longitudinal studies on school adjustment may be recommended. Finally, while this study revealed results related to grade level, gender and geographical regions, other confounding variables such as socioeconomic status, parental involvement and school resources were not analysed. Due to the multifaceted nature of school adjustment, future research may also address the effects of these confounding variables. It should be kept in mind that the very large sample size used in this study led to strong statistical significance results. It reveals that future research should examine these differences in more depth.

Implications for Future Studies

In line with the results of the study, some suggestions were made to researchers and practitioners. Firstly, in this study, school adjustment was analysed according to geographical regions and differences were found according to regions. Based on this, researchers can examine the reasons for regional differences in school adjustment. Investigating specific cultural, economic and educational factors that vary by region may be important for evaluating targeted interventions and policies. In addition, mixed research designs can be used by adding qualitative methods such as in-depth interviews and focus group interviews to obtain a more holistic perspective on the factors affecting school adjustment. Longitudinal studies can be planned to reveal the causal relationships between variables and to determine how school adjustment changes over time. In addition to the independent variables of this study, factors such as socio-economic level, parental education level and school resources can be considered.

In this study, it may be useful to implement and evaluate specific interventions aimed at improving the school adjustment of male students, students in higher grades, and students residing in the West Marmara and Istanbul regions. Since experimental studies testing the effectiveness of different programmes or strategies can provide support on how schools can better support their students, practitioners can benefit from the results of this study and provide remedial, developmental and preventive services for individuals with low school adjustment. School administrators, teachers and school counsellors can use interventions such as learning groups, social skills training and peer counselling programmes to ensure students' behavioural and social adjustment. Handbooks on how such interventions can be implemented in schools can be prepared and educators and school administrators can be informed about the applicability of these programmes through various methods such as webinars and meetings.

In addition, since school-based interventions such as psychosocial support programmes, individual and group-based interventions can increase school adjustment, various activities can be organised in schools with low school adjustment. Since it is important to provide human resource infrastructure in the organisation of these activities, various trainings and supervision support can be provided on how to implement these programmes. At the same time, studies such as learning strategies, learning techniques and improvement of learning environments can be carried out to increase students' academic achievement and improve their understanding of the lessons. School administrators and teachers ensure the balance of male and female students in class distributions and school counselors can carry out group guidance activities to increase the adjustment of male students. Preventive and interventionist studies can be planned by taking into account the decreasing adjustment of secondary school students depending on the grade level.

Finally, support can be provided for large-scale studies across Türkiye to identify inequalities at the regional level. In line with these studies, educational policies and support programmes can be diversified at regional level and adjustment programmes can be prepared according to regions. In order to increase the applicability of these recommendations, various informative meetings can be organised to ensure cooperation between the institutions that determine educational policies and local administrations and to initiate pilot implementations. In this sense, it may be important for policy makers to provide more resources for studies to increase school adjustment in regions with lower school adjustment and to make arrangements related to school infrastructure that may affect adjustment.

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Disclosure Statement

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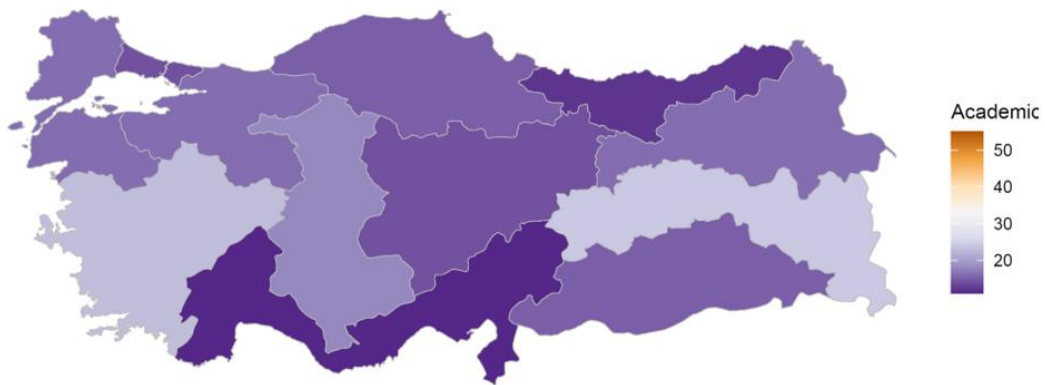
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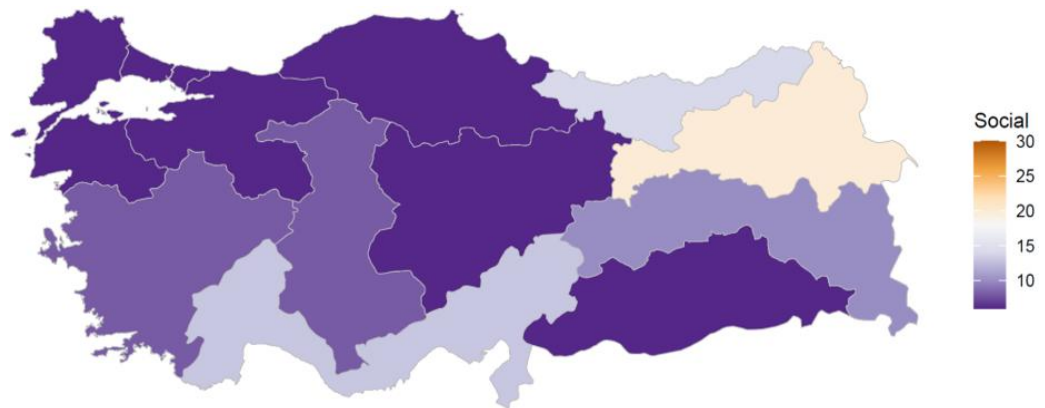
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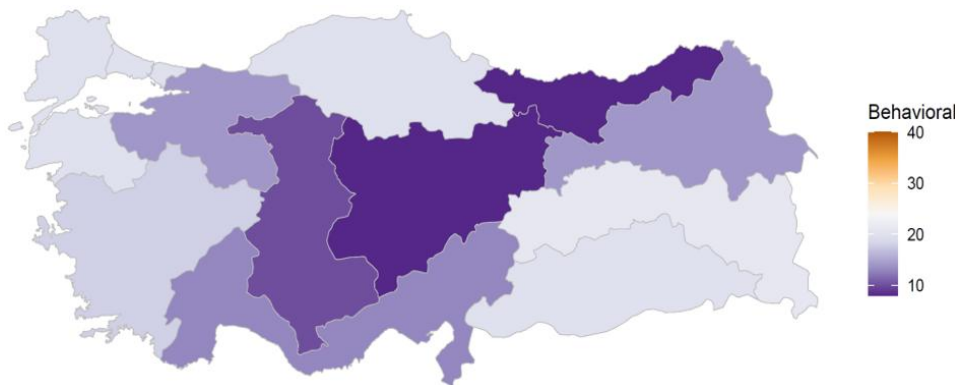
Appendix



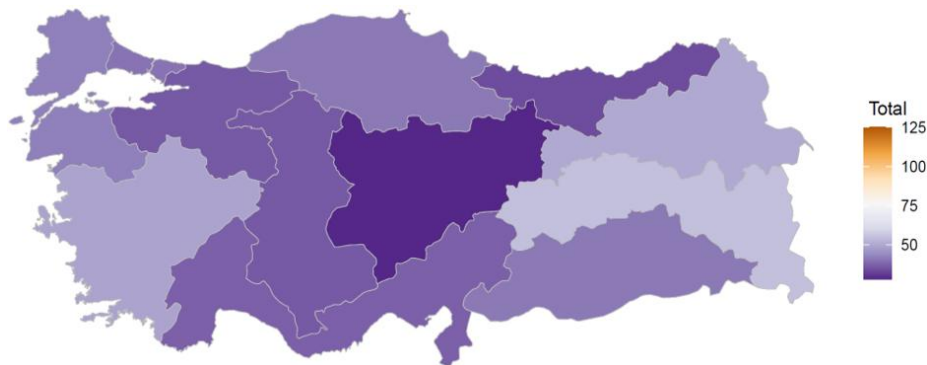
Appendix 1. Academic Adjustment of Middle School Students



Appendix 2. Social Adjustment of Middle School Students



Appendix 3. Behavioral Adjustment of Middle School Students



Appendix 4. Total School Adjustment of Middle School Students



Predicting mathematics achievement through SEM: the role of mathematics familiarity, self-efficacy, and anxiety in mathematical achievement

Fatmir Mehmeti ¹, Vedat Bajrami ²

Abstract

This study examines the structural relationships among subjective familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and academic achievement among students in Kosovo. Using data from PISA 2022, which includes a nationally representative sample of 6,027 students from 229 schools, the study employs structural equation modeling (SEM) in Mplus to test both direct and indirect effects among latent variables. The proposed model assesses how subjective familiarity influences mathematics achievement (as measured by PISA scores) through mediating pathways involving self-efficacy and anxiety. The results indicate that subjective familiarity with mathematical concepts positively predicts mathematics self-efficacy, which in turn reduces mathematics anxiety and enhances academic performance. Although mathematics anxiety negatively affects achievement, its impact is partially mediated by students' self-beliefs and prior familiarity with mathematical content. These findings underline the importance of fostering conceptual understanding and confidence in students as part of a comprehensive approach to improving mathematics achievement.

Keywords

Achievement
Mathematics anxiety
Mathematics self-efficacy
Subjective familiarity
PISA 2022

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Introduction

In an era of rapid scientific and technological advancement, mathematical knowledge is essential for both personal and societal development. Mathematics is no longer merely a school subject; it is a fundamental tool for understanding the world, interpreting complex processes, and making informed decisions in everyday life and across modern professions. Mathematics education plays a crucial role in developing analytical and critical thinking skills (Luczak & Erwin, 2023; Whitney-Smith et al., 2022). Mathematics serves as the foundation for many scientific disciplines, making it a key component of comprehensive education of individuals (Goos et al., 2023; Li & Schoenfeld, 2019). Furthermore, mathematical skills are vital not only for solving everyday problems but also for achieving success in a wide range of professional contexts (Santos-Trigo, 2024). Despite its importance, mathematics achievement remains a significant challenge for many students. Success in mathematics depends on a range of psychological and affective factors that interact closely with the learning process, including students' intellectual understanding of mathematical concepts (Jin et al., 2022), their lack of confidence or self-efficacy in problem-solving (Larsen & Jang, 2021; Živković et al., 2023), and their experience of mathematics anxiety (Ashcraft & Moore, 2009; Ramirez et al., 2013).

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The present study investigates the complex relationships among subjective familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and academic achievement. Understanding these relationships is critical, as they jointly influence students' performance in mathematics (Lessani et al., 2014; Reić-Ercegovac et al., 2019; Zeng, 2025). Subjective familiarity with mathematical concepts refers to students' self-assessed knowledge and understanding of mathematical concepts that vary in complexity (OECD, 2024). Rather than measuring actual competence, this construct captures students' perceptions of how well they understand mathematical concepts, providing insight into their confidence in their mathematical abilities. As a component of cognitive regulation, subjective familiarity is recognized as an important variable in research on self-regulated learning. This variable reflects students previously acquired mathematical knowledge, serves as a foundation for teaching mathematics, and supports students' comprehension of mathematics (Jin et al., 2022).

Bandura (1994) defines self-efficacy as individuals' beliefs in their capacity to produce desired outcomes and influence events that affect their lives, shaping cognition, motivation, emotion, and behavior. Pajares (1996a) further elaborates self-efficacy as beliefs about one's capability to organize and execute the actions required to manage prospective situations. Mathematics self-efficacy represents a task-specific judgment of confidence in one's ability to successfully perform mathematical tasks (Hackett & Betz, 1989). It reflects students' perceptions of their competence to perform mathematical tasks efficiently and influences their motivation, level of engagement, and ultimately their academic achievement in mathematics (Street et al., 2024). This concept is foundational to understanding how individuals approach tasks, cope with challenges, and persevere in the face of adversity. In educational settings, self-efficacy significantly influences students' motivation, learning strategies, and academic performance. Students with higher levels of self-efficacy are more likely to engage in challenging tasks and persist longer when confronted with difficulties (Hayat et al., 2020; Honicke & Broadbent, 2016; Zheng et al., 2021). Students with strong self-efficacy in mathematics are more likely to engage with challenging problems, invest sustained effort, and demonstrate resilience when encountering difficulties, whereas those with lower self-efficacy often avoid demanding tasks and experience heightened mathematics anxiety (Huang et al., 2019).

Mathematics anxiety is a complex and multifaceted phenomenon affecting students across different educational levels. Richardson and Suinn (1972) define mathematics anxiety as feelings of tension and apprehension that interfere with the ability to manipulate numbers and solve mathematical problems in academic and everyday situations. Extensive research has shown that higher levels of mathematics anxiety are consistently associated with poorer mathematical performance (Barroso et al., 2021; Chang & Beilock, 2016; Namkung et al., 2019; Zhang et al., 2019). This negative relationship between mathematics anxiety and performance is evident across diverse domains and educational contexts, with students experiencing significant declines in mathematics achievement as their anxiety levels increase (Zhang et al., 2019). In addition, studies have shown that students with higher levels of mathematics anxiety are more likely to avoid challenging mathematical problems, even when they possess the ability to solve them. This avoidance further exacerbates the issue by limiting their exposure to mathematical practice, ultimately reinforcing anxiety and negatively affecting their long-term academic success (Jenifer et al., 2023). Moreover, the cognitive effects of mathematics anxiety include impaired working memory, reduced problem-solving capacity, and an overall decline in cognitive functioning during mathematics-related tasks (Ashcraft & Krause, 2007). These cognitive deficits further perpetuate the negative cycle of anxiety and poor performance, making it increasingly difficult for students to overcome mathematics-related challenges.

This study places key variables - subjective familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and academic achievement - within an integrated theoretical framework drawing on metacognitive theory and social cognitive theory. From a metacognitive perspective, subjective familiarity is conceptualized as a key metacognitive experience known as the “feeling of knowing,” which reflects learners’ perceptions of their understanding of concepts (Dorsch, 2023; Dunlosky & Metcalfe, 2008; Fernández Velasco & Loev, 2024). This feeling of familiarity serves as a key mechanism in self-regulated learning processes (Zimmerman, 2002), directly influencing strategy selection, monitoring of understanding, and decision-making in problem-solving tasks (Rach & Ufer, 2020). According to social cognitive theory (Bandura & National Inst of Mental Health, 1986), such metacognitive experiences contribute to the development of mathematics self-efficacy, as efficacy beliefs are grounded in perceived competence (Schunk & DiBenedetto, 2020). The interaction between these two constructs indicates that students who feel more familiar with mathematical concepts develop stronger beliefs in their ability to successfully perform specific tasks (Pajares, 1996b). According to Pekrun’s (2006) Control-Value Theory, high self-efficacy, which reflects a strong perception of control, directly predicts lower levels of mathematics anxiety, a negative achievement-related emotion. This negative relationship is widely documented in the literature (Ashcraft & Moore, 2009; Barroso et al., 2021; Ramirez et al., 2016; Zhang et al., 2019), with strong self-efficacy beliefs disrupting the negative cycle of fear and avoidance. Building on this theoretical framework, the proposed model suggests that these psychological interactions enhance academic achievement: students who combine clear metacognitive awareness of their knowledge with high confidence in their abilities and reduced anxiety are more likely to engage effectively and persistently with complex mathematical content (Hayat & Shateri, 2019; Shen et al., 2025; Syaiful et al., 2022; Usher, 2012; Varveris et al., 2023; Zeng, 2025).

Although previous research has examined the effects of familiarity with mathematical concepts (Almuna Salgado, 2017; Jin et al., 2022; Rach & Ufer, 2020; Voica et al., 2020), mathematics self-efficacy (Hera et al., 2023; Larsen & Jang, 2021; Nicolaidou & Philippou, 2003), and mathematics anxiety (Al Mutawah, 2015; Ashcraft & Moore, 2009; Sad et al., 2016; Živanović et al., 2024) on academic achievement, integrated models that consider these variables simultaneously remain limited. This gap in literature highlights the need for in-depth research that examines the complex relationships among these factors and their combined impact on mathematical achievement. Such research is essential not only for addressing theoretical gaps but also for informing educational practice by enabling teachers and policymakers to develop evidence-based strategies to enhance students’ mathematical performance. Furthermore, this study contributes to the fields of educational psychology and mathematics education by providing a comprehensive analysis of the factors influencing mathematical achievement. Specifically, it seeks to deepen understanding of these relationships and explore their implications for mathematics education.

Literature review

Familiarity with mathematics concepts, mathematics self-efficacy, and academic success

Familiarity with mathematical concepts is a key determinant of academic success, particularly in mathematics. Students who are well acquainted with both foundational and advanced mathematical ideas are more likely to develop strong mathematics self-efficacy, the belief in their ability to successfully engage in and solve mathematical problems, which, in turn, contributes to improved academic achievement (Yang et al., 2024). Mathematics self-efficacy plays a critical motivational role, as it encourages students to confront challenging tasks, persist in the face of obstacles, and ultimately achieve higher academic outcomes (Verešová & Foglová, 2018). Empirical research consistently demonstrates that students with greater familiarity with mathematical concepts tend to perform better academically. A solid conceptual foundation enables learners to connect prior knowledge with new material, thereby promoting deeper understanding and more effective problem-solving skills (Al-Hilal, 2024). In contrast, students who lack such familiarity often struggle to develop adequate self-efficacy,

which can lead to heightened anxiety and avoidance behaviours that further impede academic progress (Huang et al., 2019). Moreover, studies suggest that instructional approaches integrating cognitive skill development with affective components, such as strengthening self-efficacy, can significantly enhance students' mathematical reasoning and overall achievement by reducing anxiety and increasing confidence (Mukuka et al., 2021). These findings highlight the importance of targeted instructional strategies designed to reinforce students' understanding of key mathematical concepts.

The role of mathematics anxiety in shaping students' performance.

Familiarity with mathematical concepts and mathematics anxiety are critical factors influencing academic success, particularly in mathematics-related fields. When students discuss and justify their problem-solving processes with peers, they develop a deeper familiarity with mathematical concepts. Such interactions enhance students' confidence and reduce mathematics anxiety, ultimately leading to improved academic performance (Pizzie & Kraemer, 2023). Conversely, insufficient familiarity with mathematical concepts often exacerbates mathematics anxiety, which can hinder academic performance by creating mental barriers that prevent students from fully engaging with the material (Huang et al., 2019). The interplay between these factors is particularly significant, as high levels of mathematics anxiety have been shown to negatively affect test performance, classroom participation, and overall academic achievement (Barroso et al., 2021; Gonzalez-DeHass et al., 2024). Furthermore, Li et al. (2021) emphasize that interventions aimed at enhancing students' understanding of mathematical concepts not only strengthen their confidence but also reduce anxiety levels, which is essential for improving academic performance and overall achievement in mathematics.

Interactions among familiarity with mathematical concepts, self-efficacy, and anxiety in predicting academic success

Close relationships exist among familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and academic success, all of which significantly influence students' educational outcomes. Research indicates that students with a strong understanding of mathematical concepts are more likely to develop high levels of mathematics self-efficacy, defined as confidence in one's ability to perform mathematical tasks successfully (Yıldız et al., 2019; Zakariya, 2022). Mathematics self-efficacy is critical because it directly affects students' willingness to engage in and persist with challenging mathematical activities, ultimately leading to improved academic performance (Skaalvik & Skaalvik, 2006). Moreover, higher levels of self-efficacy are often associated with lower levels of mathematics anxiety, which refers to the emotional distress or fear experienced by some students when engaging with mathematics (Rozgonjuk et al., 2020). Reduced mathematics anxiety has consistently been linked to improved academic outcomes, as less anxious students are more likely to approach learning with a positive attitude and engage more fully with the material. Furthermore, positive emotions toward mathematics are associated with greater academic engagement and stronger self-regulation, both of which contribute to enhanced academic achievement (Villavicencio & Bernardo, 2016).

In this study, we propose a serial mediation model grounded in the existing literature to examine how subjective familiarity with mathematical concepts relates to mathematics self-efficacy and, in turn, influences students' mathematics anxiety and mathematics achievement. Specifically, this study contributes to literature by investigating the mediating roles of mathematics self-efficacy and mathematics anxiety in the relationship between subjective familiarity with mathematical concepts and mathematics achievement (see Figure 1). The following research hypotheses are proposed for testing.

H1a: Subjective familiarity with mathematical concepts has a direct positive effect on mathematics achievement.

H1b: Mathematics self-efficacy has a direct positive effect on mathematics achievement.

H1c: Mathematics anxiety has a direct negative effect on mathematics achievement.

H2a: Subjective familiarity with mathematical concepts has a positive effect on mathematics self-efficacy.

H2b: Subjective familiarity with mathematical concepts has a negative effect on mathematics anxiety.

H3: Mathematics self-efficacy has a negative effect on mathematics anxiety.

H4a: Mathematics self-efficacy mediates the relationship between subjective familiarity with mathematical concepts and mathematics achievement.

H4b: Mathematics anxiety mediates the relationship between subjective familiarity with mathematical concepts and mathematics achievement.

H5: Subjective familiarity with mathematical concepts has an indirect effect on mathematics achievement through the sequential mediation of mathematics self-efficacy and mathematics anxiety.

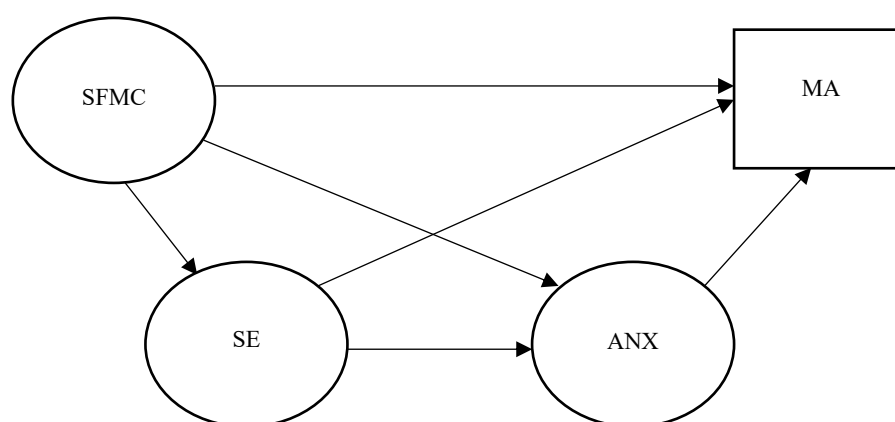


Figure 1. Structural Equation Model Depicting the Serial Mediation Effects of SE (Self-Efficacy) and ANX (Anxiety) on the Relationship Between SFMC (Subjective Familiarity with Mathematical Concepts) and MA (Mathematics Achievement)

Method

This study employed a quantitative, correlational research design to test a predictive model examining the relationships among subjective familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and mathematics achievement.

Sample

The representative sample comprised 6,027 students (2,928 girls and 3,099 boys) from 229 schools across Kosovo. The sample was designed to represent approximately 21,000 15-year-old students nationwide. Participants ranged from grade 8 to grade 12, reflecting diverse educational experiences and levels of academic development. Data for the analysis was obtained from the PISA 2022 assessment database.

Measures

The dependent variable in this study is students' mathematics achievement in PISA 2022, measured through the PVMATH plausible values provided by the OECD. All statistical analyses were conducted using the ten plausible values for mathematics. The independent variables included in the analysis consist of groups of questionnaire items from PISA 2022 measuring students' "subjective familiarity with mathematical concepts", "mathematics self-efficacy (formal and applied mathematics)", and "mathematics anxiety". Detailed descriptions and explanations of these scales are provided in the following sections.

Subjective familiarity with mathematical concepts

This scale measures the extent to which students perceive themselves as familiar with a range of mathematical concepts spanning basic, intermediate, and advanced levels of mathematical knowledge. Students rate their familiarity with 10 mathematical concepts that represent different levels of mathematical ability and understanding. Example items include “divisor,” “area of a circle,” “congruent figures,” “linear equation,” etc. Each item is rated on a five-point response scale (“Never heard of it,” “Heard of it once or twice,” “Heard of it a few times,” “Heard of it often,” and “Know it well, understand the concept”) (OECD, 2021, 2024). The composite reliability (ω) of the subjective familiarity with mathematical concepts scale is approximately .88, indicating good internal consistency and that the instrument reliably measures the intended construct.

Mathematics self-efficacy: Formal and applied mathematics

This scale assesses students’ perceived capability to manage both abstract and real-world mathematical tasks, providing a comprehensive indicator of their confidence across different domains of mathematical literacy. Students rated their confidence in performing a range of formal and applied mathematics tasks using nine items. Example items include “working out how long it would take to get from one place to another,” “calculating how much more expensive a computer would be after adding tax,” “calculating how many square meters of tiles are needed to cover a floor,” etc. Each item was rated on a four-point response scale: (“Not at all confident,” “Not very confident,” “Confident,” and “Very confident”) (OECD, 2021, 2024). The composite reliability (ω) of the mathematics self-efficacy scale, encompassing both formal and applied mathematics, is approximately .90, indicating strong internal consistency and that the instrument reliably measures the intended construct.

Mathematics anxiety

This scale measures students’ emotional reactions, levels of discomfort, and perceived stress when engaging with mathematics in academic and problem-solving contexts. Questions about mathematics anxiety consist of six items, including statements such as “I often worry that it will be difficult for me in mathematics classes,” “I get very tense when I must do mathematics homework,” “I get very nervous doing mathematics problems.” Etc. Each of the six items included in this scale had four response options (“strongly agree”, “agree”, “disagree”, and “strongly disagree”) (OECD, 2021, 2024). The composite reliability (ω) of the mathematics anxiety scale was approximately .86, indicating good internal consistency and that the instrument reliably measures the construct.

Data analysis

The study analyzed PISA 2022 data using structural equation modeling (SEM) in Mplus version 8.13, with missing values coded as -999 and handled using robust maximum likelihood estimation (MLR). The structural model assessed both direct and mediated pathways. Descriptive statistics and bivariate correlations were examined, and confirmatory factor analysis was conducted to validate the measurement model of the latent constructs (subjective familiarity, mathematics self-efficacy, mathematics anxiety, and mathematics achievement). The model tested three mediation pathways: through mathematics self-efficacy, through mathematics anxiety, and a sequential pathway through both self-efficacy and anxiety. In addition, the direct effects of subjective familiarity, self-efficacy, and anxiety on mathematics achievement were evaluated. All analyses incorporated PISA sampling weights, and indirect effects were tested using bias-corrected bootstrapping (10,000 resamples). Model fit was assessed using standard fit indices (CFI > .90, TLI > .90, RMSEA < .05, SRMR < .08).

Results

Primary analysis

Items that did not conform to the expected factor structure were removed during the initial factor analysis, as not all items were deemed suitable for inclusion in the model. Several items associated with the latent variable subjective familiarity with mathematical concepts were eliminated due to low factor loadings. Specifically, the excluded items were Item 3 (.498): *How familiar are you with the following mathematical terms? Congruent numbers* (.415); Item 9 (.566): *How familiar are you with the following mathematical terms? exponential function*; and Item 11 (.386): *How familiar are you with the following mathematical terms? 3-dimensional geometry*.

With respect to the latent variable “*mathematics self-efficacy*”, Item 1 (.588) was removed because it did not adequately fit the model. *How confident are you in math tasks? Use a [train schedule] to determine how long it would take to get from one place to another*. For the latent variable “*mathematics anxiety*”, only one item was excluded due to poor model fit: Item 1 (.582): *I often worry that it will be difficult for me in math class*.

Table 1 presents the results of the confirmatory factor analysis. The initial analysis yielded a χ^2 of 4332.702 with 296 degrees of freedom, a χ^2/df ratio of 14.637, a CFI of .866, a TLI of .853, an SRMR of .068, and an RMSEA of .054. After removing poorly fitting items, the revised conformity factor analysis demonstrated substantial improvement in fit indices: $\chi^2(186) = 2006.083$, $\chi^2/\text{df} = 10.785$, CFI = .925, TLI = .916, SRMR = .049, and RMSEA = .045. The CFI and TLI values exceeded the recommended threshold of .95, indicating a strong model fit. Given that the analysis is based on PISA 2022 data, which includes a very large sample size, the χ^2 statistic—and consequently the χ^2/df ratio—tends to become inflated. Therefore, the elevated χ^2/df ratio observed in the first CFA should not be interpreted as strong evidence of poor model fit. Consequently, alternative fit indices that adjust for sample size, such as RMSEA and SRMR, provide a more appropriate evaluation of model fit in large-scale assessments. In this study, both CFAs produced RMSEA and SRMR values within acceptable ranges, supporting the adequacy of the measurement model despite the inflated χ^2 statistics.

Table 1. Confirmatory factor analysis fit indices for the measurement model

	χ^2	df	χ^2/df	CFI	TLI	SRMR	RMSEA	p
First CFA	4332.702	296	14.637	.866	.853	.068	.054	.000*
Second CFA	2006.083	186	10.785	.925	.916	.049	.045	.000*

*p<.05

Following the confirmatory factor analysis (CFA) to assess the adequacy of the measurement model, a Pearson correlation analysis was conducted to examine the relationships among the study variables. The results of this analysis are presented in Table 2, showing the correlations among the constructs and their indicators, providing a clearer understanding of the interdependence within the data.

Table 2. Means, standard deviations, and correlation coefficients for key variables

	Mean	Sd	FMC	SE	ANX
1. SFMC	3.32	1.14	1		
2. SE	2.52	.77	.456**	1	
3. ANX	2.52	.78	-.308**	-.413**	1
4. MA	352.41		.347**	.317**	-.251**

**p < .01; Sd = Standard Deviation; SFMC = Subjective familiarity with mathematical concepts; SE = Mathematics self-efficacy; ANX = Mathematics anxiety; MA = Mathematics achievement

The correlation table includes four primary variables: mathematics achievement, mathematics anxiety, mathematics self-efficacy in formal and applied mathematics, and subjective familiarity with mathematical concepts. The results revealed a positive correlation ($r = .456$) between subjective familiarity with mathematical concepts and mathematics self-efficacy in formal and applied mathematics, indicating that higher levels of familiarity with mathematical concepts are associated with greater self-efficacy in mathematics. Subjective familiarity with mathematical concepts was also positively correlated with mathematics achievement ($r = .347$). In contrast, subjective familiarity with mathematical concepts was negatively correlated with mathematics anxiety ($r = -.308$), indicating that greater familiarity with mathematics is associated with lower levels of anxiety. Mathematics self-efficacy in formal and applied mathematics showed a positive relationship ($r = .317$) with mathematics achievement, implying that students with higher self-efficacy tend to perform better academically. At the same time, mathematics self-efficacy was negatively correlated with mathematics anxiety ($r = -.413$), suggesting that higher confidence in mathematical ability is associated with reduced anxiety. Furthermore, mathematics anxiety was negatively correlated with mathematics achievement ($r = -.251$), indicating that students experiencing higher levels of anxiety tend to demonstrate lower academic performance.

Hypothesis testing further clarified the relationships among subjective familiarity with mathematical concepts, mathematics self-efficacy in formal and applied mathematics, mathematics anxiety, and mathematics achievement within the PISA. Table 3 presents the standardized estimates, confidence intervals (lower and upper bounds), and p-values for each hypothesis.

Table 3. Direct and indirect effects from the structural equation model

H	Hypothesis Test	Std. Estimate	Lower (5%)	Upper (5%)	P-value
H1a	SFMC $\rightarrow$ MA	.239	.209	.269	.000*
H1b	SE $\rightarrow$ MA	.162	.128	.196	.000*
H1c	ANX $\rightarrow$ MA	-.111	-.141	-.081	.000*
H2a	SFMC $\rightarrow$ SE	.456	.432	.480	.000*
H2b	SFMC $\rightarrow$ ANX	-.151	-.182	-.119	.000*
H3	SE $\rightarrow$ ANX	-.344	-.375	-.314	.000*
H4a	SFMC $\rightarrow$ SE $\rightarrow$ MA	.074	.058	.022	.000*
H4b	SFMC $\rightarrow$ ANX $\rightarrow$ MA	.017	.011	.022	.000*
H5	SFMC $\rightarrow$ SE $\rightarrow$ ANX $\rightarrow$ MA	.017	.012	.022	.000*

* $p < .05$; SFMC= Subjective familiarity with mathematical concepts; SE= Mathematics self-efficacy; ANX= Mathematics anxiety; MA= Mathematics achievement

The results of the hypothesis testing on subjective familiarity with mathematical concepts (see Figure 2) reveal significant relationships among familiarity with mathematical concepts, mathematics self-efficacy, mathematics anxiety, and mathematics achievement. Familiarity with mathematical concepts has a direct positive effect on mathematics achievement ($\beta = .239$, $p < .05$), indicating that students who perceive themselves as more familiar with mathematical concepts tend to achieve higher scores, thereby supporting H1a. Mathematics self-efficacy also has a positive and significant effect on student achievement ($\beta = .162$, $p < .05$), supporting the theoretical assumption that confidence in one's mathematical abilities enhances performance; thus, H1b is confirmed. Conversely, mathematics anxiety has a significant negative effect on mathematics achievement ($\beta = -.111$, $p < .05$), suggesting that students with higher levels of anxiety are associated with lower performance in mathematics. This finding validates H1c. Furthermore, familiarity with mathematical concepts has a strong positive effect on mathematics self-efficacy ($\beta = .456$, $p < .05$), indicating that greater knowledge of mathematical concepts enhances students' confidence in their mathematical abilities. This result also supports H2a. In addition, familiarity with mathematical concepts has a negative effect on mathematics anxiety ($\beta = -.151$, $p < .05$), suggesting that increased familiarity with mathematical concepts reduces students' anxiety toward mathematics, thereby confirming H2b. Mathematics self-efficacy also has a negative effect on

mathematics anxiety ($\beta = -.344, p < .05$), indicating that students with higher self-confidence experience lower levels of mathematics anxiety. This result corroborates H3. On the other hand, familiarity with mathematical concepts influences mathematics achievement through the mediation of mathematics self-efficacy ($\beta = .074, p < .05$), demonstrating that self-efficacy serves as an important mechanism through which familiarity with mathematical concepts enhances performance. This finding supports H4a. Moreover, familiarity with mathematical concepts also affects mathematics achievement through the mediation of mathematics anxiety ($\beta = -.017, p < .05$), indicating that anxiety represents an additional, albeit weaker, pathway in this relationship. This result supports H4b. Furthermore, familiarity with mathematical concepts influences mathematics achievement through the sequential mediation of mathematics self-efficacy and mathematics anxiety ($\beta = .017, p < .05$), suggesting that greater familiarity increases self-efficacy, which in turn reduces anxiety and ultimately improves mathematics achievement. This finding confirms H5. All hypotheses are supported with $p\text{-value} = .000$, indicating that the observed effects are statistically significant.

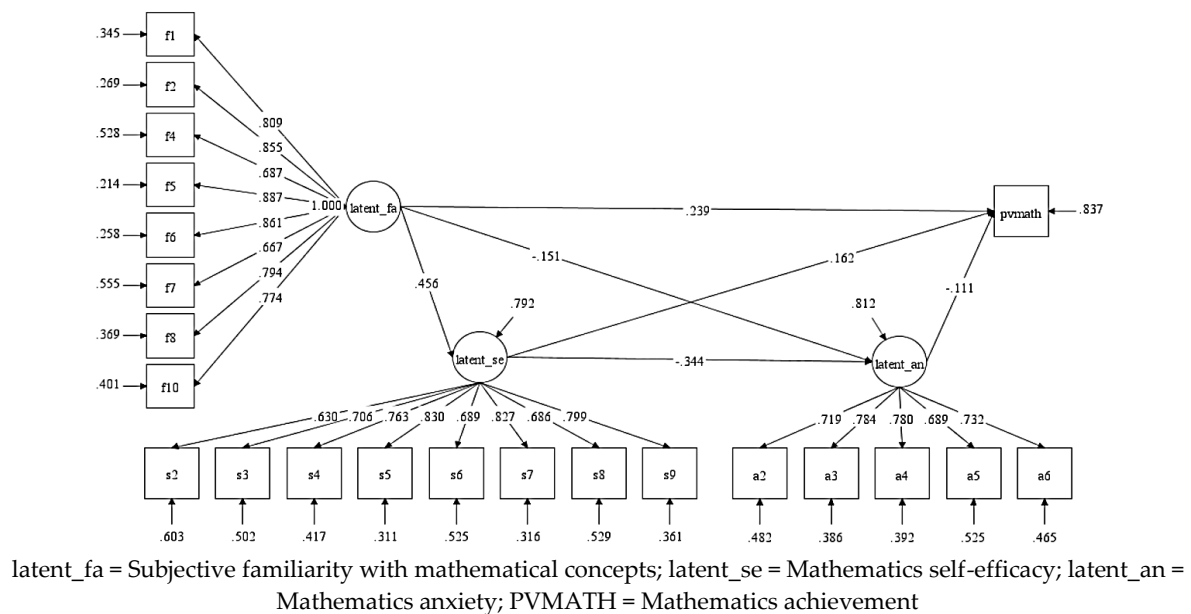


Figure 2. Structural Equation Model Depicting the Serial Mediation

Discussion

Researchers frequently examine multiple factors that influence students' academic success when analyzing their performance in mathematics. In this context, subjective familiarity with mathematics, formal and applied, mathematics self-efficacy (both formal and applied), and mathematics anxiety have been identified as key psychological variables that play an important role in shaping student performance.

The results of the present study indicate that subjective familiarity with mathematical concepts has a positive and significant effect on mathematics achievement. When students perceive themselves as familiar with mathematical concepts, they are more likely to understand the subject matter and demonstrate a greater willingness to engage in learning activities (Breetzke et al., 2024). This perceived familiarity is associated with reduced stress and increased engagement (Yuan et al., 2023), as well as heightened motivation to explore and solve new problems (Voica et al., 2020). Moreover, familiarity with mathematical concepts enables students to employ more effective learning strategies, such as problem-solving and seeking assistance when difficulties arise (Tambunan, 2019). Strong prior knowledge, often reflected in high levels of subjective familiarity, facilitates the comprehension of new concepts and supports the solution of complex problems (Rach & Ufer, 2020). These mechanisms, including enhanced confidence, reduced cognitive load, increased motivation, and activation of prior knowledge, help explain why students with higher subjective familiarity achieve better outcomes in

mathematics. Noble (1963), addressing the relationship between meaningful learning and familiarity, emphasized the influence of prior learning experiences on academic achievement. Subsequent research has similarly demonstrated a relationship between perceived familiarity and learning outcomes, showing that familiarity supports clearer self-expression and more sophisticated explanations of subject matter (Clifton, 1997; Schönwetter et al., 2002). This suggests that the similarity between the findings of the current study and those reported in the literature is not surprising. Students who are familiar with mathematical concepts tend to experience lower cognitive load (Mapson & Major, 2021) and demonstrate greater self-control (e.g., the use of effective learning strategies and reduced dependence on teacher support) during the learning process compared to less familiar students (Murray, 1991; Scott & Dienes, 2010). Familiarity also appears to attract and sustain students' attention, thereby enhancing achievement. Studies by Soppe et al. (2005) and Sockalingam and Schmidt (2013) found that students show greater interest in familiar contexts, which is positively associated with academic success. These findings suggest that the influence of familiarity on student achievement may stem from reduced learning time, stronger integration of new and prior knowledge, facilitated learning and transfer, and increased interest in content and context.

On the other hand, research consistently demonstrates that self-efficacy plays a central role in students' mathematics achievement, often exerting a stronger influence than many other affective variables (Yang et al., 2024). High levels of self-efficacy enhance students' motivation and persistence, enabling them to persevere in the face of challenging tasks and to manage difficulties more effectively (Koh et al., 2022; Schunk & Mullen, 2012). In addition, self-efficacy supports metacognitive and self-regulatory processes. Students with greater confidence tend to set clearer goals, monitor their progress more effectively, and employ more effective learning strategies, such as engaging in challenging tasks that require critical thinking and the application of new ideas (Usher, 2012; Syaiful et al., 2022; Varveris et al., 2023). Through these interconnected mechanisms, including increased motivation and improved self-regulation, self-efficacy makes a substantial contribution to enhanced mathematical performance, explaining its strong and sustained effect on student achievement (Doménech-Betoret et al., 2017). In contrast, mathematics anxiety has a well-documented negative impact on mathematics performance, consistent with extensive evidence showing that anxiety impairs academic achievement (Devine et al., 2012; Foley et al., 2017; Süren & Kandemir, 2020; Zhang et al., 2019). High levels of mathematics anxiety reduce students' ability to concentrate and to retain key information during problem solving (Ramirez et al., 2013). Anxiety also undermines students' confidence in their abilities, leading to increased insecurity and diminished self-belief (Xie et al., 2019). This loss of confidence, in turn, reduces motivation to engage in mathematical tasks and hinders learning progress. Furthermore, fear of making mistakes, which is a common component of mathematics anxiety (Demedts et al., 2022), causes students to adopt overly cautious or avoidant approaches, limiting their opportunities for learning through exploration and experience.

The study findings reveal a strong positive relationship between subjective familiarity with mathematical concepts and mathematics self-efficacy, indicating that students who perceive themselves as more familiar with mathematical concepts also feel more capable of handling mathematical tasks. This result is consistent with existing literature, which highlights the important role of familiarity with mathematical concepts in building self-confidence and fostering greater academic engagement (Jin et al., 2022; Street et al., 2022). Familiarity facilitates learning by allowing students to process related concepts more efficiently, thereby enhancing their sense of confidence. This sense of confidence, in turn, strengthens perceptions of self-efficacy (De Vries et al., 2010). Furthermore, subjective familiarity with mathematical concepts is found to have a small but statistically significant negative effect on mathematics anxiety. Prior research indicates that familiarity can reduce anxiety levels to some extent (Calvo & Eysenck, 2008). Although the effect is modest, this finding suggests that higher perceived knowledge may alleviate feelings of fear and uncertainty related to mathematics, making students more willing to engage with learning tasks. By increasing students' sense of competence, familiarity with mathematical concepts not only enhances self-confidence but also contributes to a reduction in learning-related anxiety, which is known to impede motivation and slow the learning process.

Another key finding of this study is the strong negative effect of mathematics self-efficacy on mathematics anxiety. The results indicate that higher perceptions of mathematics self-efficacy are effective in reducing levels of mathematics anxiety. This finding is consistent with a substantial body of research demonstrating a similar relationship (Hoffman, 2010; Jain & Dowson, 2009; Lee, 2009; Ma & Xu, 2004; Taheri-Kharamah, 2017; Živković et al., 2023). High self-efficacy enables students to better manage stress and academic pressure by encouraging the use of effective coping strategies, such as planning, consistent preparation, and proactive engagement with learning tasks (Freire et al., 2020; Kristensen et al., 2023). Belief in one's own competence allows students to remain calm and focused even in challenging academic situations, thereby mitigating the disruptive effects of anxiety (Muharani & Sucipto, 2023). Moreover, high levels of self-efficacy are associated with more positive attitudes toward learning and a greater willingness to engage actively in academic activities, which ultimately contributes to improved academic performance (Klassen & Usher, 2010). In contrast, students with lower self-efficacy tend to experience higher levels of anxiety, particularly in evaluative contexts, which can hinder their academic performance (Barrows et al., 2013).

Based on these findings, it is essential to examine how mathematics self-efficacy and mathematics anxiety interact to shape the relationship between subjective knowledge and academic achievement. Mathematics self-efficacy plays a crucial mediating role in the relationship between subjective familiarity with mathematics and academic achievement. When students feel comfortable with mathematical concepts and believe in their abilities, they are more likely to understand the material effectively and to develop a positive attitude toward mathematics, viewing it as an opportunity for learning and academic growth (Blotnick et al., 2018; Živković et al., 2023). This combination of knowledge and self-confidence promotes the development of self-regulatory skills, such as planning, goal setting, and progress monitoring, which enable students to manage their learning more effectively and enhance their mathematical performance (Tian et al., 2018). In this way, subjective familiarity and self-efficacy work together to establish a stable foundation that supports motivation, self-regulation, and academic success. Thus, self-efficacy is not merely an affective belief but a catalyst that empowers students to transform passive knowledge into active and successful performance. In addition, mathematics anxiety serves as a mediating factor in the relationship between subjective familiarity with mathematics and mathematics achievement. Although subjective familiarity with mathematics exerts a strong direct positive effect on performance, it also contributes indirectly by reducing levels of mathematics anxiety. This pattern suggests that while subjective knowledge can alleviate some of the negative effects of anxiety, it may not fully eliminate them. Despite the significant detrimental influence of anxiety, the positive effect of subjective familiarity may function as a protective factor, enabling students to sustain a certain level of performance despite emotional challenges. A strong sense of familiarity with mathematical content enhances self-confidence and reduces the uncertainty often associated with anxiety. Moreover, higher levels of subjective familiarity are linked to improved self-regulation skills, which help students manage stress and anxiety related to mathematics more effectively (Furner & Duffy, 2022). This capacity for self-regulation allows students to cope with challenging situations and maintain strong academic performance even in the presence of anxiety.

Finally, a multiple mediation process is observed in which subjective knowledge of mathematics influences students' mathematics achievement through the sequential effects of mathematics self-efficacy and mathematics anxiety. This finding underlines the importance of an integrated approach that simultaneously strengthens subjective knowledge and self-efficacy while addressing mathematics anxiety in order to achieve optimal academic performance. The combined influence of subjective knowledge and mathematics self-efficacy provides a strong foundation for mathematical success. When students are confident in their understanding of mathematical concepts and believe in their ability to solve mathematical problems, they exhibit higher levels of motivation and engagement in learning mathematics (Durksen et al., 2017). This dual confidence enhances performance and helps mitigate the negative effects of mathematics anxiety. The effects of both subjective knowledge of mathematics and mathematics self-efficacy are evident in shaping students' academic outcomes. Supporting students in developing effective strategies to manage anxiety can further enhance their

performance. Students who feel confident in their abilities are better equipped to apply anxiety-management techniques and to confront mathematical challenges more effectively (Zhu et al., 2024). Moreover, when students perceive themselves as knowledgeable and competent, they are more likely to engage actively in their studies and remain motivated to tackle challenging tasks (Acosta-Gonzaga, 2023). This increased engagement and motivation, in turn, contribute to improved performance and help students overcome the obstacles associated with mathematics anxiety.

Conclusion

In conclusion, this study elucidates the dynamic psychological mechanisms underlying mathematics achievement, demonstrating that subjective familiarity and mathematics self-efficacy form a synergistic relationship that operates through both motivational and self-regulatory pathways to directly enhance performance and indirectly mitigate the detrimental effects of mathematics anxiety. From a theoretical perspective, these findings contribute a robust multiple mediation model to the existing literature by clarifying the distinct yet sequential roles of these constructs and extending beyond simple direct-effect explanations. From a practical standpoint, the results underline the need for multifaceted educational interventions that integrate pedagogical strategies aimed at strengthening conceptual familiarity with psychological approaches designed to cultivate resilient self-beliefs and effective anxiety-management skills. Future research should employ longitudinal studies to examine how these relationships evolve over time, as well as experimental approaches to evaluate the effectiveness of integrated intervention programs that simultaneously target these key psychological determinants of academic success.

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Being a teacher in a disadvantaged school: a narrative from a professional development perspective *

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Abstract

The aim of this study is to examine in depth the teaching story and professional experiences of a teacher working in a socioeconomically disadvantaged vocational high school, with a particular focus on professional learning and development. The research adopts a narrative inquiry design within the qualitative research paradigm. The participant teacher was selected using criterion sampling, one of the purposive sampling methods, and the data were collected through a semi-structured interview form. The data were analyzed using thematic analysis tailored to the narrative research design. According to the findings, the idealistic thoughts regarding professional learning and development, which were strongly felt before starting to work at a school affected by disadvantages such as dropout, early marriage, and child labor, gave way to professional burnout, discouragement, and a sense of not being able to fully utilize one's professional potential. These disadvantages revealed the teacher's specific professional learning and development needs and led the participant to seek training to address them. The professional development and training activities undertaken by the participant were described as dysfunctional in terms of their scheduling. The lack of additional support provided to disadvantaged schools within these practices and the disregard of practicum-based learning were found to negatively affect the teacher's professional learning and development process. Based on the participants' experiences, the reasons for the ineffectiveness of professional learning and development practices include decision-making processes that overlook field applicability, a failure to consider the specific conditions of disadvantaged schools, and the excessive workload faced by teachers in such contexts, which limits their opportunities for continuous professional growth. This study reveals how the conditions of disadvantaged schools are reflected in teachers' professional learning and development and offers significant implications for future education policies through its suggestions for eliminating these disadvantages.

Keywords

Disadvantaged school
Teacher learning
Teacher professional development
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Introduction

While the literature on teacher development and learning expands daily, the fact that this topic underlies student and school achievement outcomes maintains research interest in the topic. Research evidence on teacher professional development and learning demonstrates that teacher learning varies depending on the teacher, the learning activities themselves, and the school context (Opfer & Peder, 2011). One dominant view in the literature on the relationship between the structural and cultural aspects of schooling, teacher learning, and change focuses on the capacity of schools to transform themselves into supportive environments for teacher learning and change (Sleegers & Leithwood, 2010). Therefore, it can be argued that the internal and environmental conditions of schools influence teachers' professional development and learning, and the most challenging of these conditions are thought to be related to schools located in disadvantaged areas.

There is research in the literature indicating a positive and significant relationship between a school's level of disadvantage and teacher turnover rates (Allen et al., 2018). The ineffectiveness of guidance services for disadvantaged school profiles in many schools places the burden of addressing students' mental and social-emotional behaviors on teachers (Walton-Fisette, 2020). Consequently, these schools face numerous challenges that impact not only student performance but also teachers' quality of work-life. However, there is also research evidence that highlights that despite poor socioeconomic conditions, some of these schools perform well, thus offering satisfactory work conditions for teachers, among other positive factors (Matla & Xaba, 2020). The varying impact of being a disadvantaged school on variables such as teacher motivation and turnover across cultures, contexts, and countries raises questions about its implications for teacher professional learning and development. Research indicates that disadvantaged student and school profiles increase teacher burnout and reduce their motivation, further disadvantaging schools. In addition, the same study draws attention to the inadequacy of the professional qualifications of teachers among the reasons that push the school to be disadvantaged (Tosun et al., 2020), making it necessary to address the professional learning and development (PLD) processes of teachers working in such schools. Therefore, the aim of the study was to reveal the reflection of the disadvantaged school environment on the professional learning and development of the teacher.

Disadvantaged School Characteristics

While poverty and social class differences emerge as the strongest factors in educational disadvantage in countries like the United Kingdom (White & Murray, 2019), there is research evidence that the situation is similar in the Turkish context. An examination of the environmental conditions of schools located in disadvantaged areas reveals that individuals there are often groups experiencing poverty and prone to violence, as well as immigrants, individuals with disabilities, women, and children (Toprakçı & Arslan, 2022). Furthermore, students in these areas may be experiencing and internalizing trauma stemming from various factors, such as poverty, hunger, violence, and drug addiction (Sutherland & Parker, 2020). Furthermore, disadvantaged groups in schools, such as those with chronic illnesses, high household care burdens, and working children, may be more absent from school than other children (Gencer et al., 2023; Gürgeç, 2024). One of the biggest challenges for schools in socially deprived areas is the high number of students from socially disadvantaged backgrounds, who have lower educational aspirations and less access to institutionalized educational resources, which can create a negative learning environment (Klein, 2017). This negative learning environment is likely to create challenges not only for students but also for teachers' professional learning and development.

Teacher Professional Learning and Development

As a concept, teacher self-improvement is expressed under different concepts such as personnel development, in-service training, professional development, and continuing professional development in the literature. Professional development can be seen as a learning process that encompasses an individual's career and results from meaningful interactions of the teacher educator with their work environment (Kelchtermans, 2004). While professional learning is defined as the mobilization of the energy that emerges from the combination of teachers' skills and competencies (Senge, 2014), programs aimed at this end generally take place in formal environments such as teaching research groups and formal mentoring programs (Timperley, 2011). Within the context of formal learning environments, in-service training can be seen as the most prominent form of professional learning. This training is organized to ensure the individual and professional development of teachers and includes many objectives. These trainings involve ensuring the adaptation of new teachers to their duties; acquiring knowledge, skills and attitudes that contribute to the goals, values and principles of the school; increasing teacher performance and satisfaction; enriching experience within the scope of career development; aims to achieve goals such as solving professional problems (Önen et al., 2009; Özbek et al., 2018). In addition, teachers can learn through informal interactions that occur during peer teaching, collaborative planning, and mentoring among colleagues (Little, 2012). In the professional learning process, teachers are individuals who can actively manage their own learning, collaborate with colleagues, update their teaching with student and teacher feedback, and observe and reflect on the learning of other teachers (Liu & Hallinger, 2018). Teachers' informal learning sources include intensive interaction with colleagues or other educational stakeholders, active participation in the process, direct reference to information sources, and learning by doing or gaining experience (Çelik et al., 2021). Regardless of the type, it is undoubtedly important that continuing professional development activities transform teachers into professionals who are constantly learning and researching (Özdemir, 2016). Furthermore, continuous professional development stands out as a prominent element among idealistic teachers (İğde & Yakar, 2021).

According to the 2018 Teaching and Learning International Survey (TALIS), more than 80% of teachers report that the professional training they receive has a positive impact on their teaching practices (Organization for Economic Co-operation and Development [OECD], 2019). Providing teachers with support for professional development can potentially lead to higher job satisfaction (Chen & Ramos, 2024). Teaching standards established by the Institute for Teaching and School Leadership in Australia, similar to those of the National Board for Professional Teaching Standards in the United States, encompass three teaching domains: professional knowledge, professional practice, and professional engagement. This professional engagement domain dictates that teachers engage in professional learning and engage professionally with colleagues, parents, caregivers, and the community, with a strong focus on developing teachers' professional expertise (Darling-Hammond, 2021). Moreover, rather than a series of isolated activities, professional learning is now conceptualized as a dynamic, interactive, and ongoing development process for teachers (Karacabey et al., 2020). Therefore, ethical, social, cultural, and political dimensions, as well as reflective and research-based aspects of teacher education, must be considered (Flores, 2023). Ensuring and sustaining teachers' professional learning and development can be more challenging in the adverse conditions of disadvantaged school contexts.

Professional Learning and Development in Disadvantaged Schools

In addition to professional learning and development training, contextual factors also significantly influence teachers' perceptions of their professional and personal identities. The socioeconomic contexts from which students come, in particular, have an impact on teachers' ability to measure student achievement (Day et al., 2006). Disadvantaged areas, one of these contexts, are defined as areas with lower socioeconomic and cultural opportunities than other regions (Köse, 2014). The resources available to schools in these areas also vary (Kondakçı et al., 2016). Disadvantaged groups include those experiencing poverty, social exclusion, or those experiencing or at risk of discrimination and violence, as well as immigrants, ethnic minorities, people with disabilities, children, and isolated

elderly people (Disadvantaged Groups, 2024). Furthermore, disadvantage can arise from innate characteristics such as gender and skin color, as well as from socially acquired characteristics such as language, religion, and race (Çağlayan, 2021). There is evidence that professional learning and development, if significant, is a factor that ensures teacher recruitment and retention in schools and districts experiencing such disadvantages (Archibald et al., 2011). Teachers' lack of adequate conditions and energy to develop themselves and renew their knowledge in disadvantaged school environments negatively impacts their professional development (Tosun et al., 2020). Teachers, especially those working in high-needs schools, face numerous obstacles in their careers, including inadequate training, development, and autonomy support (Chang et al., 2022; Mendoza & Dizon, 2024). In high-poverty schools, the perceived organizational climate is a key factor in the stress-resilience-teaching relationship (Ellison & Woods, 2019). It is emphasized that it is not enough for disadvantaged school teachers to have a heart of gold; they must also possess a wealth of knowledge and expertise. It has been stated that teachers need to know how to connect the capital needed to move students into higher social classes with the existing cultures of these children's families and communities (Hargreaves & Fullan, 2012). Therefore, in such schools, it can be argued that teachers' basic skills and competencies, as well as their ability to continue their professional learning and development processes, become even more important.

It has been determined that both the difficulties of working in disadvantaged schools (Akin et al., 2022; Allen et al., 2018; Burnett & Lampert, 2019; Klein, 2017; Matla & Xaba, 2020; Tosun et al., 2020; Walton-Fisette, 2020; White & Murray, 2019) and research on professional learning and development of teachers (Archibald et al., 2011; Day et al., 2006; Eroğlu & Özbek, 2020; İlğan, 2017; Karacabey et al., 2020; Little, 2012; Özdemir, 2016; Timperley, 2011) have a wide coverage in the literature. However, a research gap that explores in depth the professional learning and development stories of teachers who experience disadvantaged school conditions is striking, and due to the limitations of the literature review, it appears that research focusing on this topic is almost nonexistent. Exploring teachers' internal approaches to learning and development in disadvantaged settings, where the necessary conditions and needs for professional development are absent, is closely linked to concepts such as teacher career development and well-being, and their implications for these concepts need to be explored. Therefore, there is a need for research focusing on the professional learning and development of teachers in disadvantaged schools. This research explores the impact of disadvantaged school conditions on the teacher's emotional and intellectual world, professional development, and learning in a more in-depth manner by focusing on the teacher's own story and distinguishes it from other qualitative studies on this topic. The research results can guide for determination of the ways, forms, and relationships within the teacher's disadvantaged school context that influence the teacher's learning and professional development process, and for identifying variables to improve and develop these pathways. Furthermore, they can serve as a basis for informing instructional and professional development practices in disadvantaged schools, as well as the topics and methods of general in-service training and legal regulations for decision-makers. The main reason for conducting this research is to reflect the professional learning and development process of disadvantaged school teachers, who start the race one step behind the starting line compared to other schools and need to work harder to close this gap, based on the teaching story.

In this context, the purpose of this research is to examine the professional learning and development experiences of a teacher working in a disadvantaged school, focusing on their teaching stories and narratives. Therefore, the research sought to answer the following question:

How is the experience of teaching in a disadvantaged school reflected in the teacher's professional learning and development process?

Method

Research Design

The research was designed as a narrative research method based on a qualitative research approach. Narrative research is a research design in the human sciences in which the researcher examines the lives of individuals and solicits their own life stories from them (Reisman, 2008). This design analyzes the ways individuals experience life. In narrative research, the researcher, teacher, and students become narrators and characters in their own and others' stories, based on the notion of "the construction and reconstruction of social and individual stories" (Connelly & Clandinin, 1990). Narrative research goes beyond simply retelling, compiling, or re-presenting a particular story; it requires a more careful analysis of the data, encompassing the participants, the researcher, and the cultural processes in which they participate (Barrett & Stauffer, 2009). It also considers not only the individual act of storytelling but also how researchers select, shape, and present stories to foster engagement with a broader audience (Ayers & Miller, 1997). According to this approach, professional stories allow us to understand how teachers establish connections between acquired theoretical knowledge and practical knowledge (Josselson, 2006) and how they cope with the different components of their roles as teachers (Dvir & Schatz-Oppenheimer, 2020). Furthermore, understanding professional development as a journey is a developmental concept guided by a wide variety of experiences, people, contexts, and interactions (Vanassche & Kelchtermans, 2016). Therefore, since the research focuses on the narratives of a teacher working in a disadvantaged vocational high school regarding the professional learning and development process, using this design is advantageous and preferred. In this context, the teacher's story of teaching in a disadvantaged school served as the basis for their narratives.

Research Context

The school where the research was conducted is located in a neighborhood with a population of 12,300 in a district with a population of 57,000 in a province in the Aegean Region of Turkey (Turkish Statistical Institute, 2022). The socioeconomic landscape of the area where the school is located is dominated by the prevalence of early marriages, the adoption of marketing as a profession by family members, including children, low parental education levels, the prevalence of school dropouts, and low school engagement (absenteeism). Problems in the neighborhood where the research was conducted were classified into four categories: educational problems, health problems, family problems and economic problems. Educational problems include school dropouts and low school engagement due to early marriage, while health problems include a lack of knowledge about hygiene. Family-related problems include a high divorce/separation rate, early marriage, and broken families. Economic problems include lack of social security due to the adoption of agriculture and marketing professions, low income, and not being able to pursue other lines of work (Özdemir & Demiriz, 2004). The school where the participant works is a vocational and technical high school located in this region. The school also includes an apprenticeship training center program. The high school has seven classrooms, 23 teachers, and 284 students. The high school consists of a prefabricated building and does not have a laboratory. According to the researchers, the socio-cultural situation of the school district negatively affects children's education and reduces school engagement by alienating children from school, which in turn leads to academic failure (Köse, 2014). Therefore, the fact that there is research evidence that the school can be considered socio-economically disadvantaged due to the regional conditions in which it is located demonstrates the suitability of the research context for the research purpose.

Participant

Data (experiential narratives) were collected through the experiences of a teacher who worked in a disadvantaged school. This single-participant design was chosen to focus more deeply on the teacher's teaching story and to create a more intimate and sustained interaction through multiple interviews with the same participant. Furthermore, it was believed that focusing on a single participant would reveal the effects of experiences in the context of a disadvantaged school on emotions, thoughts, professional learning, and development in a more striking, profound, and realistic manner.

The participating teacher was selected using criterion sampling, a purposive sampling method. Criterion sampling is the study of situations that meet a predetermined set of criteria. Criteria are created by the researcher, or a pre-established list of criteria can be used (Marshall & Rossman, 2014). The criteria for selecting participants in this study were working in a disadvantaged high school and having worked at the school for at least five years, with a demonstrated understanding of the impact of these experiences on professional learning and development. Accordingly, a teacher who had been working at a disadvantaged vocational high school for over five years was selected as the research participant. For confidentiality, she is referred to as "Duygu."

Teacher Duygu and the researcher crossed paths in a social setting, and during their brief conversations about education, the researcher realized the profound impact of working at a disadvantaged school on the participant's professional development. The researcher identified the negative impact of working at a disadvantaged school on a teacher's professional development as a problem and aimed to explore the issue in depth. The researcher then conveyed the purpose and information about the study to Teacher Duygu, and an invitation was sent to the researcher. And she expressed her pleasure in participating voluntarily. Teacher Duygu teaches in a disadvantaged area. She is 45 years old and a woman. She is married with two children and has 19 years of experience. She holds a doctorate and began her career as a research assistant at a university. After two years at university, she continued her career as a biology teacher under the Ministry of National Education (MoNE). During his time at the Ministry of National Education, she was first assigned to a boarding school in Turkey's Eastern Anatolia Region. She has currently been teaching at a vocational high school in a city in the Aegean Region of Turkey for 11 years.

Data Collection Tools

Data were collected using a semi-structured interview form developed by the researcher in accordance with a narrative research design. The interview form was based on questions appropriate for narrative research within the framework of the literature on the problems of disadvantaged schools and the professional learning and development of teachers. The following points were considered in the development of the questions (Etherington, 2011):

- Cultural contextuality: Questions aimed at exploring details about beliefs, values, and habits.
- Embodied nature: Questions that ground the narrative in real-life experience by shaping the narrator's participation in events and the embodied nature of the events, feelings, thoughts, attitudes, and opinions related to the events.
- The importance of other people: Questions related to how the narrator's network of relationships influences events and the identity of the other characters.
- The narrator's choices and actions: The narrator is an active participant in the events and makes choices based on values, beliefs, and goals. Therefore, questions related to these choices were:
- Historical continuity: Questions related to historical continuity to understand the narrator as coming from somewhere (contextual information) and going somewhere else.
- Beginning, middle, and end: A story needs recognizable parameters; otherwise, it appears chaotic or meaningless. The story begins with an event or decision, or some recognizable trigger. The narrative then develops toward some kind of completion. Questions related to the beginning, middle, and end of the story.
- Metaphors, symbols, and creative, intuitive ways of knowing: Questions related to metaphors, symbols, and intuitive ways of knowing that help capture vivid representations of experiences.

In developing the questions included in the interview form, a comprehensive literature review was conducted based on the research purpose. Draft questions, tailored to the research question and narrative research design, were presented to an expert from the Department of Curriculum and Instruction, who has experience in narrative design. After consulting two experts from the Department of Educational Administration, an expert from the Department of Turkish Language and Literature was consulted to examine the language and expression aspects, and necessary adjustments were made based on their opinions. Some of the questions asked in this research context are as follows: "How did you decide to become a teacher? What influenced you in making this decision? Could you tell me about your predominant feelings and thoughts regarding your professional learning and development in the early years of your teaching? The school you currently work at is described as a "disadvantaged school." What are your thoughts on this? How does teaching at this school make you feel? What training do you think you need to receive to strengthen your professional skills? Are there any efforts at your school or within the ministry to meet your professional learning and development needs? If yes, what are these efforts? What are your thoughts on the adequacy and effectiveness of these efforts? What do you think is the reason for this? What are the impacts of your relationships with school stakeholders—since you have to deal with more challenges than other schools—on your professional learning and development? Could you tell me how they make you feel and think?"

Implementation Process

In the narrative design, data can be in the form of documents and writings such as field notes related to shared experiences, observations of others, journal entries, storytelling, metaphors, pictures, interview transcripts, etc. (Connelly & Clandinin, 1990). Interviewing was used as the data collection technique in this study. Interviewing is defined as a necessary technique for expressing events and phenomena in the individual's environment and revealing unobservable behaviors and feelings (Merriam, 2018). During the interview process, the researcher begins with a position of curiosity and focuses on questions that address the storyteller's cultural context. These questions are crucial for capturing the context through the narrator's feelings and emotions, thoughts, ideas, and attitudes regarding events; the importance of other people; the narrator's choices and actions based on beliefs, values, and goals; historical continuity; and symbols, metaphors, and intuitive and creative ways of knowing that represent their experiences (Etherington & Bridges, 2011). Therefore, the interview questions focused on the participants' feelings about the environment, the thoughts that influenced their choices, and historical continuity. The data presented in this study consists of the participants' interviews, which were recorded in the form of questions and answers. Two interviews were conducted with the participant on days and at times convenient to him, each lasting 40-45 minutes. The interviews were held in a social place, in a warm and friendly atmosphere. Before the interview, the participant was given a brief chat to help them relax, and attention was paid to creating a long-term interaction to gather in-depth data.

Data Analysis

There are four typologies for analyzing narrative research data: thematic analysis, structural analysis, dialogic analysis, and presentational analysis. The first of these, thematic analysis, analyzes the content of the data and analyzes what the participants say. In structural analysis, the researcher focuses on how the story is told. In dialogic analysis, the production of the story occurs through the interaction between the participant and the researcher. Presentational analysis, which is developed by elaborating on dialogic analysis, analyzes the arguments, body language, gestures, and facial expressions used by the participant while telling the story (Reisman, 2008). Data in the study were analyzed using thematic narrative analysis, which identifies themes and categories based on the participant's story (Ollerenshaw & Creswell, 2002). Raw interview data were stored in a computerized environment. Before data analysis, the participant was asked if there were any areas they wished to correct, and confirmed the transcription. The researcher analyzed the data in two rounds. After the initial analysis, the codes and themes were rechecked at three-day intervals to prevent data loss and miscoding. The data obtained were first coded, then organized into categories and themes, defined, and finally interpreted, according to the order suggested by Creswell (2021). An example of how the

classification into codes, categories, and themes was performed during data analysis is presented in Table 1.

Table 1. Sample Data Analysis

Theme	Category	Code	Quote (Expression)
The first years of teaching	Dominant emotions and thoughts	Decision to become a teacher	"I actually decided to become a teacher when I was a child. My father influenced me more because he was a teacher, and when I saw him, when I saw his students respect him, when they saw him outside and asked how I was, I was very impressed. That's why I decided to become a teacher."

Table 1 includes a direct statement from the participant, stating that she decided to become a teacher because of the respect her students showed her father, who was a teacher. This statement was defined and coded as "Decision to become a teacher." This code was then organized under the category "Dominant emotions and thoughts" and placed under the theme "Early years in teaching." The analysis was completed by continuing to separate the data into codes, categories, and themes.

Validity and Reliability

Validity is defined as taking the necessary precautions to obtain accurate data (Yıldırım & Şimşek, 2016). While less emphasis is placed on validity in narrative research than in others, it has been recommended that multiple validity strategies be applied in all qualitative research designs, regardless of type (Creswell, 2021). Multiple strategies were implemented to ensure validity and reliability in the study. One of these is a detailed explanation of the research process, which is crucial for establishing validity (Merriam, 2018). Therefore, an attempt was made to support research validity by providing detailed explanations of the interview form creation, data collection, and data analysis processes. Thus, a detailed explanation of the research process also strengthened the transferability of the findings to similar contexts. To ensure content validity, the semi-structured interview form was developed with expert opinions, and the strategy of including direct quotes from the participant (Yıldırım & Şimşek, 2016) also supported research validity. To ensure validity, a long-term interaction strategy was implemented, and interviews were conducted multiple times and kept as long as possible.

In qualitative research, reliability also refers to the consistency between the responses of multiple coders (Creswell, 2021). It has been stated that consistency can be determined by examining the consistency of definitions in coding and the rate of agreement between coders (Gibbs, 2007). Therefore, multiple coders were used for the transcribed interviews. A doctoral researcher with a doctorate in educational administration conducted the control coding using the reliability formula of Miles and Huberman (2015) ($\text{Reliability} = \frac{\text{Consensus}}{(\text{Consensus} + \text{Disagreement})} \times 100$). Coding consistency was found to be 86.5%. Care was taken to ensure consensus with the coders when creating categories and themes, as consensus-based coding contributes to the quality of the research and the reliability of coding (Kuckartz, 2014). In addition to all these, to increase coding consistency and prevent the overfamiliarity effect, the researcher repeated the coding twice, three days apart.

The Role of the Researcher

According to Merriam (2018), the researcher should identify individual biases, assumptions, and worldviews that may influence the study, and also engage in self-critical self-reflection. In this context, the researcher holds the assumptions and prejudices acquired in the field of educational administration through reading and experience. The researcher has extensive research in the field of educational administration, as well as experience in the field through graduate education and administrative practice. Therefore, the researcher demonstrated sensitivity to this issue, being aware of the bias and manipulation that these biases and prior knowledge might introduce. Considering her social connection with the participant, the researcher maintained an objective, sincere, and genuine attitude during the interview process without directing the participant. She was meticulous in her

efforts to approach the topic from a different perspective. Furthermore, by positioning herself critically, without being influenced by her preconceived notions, the researcher attempted to critically explore the professional learning and development of teachers within the context of disadvantaged schools.

Ethical Issues

This study was conducted in accordance with research ethics procedures. An application was made to the Adnan Menderes University Educational Research Ethics Committee for research ethics permission, and approval was granted on February 29, 2024, numbered 2024/2. Before the first interview, the participant was presented with a voluntary consent form, and written permission was obtained. They were informed that the information collected would not be used for purposes other than the research and that they could withdraw from the study at any time. To protect the participant's personal information, they were given a code name to ensure confidentiality.

Findings

The findings are based on Teacher Duygu's narratives, which reflect on her professional learning and development from her experiences at the disadvantaged school where she worked. The themes, categories, and codes that emerged from this context are presented in Figure 1 and Table 2, with direct quotes from the participant and corresponding codes also included in the subheadings.

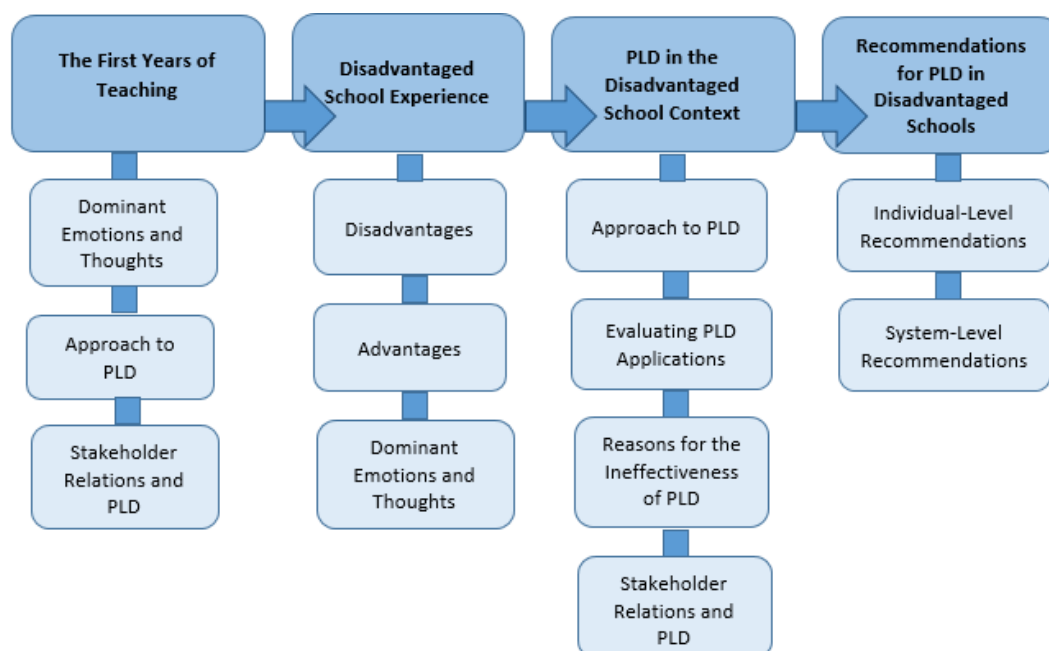


Figure 1. Professional Learning and Development Themes and Categories in the Disadvantaged School Context

Early Years in Teaching

In keeping with the historical nature of the narrative research, the participant's views on her early experiences before starting work at a disadvantaged school were first obtained. Within the scope of Duygu Teacher's narratives about her first years in her profession, three categories were formed: dominant emotions and thoughts, approach to PLD, and stakeholder relations and PLD. Teacher Duygu stated that her father was also a teacher and that she chose this profession because of the respect her students showed her. The participant began teaching at a multi-program high school with a boarding house. She described her professional satisfaction during her years there as follows: *"When I try to compare it to where I work now, the student and parent profiles there were very different from where I work now. .../You could get rewarded for your efforts and achieve academic success."* Teacher Duygu particularly emphasized that she possessed an idealistic power during that period. Comparing her experiences at a disadvantaged school, she explained that this idealistic power gradually faded away:

“I was very selfless, very idealistic, I was saying I could do anything and I was doing it.../ Even if we create the opportunity here, even if you do, the students and parents have no interest in you. After a while, your idealism gradually disappears.”

Table 2. Themes, Categories, and Codes Regarding the Reflection of Disadvantaged School Experience in PLD

Theme	Categorie	Code
The first years of teaching	Dominant emotions and thoughts Approach to PLD Stakeholder relations and PLD	Decision to become a teacher Professional satisfaction Idealistic power Desire to learn and develop Continuous improvement through benchmarking Parent support
Disadvantaged school experience	Disadvantages Advantages Dominant emotions and thoughts	School dropout Early marriage Lack of family environment (broken family/non-marital status) Child labor Lack of healthy emotional communication Low school engagement (absence) Recognizing PLD needs Initially idealistic Discouragement and fatigue in later years Happiness in the positive transformation of graduating students, Thinking that one is not fully using one's potential
PLD in the disadvantaged school context	Approach to PLD Evaluating PLD applications Reasons for the ineffectiveness of PLD Stakeholder relations and PLD	Meeting recognized PLD needs Training programs are ineffective in terms of timeframes. No additional support is provided to disadvantaged schools during implementation. Neglecting practical courses negatively impacts the PLD. Disadvantages necessitate more support for the PLD. Decisions are made without considering suitability for the field. The special conditions of disadvantaged schools are not taken into account. Teacher success is measured by exam success. Inadequate parent-student readiness and physical facilities. Teacher overload prevents opportunities for PLD. The determinant effect of administrator justice on PLD The negative impact of parental indifference on PLD Students' contribution to PLD learning together
Recommendations for PLD in disadvantaged schools	Individual-level recommendations System-level recommendations	Providing psychological support and guidance to teachers Creating special funding for disadvantaged schools Making additional improvements to minimum teaching materials and physical conditions Working with teachers in the field through specialized ministry units Providing face-to-face training during seminar periods

Teacher Duygu emphasized her constant desire to learn and develop during these early years of her career, saying, *"I mean, I had a desire to learn everything. I can do everything, I don't know this, I should do this, look, they're doing this, I'm lacking in this, I should participate."* She also compared her own skills and opportunities with other classes, saying, *"Look, they're using Web 2.0 tools, I should use them too. Here's what they're doing to the kids, we should have it too."* She also stated that she was engaged in a constant professional learning effort. The participant stated, *"...our parents were also supporting us there. It was a small place, but the parental support was very important, it was nice,"* and that she also received parental support and considered this support very important.

Therefore, in her early years as a teacher, Teacher Duygu experienced professional satisfaction through idealistic thoughts. The participant believed she could achieve anything professionally while teaching, and with the support she received from her parents, she felt a constant desire for professional learning and development. These emotions and thoughts led Teacher Duygu to maintain a positive attitude toward professional learning and development in her early years.

Disadvantaged School Experience

Teacher Duygu's experiences of disadvantaged schooling were considered significant in terms of their impact on her professional learning and development. The participant's narratives in this theme, which describe the disadvantaged school context, were categorized under disadvantages, advantages, and dominant feelings and thoughts.

Disadvantages and advantages

Teacher Duygu stated that disadvantages in the school and region where she works include school dropout, early marriage, lack of family environment, child labor, lack of healthy emotional communication, and low school engagement (absence). The participant stated, *"Where I work, there is a bride price; they still charge it to girls under current circumstances. When I interviewed parents, we said, 'Look, this girl is very smart, she needs to study, she needs to go to school,' and they said, 'Teacher, they took it from me, why shouldn't I?' That's sad. They see what they've been through as befitting themselves, as befitting their children. That's the saddest thing."* She emphasized the continuation of outdated practices like bride price. The participant noted that parents' perspectives on education regarding child labor are very narrow. She responded, *"They say, 'I go to the market here or there with my children, and I earn in 15 days what you earn in a month. If I bought another stall, I could double that amount. Why should she go to school?'"* Teacher Duygu's current conditions at a disadvantaged school appear unsuitable for professional learning and development. However, the participant offered an interesting insight, stating that the school offers advantages alongside these disadvantages. She emphasized that this situation provides an advantage in recognizing the needs of the PLD (Problem Learning Development) by saying, *"It's a disadvantaged school, but you can say 'I'm lacking in something,' and you make an effort to improve yourself."* Therefore, the school's current disadvantages and advantages contributed to the teacher's process by helping her recognize her professional learning and development needs.

Dominant emotions and thoughts

Teacher Duygu stated that during her experience at a disadvantaged school, she continued to feel the same idealistic strength she had at the beginning of her professional career, and that this belief was dominant, saying, *"I worked in the east, I can do it here too. After all, it's my school, I can go, I can do it. The child is the same, nothing has changed, the curriculum is the same."* However, she added that in later years, she felt a sense of discouragement and fatigue due to the lack of reciprocity from parents and students for the dedication shown. She explained these feelings by saying, *"For example, when I first started there, I said we were enthusiastic, we were doing everything. Now, doing the same things, not getting the same attention from the children, not getting the same attention from the parents, it's tiring. Now, professional discouragement has set in."* Teacher Duygu expressed her happiness at the positive transformation she saw in the students who managed to graduate, and that she sometimes felt renewed enthusiasm with this idealistic strength, but after a while, she returned to the same feelings of discouragement and fatigue. A striking finding was that the participant stated that due to this discouragement, she did not fully utilize her teaching potential, achieving only 40-50% of her performance in the first years of her

career. Teacher Duygu expressed her views on these issues by saying, *"You know, when you see that there's no enthusiasm in children, you get fed up. I think I'm experiencing professional weariness right now. So, when I look back, I'm only doing 40-50% of the work I did when I first started, meaning I'm not working to my full potential."*

It was determined that Teacher Duygu's idealistic thoughts persisted in the early stages of her professional learning and development in the context of a disadvantaged school. However, over time, due to factors such as parental and student indifference in the disadvantaged school context, this idealism gave way to feelings of discouragement and fatigue. The participant also pointedly stated that these feelings and thoughts prevented her from fully realizing her professional potential.

Professional Learning and Development in the Disadvantaged School Context

This theme constitutes the most striking part of the research and encompasses Teacher Duygu's narratives about how her experiences in a disadvantaged school context reflected in her professional learning and development. The findings for each category comprising this theme are presented under separate subheadings.

Approach to professional learning and development

When Teacher Duygu began working at a disadvantaged school, she recognized and worked to address their professional learning and development needs. The participant teacher observed that students had learning disabilities stemming from family relationships, such as dyslexia, autism, and attention deficit disorder. At the time, she was unsure how to accurately identify these problems and how to intervene. She also noted that this situation created a gap in her understanding. She stated the following about this situation:

"Marriage outside the community is very rare here, so most children are actually related, meaning they share some common genes, and this can lead to some problems in children, learning disabilities. For example, there are things like dyslexia, attention deficit disorder, autism. I didn't know much about these things. Actually, yes, we did learn, but I didn't know how to intervene, how to detect them, what the methods would be./.../ We always think about things like that, but there are also gifted children. For example, a child might have a distraction, might not listen to me in class, might draw pictures, but if the child is gifted, they understand what I say. They need special education. So, I considered myself as lacking in this regard."

Recognizing these professional learning needs in herself, Teacher Duygu volunteered to attend a course organized by the Guidance and Research Center in the district to meet her professional learning and development needs. The participant's statements on this topic are as follows:

"When I first started, I volunteered for the 180-hour Guidance and Research Center's district-wide course. We tell children with special needs, 'This child doesn't understand anything, I explain it, but they don't understand.' Okay, the child can't do this, but what's the underlying reason? /.../ In the course I attended, I learned the following from an expert: 'First, look at the student's report. Based on that, you should start with one learning outcome based on their level. It doesn't matter if you write one learning outcome for the entire year; no one will ask why you wrote one.' /.../ After teaching the child that one learning outcome, add the second learning outcome right below it. Frankly, I wasn't very familiar with it. But after that course, I realized it /.../ After that, I received training for gifted individuals provided by official institutions."

The participant recognized his professional shortcomings when faced with the challenges of his disadvantaged school environment. Then, she voluntarily attended courses opened by official institutions. It was determined that the participant felt a need to continue his professional learning and development within a disadvantaged context.

Evaluating professional learning and development practices

The research participant evaluated the practices of the administrative units regarding professional learning and development during his tenure at a disadvantaged school. She noted that although the ministry organized numerous professional learning and development programs, she did not participate because the timing was inconvenient. She suggested that these programs would be more effective if offered during seminar periods or mid-term breaks:

"Yes, there are projects that are being implemented, but they are not functional. The Ministry is working hard, but they are being implemented just for the sake of it, and I cannot participate. If they were to open these projects during seminar periods, as I said, and of course, they are available at school during the mid-term breaks, teachers could do these projects then."

Regarding the Movement for Increasing Opportunities and Improving Technology (FATİH) project, which focused on professional learning and development, the participant stated, *"What's right for one school isn't right for another. For example, I'm in a disadvantaged area, and yes, a smart board has been installed. But our school has only had it for two years. The Fatih project is a good project, using technology in education is great, but while all the other schools are using it, our school has only had it for two years/.../More support is needed to close the gap. We don't receive that support."* However, according to Teacher Duygu, not all schools should be put in the same category, and to close the gap stemming from their disadvantages, they should be provided with more support than other schools in these kinds of applications.

Teacher Duygu stated that the necessary emphasis was not placed on the practical courses required for her field (biology) at a disadvantaged school, and that this situation negatively impacted her professional learning and development. The participant explained that she provided the materials needed for the practical courses herself and tried to engage students in practical exercises required for her field:

"For example, when I teach biology to children in 9th grade, I say "single-celled organisms," and the children can't quite grasp it. What is this single-celled organism? Microscopes are so old-fashioned, there's no binocular microscope, no stereoscopic microscope. I prepare a single-celled culture, and I bring the culture. I plug the missing device into the computer, which I motivate in the best way I can, and show the children the single-celled organism. I want the lab to click on the child's head so they understand when I say "single-celled."/.../ Due to the physical conditions, we don't have laboratories at our school, so we closed them. We had to build classrooms, but our physical conditions aren't sufficient for laboratories right now, and because of that, the lab was closed, meaning there's no professional support whatsoever."

She also emphasized that the disadvantages of the school and the district necessitate more support than usual for professional learning and development, and that adequate opportunities for professional development should be provided not only to students but also to teachers. Regarding this, the participant said, *"I think extra support should be provided, not only to students but also to teachers, because if you want to teach and learn something professionally, you need to have the resources."* Teacher Duygu made an important assessment, emphasizing that while there is a lot of theoretical training provided by the Ministry, this needs to be supported by practice. She explained this situation with the following words:

"Yes, there's a lot of in-service training, a lot on every subject. Not only that, but I also use technology/.../But I just listen. Some things need to be put into practice, and they're left hanging/.../Yes, I have an idea on the subject, but I don't have the skills to put it into practice. The important part is how we can integrate the training the Ministry provides into children's lives and education. Let that training have a reward. For example, I took drama training, and I applied it in a quiz show."

Therefore, the participant acknowledges that there are practices for professional learning and development. However, she views these practices as dysfunctional and inadequate in terms of the time and additional support they require to be tailored to the disadvantaged context. Overall, the participant expressed negative opinions about the professional learning and development practices at the disadvantaged school.

Reasons for the ineffectiveness of professional learning and development practices

Teacher Duygu stated that the practices implemented for professional learning and development were ineffective and offered her views on the reasons for this. The participant emphasized that decisions made without considering their relevance to the field made the PLD practices ineffective, saying, *"With us, everything is on paper!.../I mean, if something is to be done, we should first go to the field and see how it works in practice, based on what's written on paper."* The participant also emphasized that the failure to consider the special circumstances of disadvantaged schools was another reason, saying, *"I don't believe that every school or every disadvantaged region can be given equal professional development work. Because it's not legislated, saying 'School A should do it differently, School B should do it differently,' but rather, it's a general initiative aimed at both schools and teachers."* Teacher Duygu also believes that one of the reasons for the ineffectiveness of professional learning and development practices is that teacher success is measured by exam performance, which trivializes professional practice. The participant expressed her thoughts on this as follows:

"Unfortunately, in our country, everything is measured by exam success, so you tend to abandon experimentation. Your success is determined by how many biology exams your student completed on the TYT exam, and you're a success! How many biology exams they completed, and you're a failure! Successful by what? Successful by whom? Successful by many factors: the teacher, the student, the parent, the student's current state of mind during the exam, whether they attended school, and so on."

Teacher Duygu strikingly stated that the exaltation of exam success has overshadowed practices like experiments, which contribute to professional learning and development. This situation highlights the negative impact of an exam-focused education system on professional learning and development. Furthermore, she emphasized that inadequate parent-student readiness and physical facilities render PLD practices ineffective, saying, *"Are all schools the same? For example, I went to a science high school. You can do anything in a science high school. The child is ready, the parent is ready, the physical facilities are sufficient, you can do anything. My school is prefabricated; do I have enough resources? I don't."* Teacher Duygu emphasized that excessive workloads do not provide opportunities for PLD and render PLD practices ineffective, saying, *"Right now, we're teaching things like how to gather students, how to bring them together, how to teach them social rules, rather than our own professional development!.../We've been putting professional development on the back burner for a long time now; if you have it in you, you do it yourself. For example, I learned Web 2.0 tools myself."*

Stakeholder Relationships and Professional Learning and Development

The participant was also asked how stakeholder relationships impact professional learning and development in disadvantaged school environments. The participant explained that administrative justice is a determining factor in the PLD process, saying, *"If my manager is good and encourages me in terms of professional learning and development, and if he or she is fair to me, I work harder. But if my relationship with my manager isn't good, neither my professional development nor my mood nor my peers will be good at all. But with a fair environment, I achieve more of everything."* Teacher Duygu addressed the lack of interest from parents in such schools, stating that this has a negative impact on PLD. In this regard, she said, *"Parents' attitudes and behaviors really take you one step forward or one step back professionally. For example, the attitudes and behaviors of certain data make me feel professionally exhausted!... /I don't think the parent profile in disadvantaged regions of our country is truly supportive of professional learning and development."* The participant happily noted that her students contribute to her own professional learning and development. Emphasizing that they learn together with their students, Teacher Duygu drew attention to this situation with these words:

"But I think I've learned a lot from my students, and I also think they've contributed a lot to me professionally. I tell them, "Yes, I'm a biology teacher, but I may not know everything about biology; I only have an opinion. I'll tell you I don't know what I don't know, but if you ask me, I'll go home and research it, and I can learn it too." And they ask such positive questions, which encourages me to learn. That's why I love students; sharing with them makes me happy. If you ask, "Administration, parents, students?" I prefer students, and it has a positive impact on my professional development."

As can be seen from the statements above, Teacher Duygu finds her interactions with her students, rather than with administrators or parents, to be the most supportive and positive during the professional learning and development process in a disadvantaged school context. The participant stated that her students' curiosity and questions encourage her to learn, clearly expressing their positive impact on her students' professional development.

Recommendations for Professional Learning and Development in Disadvantaged Schools

Teacher Duygu was asked about her suggestions for supporting the professional learning and development of teachers working in disadvantaged schools. The participant offered some striking suggestions on this matter, categorized at the individual and system levels. Teacher Duygu stated that these teachers, who work under challenging conditions, should be provided with psychological support and guidance primarily. She made the following statements on this topic:

"First of all, teachers are exhausted and need psychological support/.../ I'm currently experiencing professional burnout. This year, I'm using 40% of the effort I put in last year./.../ Because you've been working in a disadvantaged area for 12 years, 12 years is plenty of time to burn out./.../Because after a while, you burn out, constantly encountering negative conditions, and when you think, 'This is never going to get better, this is my life' you're psychologically exhausted. You have to provide this to the disadvantaged area so that teachers can focus on their own development and professional learning."

The participant emphasized the necessity of providing psychological support to teachers so they can focus on their professional learning and development. The participant's words highlight the psychologically negative impact of constantly encountering negative conditions. Furthermore, the fact that teachers report experiencing professional burnout after working in disadvantaged schools for extended periods is an important finding in terms of professional learning and development.

The participant also offered system-level suggestions for supporting teachers' professional learning and development in disadvantaged schools. Among these, regarding the creation of special funding for disadvantaged schools, she said, *"There should be funding for teachers in disadvantaged areas, not for teachers, but for children. This should be provided to disadvantaged areas so teachers can focus on their own development and professional learning."* She emphasized the importance of providing funding for children to focus on their professional development. She also suggested additional improvements to the school's minimum teaching materials and physical conditions:

"We need easy access to innovations, technologically speaking. I'm talking about physical facilities, but I don't have the physical resources for a "prefabricated school." For example, if I put a microscope on a board and put single-celled organisms there, I'd like to show them all, like the moving "euglena" and the "amoeba," all under one microscope. But I need to be able to attach it to a smart board; that equipment should be provided for me/.../ Yes, it is provided, but it's not sufficient. So, physical facilities need to be improved."

The participant suggested that special ministry units be established to support the PLD program, saying, *"The ministry should have a dedicated unit, and it shouldn't be 'I did it on paper,' but rather*

one-on-one discussions with teachers in the field." Teacher Duygu also added face-to-face training during seminar periods to her system-level recommendations, explaining:

"I also believe that we could be in a better position if, instead of watching three- or five-minute videos during our seminar periods, we could provide face-to-face training on any topic, such as first aid, giftedness, special education, or individualized education, for a week with experts in the subject."

Teacher Duygu believes that supporting the PLD process requires providing teachers with psychological support and guidance to protect them from the psychological strain caused by disadvantage. She also advocated for special assessments of disadvantaged schools and the creation of dedicated funds, which could help teachers focus on their professional learning and development. Teacher Duygu also emphasized the need for further improvements in teaching materials and physical conditions in such schools. In addition, the participant suggested that the Ministry establish special units for disadvantaged schools and conduct practical fieldwork with teachers on this issue.

Discussion, Conclusion, and Recommendations

This research focused on revealing the reflection of a teacher's teaching experience in a disadvantaged school on the professional learning and development process. According to the research results, Teacher Duygu displayed a positive attitude towards professional learning and development in the first years of her teaching career. During that time, she held idealistic views and felt a sense of professional (job) satisfaction. With the positive support she received from parents, these dominant feelings and thoughts were reflected in the teacher's professional learning and development as a desire for continuous learning and improvement. Similar to the findings, idealism is considered a professional competence within the scope of teachers' professional knowledge, skills, attitudes, and values, and the continuous self-improvement that idealist teachers prioritize is their professional qualities (İğde & Yakar, 2021). Wang et al. (2024) highlighted the link between teachers' job satisfaction and professional development. Job satisfaction, as a good predictor of teachers' professional performance (Ololube, 2006), increases in-class professional performance (Avcı et al., 2022). Furthermore, it has been established that effective teachers frequently collaborate and share with parents within the context of professional development activities (Eroğlu & Özbek, 2020), and that a positive parental approach has a positive impact on and increases teachers' professional productivity (Hatipoğlu & Kavas, 2016). Based on the findings and literature, it is possible to argue that idealistic thoughts and professional satisfaction, along with the positive support and approaches they receive from parents, positively impact teachers' professional learning and development during their early years. Therefore, during their first years as teachers, they have full faith in their professional learning and development, a desire to learn and develop, and thus experience professional satisfaction.

The study explored the disadvantages of the disadvantaged school where the teacher worked to demonstrate the school context, which is crucial for professional learning and development. The school and school district included disadvantages such as dropout, outdated practices such as bride price, lack of family environment, child labor, lack of healthy emotional communication, and absenteeism. These disadvantages, which are not particularly conducive to professional learning and development, were found to provide an advantage to the teacher. This advantage stemmed from the teacher's awareness of professional learning and development needs due to the unique characteristics of the school district. While it has been noted that teachers frequently face professional training and development needs in disadvantaged schools (Chang et al., 2022; Mendoza & Dizon, 2024), research has also shown that teachers have a high awareness of their individual learning skills, demonstrating a constant desire to learn (Çilek et al., 2023). Therefore, the school's context, which includes various disadvantages, has become an advantage for the teacher by creating a need for professional learning and development awareness and contributing to this development process.

The study also identified the dominant feelings and thoughts experienced by teachers during their experiences at a disadvantaged school. Accordingly, the idealistic thoughts and professional satisfaction felt by teachers in their early years of teaching transformed into feelings and thoughts of professional burnout, discouragement, and a sense of underutilization of professional potential after a prolonged (12-year) tenure at a disadvantaged school. Similar evidence exists in the literature. Burnout, one of the many problems experienced by teachers in Turkey (Özdemir, 2007), refers to low professional effectiveness and decreased productivity in terms of personal accomplishment (Maslach & Leiter, 2016). Burnout has been considered an occupational hazard for people-centered professions such as education for years (Maslach et al., 1996), and it has been noted that disadvantaged students and school conditions increase teacher burnout levels (Tosun et al., 2020). Therefore, the problematic school environment caused by disadvantages has diminished teachers' idealistic thoughts and professional satisfaction, which support development and learning, and transformed them into feelings and thoughts such as professional burnout and discouragement. Furthermore, this disadvantaged context prevents teachers from reaching their full professional potential. A solution to this situation could be to impose a quota (4-5 years) on tenure in disadvantaged schools and to include more professional training and social activities in these schools to ensure teachers maintain and maintain their professional learning and development.

It has been determined that teachers' approach to professional learning and development in disadvantaged schools is to identify and address professional development needs in response to frequently encountered learning difficulties in students. Research has also shown that teachers who are more exposed to professional development have higher levels of job satisfaction (Toropova et al., 2021), and that teachers with autonomous motivation are more engaged in professional development and learning (Gorozidis & Papaioannou, 2014). Therefore, it can be argued that participants are driven to address their professional learning and development needs to gain insight into students' learning challenges and adapt to the disadvantaged school context. Furthermore, an inverse relationship has been found between turnover and disadvantage in Norwegian schools (Falch & Rønning, 2007). This result may stem from the idealistic perspective held by teachers in disadvantaged schools. The recognition of professional learning needs in disadvantaged schools, coupled with an idealistic perspective, and their focus on addressing these needs, supported and ensured the continuation of the professional development process.

The study also conducted an evaluation of professional learning and development practices in a disadvantaged school. This evaluation determined that the training practices were dysfunctional in terms of timeliness. Similarly, it was emphasized that professional learning and development training overlapped with teachers' working hours, that training programs tailored to their needs were not offered, and that other family responsibilities left them with limited time for training (Köseoğlu et al., 2020). The study results indicated that disadvantaged schools were not provided with additional support in professional learning and development practices, and that disadvantaged individuals required more support for professional learning and development. However, it was emphasized that teachers need different professional learning and development practices due to the different types of schools they work in, student profiles, and student readiness (İlğan, 2017). Furthermore, the study found that failure to consider the special conditions of disadvantaged schools in professional learning and development practices also made these practices ineffective. Teachers who experience disadvantaged school conditions struggle with more challenges. Therefore, they need professional learning and development more than other teachers. Because these teachers experience more specialized conditions, their professional learning and development needs are also unique. Therefore, the specific needs of disadvantaged school contexts necessitate more specific professional development practices and increased support for teachers.

Research results indicate that neglecting practical training due to the limited resources of disadvantaged schools negatively impacts professional learning and development. In the literature, the majority of science and technology teachers emphasize the importance of laboratory practices and

recommend that professional development training provided to teachers be made ongoing at regular intervals (Böyük et al., 2010). Considering that professional learning and development would be incomplete without a practical component, the necessary practical training should be provided, especially for branches requiring a laboratory environment, such as science. This ongoing training can prevent teachers from becoming professionally atrophied within their own fields. Research results indicate that one of the reasons for the ineffectiveness of professional learning and development practices is that measuring teacher success by exam success trivializes practices such as experiments, which contribute to professional learning and development. A study examining teachers' opinions on the high school entrance exam emphasized that teacher success is measured by the number of successful students on the exam, and that the exam system puts pressure on teachers and hinders professional development (Dilekçi et al., 2023). Therefore, while practical courses such as experiments within the scope of "theory + practice" have been observed to contribute to the professional development of teachers, the Ministry should prioritize these practical courses and allocate the necessary physical conditions and time. Furthermore, the fact that teachers' overload due to the challenging conditions of disadvantaged contexts does not provide opportunities for professional learning and development has been found to be a reason for the ineffectiveness of these practices. Similarly, while the literature indicates that teachers cannot allocate sufficient time to professional learning and development activities due to their workload and intensity (Eroğlu & Özbek, 2020), it should be kept in mind that this workload can increase even more in disadvantaged contexts. To eliminate this situation, it would be beneficial to allocate effective and productive time for professional learning for teachers experiencing disadvantaged school conditions and to introduce legal regulations for this. Thus, teachers can dedicate a significant amount of time, other than the time allocated to teaching, to their own development and continue their professional learning and development activities in disadvantaged schools.

In disadvantaged schools, stakeholder relationships appear to be crucial for teachers' professional learning and development. Among these stakeholders, the justice provided by the administrator is a key determinant of teachers' professional learning and development. While the combined provision of administrator justice and professional development opportunities increases teacher motivation (Ünsal & Görücü, 2023), the leadership of the administrator and the culture of trust and respect within the school have been found to be more effective than other factors in professional satisfaction (Johnson et al., 2012). Therefore, in schools with various challenges, a fair, respectful, and trusting environment provided by the administrator can be seen as motivating teachers for professional learning and development. The study determined that students, another stakeholder, contribute to teachers' professional learning and development in the context of disadvantaged schools. The participating teacher singled out her students for professional learning and development among all stakeholders and continued the learning process with her students. Similarly, it was noted that students, as collaborators in professional development, engage in a learning process alongside teachers, and teachers continue to expand their understanding of professional education practices (Sprott, 2019). Therefore, even under challenging circumstances, teacher interaction with students can be seen as a crucial element in the professional learning and development process. It has been identified that the Ministry, a system stakeholder, needs to support the theoretical professional learning and development training provided to teachers in disadvantaged schools with practical application. Teachers in OECD countries emphasized that the most effective element of the professional development training they receive is the opportunity to apply new knowledge and ideas in the classroom (86%) (OECD, 2019). Therefore, the importance of dedicated time for professional learning and development is also highlighted here. Indeed, learning by doing or experience is also an informal form of professional learning and development.

The research also provided recommendations for the professional learning and development of teachers working in disadvantaged schools. The recommendation at the individual level was to provide teachers with psychological support and guidance. Research has reported that teachers' lack of sufficient knowledge about emotional and social development in their relationships with at-risk students who have challenging experiences increases their emotional burden (Alisic, 2012), negatively impacting

teachers' professional attitudes and motivation, as well as their physical and psychological health, in an already challenging teaching environment (Yurduseven et al., 2022). Therefore, providing psychological support and guidance is deemed essential to eliminate the psychological stress created by constantly encountering negative conditions in disadvantaged schools and to better focus on professional development. Emphasizing the inevitability of professional burnout after long-term employment in such schools, this support becomes even more crucial for continued professional development. System-level recommendations include creating special funding for disadvantaged schools to enable teachers to focus on professional learning and development, and making additional improvements to minimum teaching materials and physical conditions. Literature evidence also emphasizes the importance of ensuring that socioeconomically and culturally disadvantaged students have equal access to educational opportunities, emphasizing that these students only have the opportunity to change their socioeconomic status and circumstances through education (Toprakçı & Arslan, 2022). Minimizing the problems and challenges that create disadvantages for students can improve teachers' professional conditions and help them focus more easily on their professional learning. Furthermore, research has emphasized that school administrators believe the Ministry should provide additional materials, resources, and budgets to disadvantaged schools (Akin et al., 2022). Therefore, within the scope of teacher professional learning and development, support with special funds and additional improvements, as well as positive discrimination, is essential to help these schools break out of the cycle of disadvantage. System-level initiatives to support professional learning and development include working with dedicated ministry units in the field with teachers and providing face-to-face training during seminars. Similar to the results, the ministry emphasized that professional development seminars offered by teachers via distance learning should be delivered in schools as practical training sessions in which teachers participate (Kahyaoglu & Karataş, 2019). It was also emphasized that provincial and district units of the ministry should be aware of the disadvantages of schools and prioritize teachers' opinions and support professional training (Özdemir & Kazancı Tınmaz, 2024). In this context, it can be argued that the specific situation of disadvantaged schools deserves special attention, not general rules, regarding teacher professional learning and development. Teachers in these schools should participate in research groups focused on disadvantaged schools with ministry experts, conduct fieldwork, and have a voice in policy decisions. Furthermore, the training provided during the seminars should be implemented face-to-face to ensure greater effectiveness.

This research is limited by the views of a single participant selected at a specific time to provide an in-depth and detailed understanding of the impact of the disadvantaged school context on teachers' professional learning and development, and by the validity and reliability of the data collection tools used to measure these views. The interviews are limited to reflecting the experiences of a single participant working in a disadvantaged school on their professional learning and development. To overcome this limitation, a separate study could be conducted with multiple participants and employing quantitative or mixed research designs.

Recommendations based on the research results are as follows:

- Idealistic teachers working in disadvantaged schools and regions can be supported with material and moral rewards, provided with the best opportunities to address their professional learning and development needs, encouraged to lead other teachers in these areas, and additional incentives and career support mechanisms can be incorporated into education policy.
- Collegiate learning and professional learning communities can be established within the framework of a collaborative learning culture among teachers in disadvantaged schools, and teachers can be encouraged to support each other.
- Policy decisions can be made to design school-based continuous professional development programs sensitive to the local context for teachers working in disadvantaged schools.

- The timing of professional learning and development training can be carefully evaluated based on teacher participation, thus avoiding wasted time and resources.
- Education policies can be developed to develop mentoring/coaching systems that pair new teachers or those in need of support with experienced teachers in disadvantaged regions.
- Internships can be incorporated into teacher education policies, alongside theoretical training specifically for disadvantaged contexts.
- Teachers can be supported with specialized training tailored to the cultural, economic, and social structures of the disadvantaged communities in which they work; and models for collaboration with families and the community can be developed.
- The effectiveness of professional learning and development policies implemented for disadvantaged communities can be regularly monitored and continuously revised based on feedback from teachers, and these can be incorporated into educational policies.
- Professional learning processes can be supported by implementing community collaboration and socio-cultural sensitivity policies to focus on the social context of disadvantaged areas.
- Professional learning and development programs that are more specialized than general education can be implemented for teachers in disadvantaged schools.
- Emphasis can be placed on practical courses conducted in laboratories to prevent the atrophy of teachers' professional practice skills.
- By employing a sufficient number of teachers, teachers can be encouraged to spend the majority of their time on their own professional learning and development, as in countries such as Singapore and Japan, which have achieved high performance in the PISA exams.
- School principals can support teachers' professional learning and development by creating a fair environment within the school.
- Theoretical training designed for professional learning and development can be designed to be applied by teachers in classroom teaching. • Psychological support and guidance programs can be implemented for teachers in disadvantaged schools to support their professional learning and development.
- Special additional funds and budgets can be established for disadvantaged schools to ensure that students have the same opportunities as students in other schools.
- Ministry units can conduct regular fieldwork with teachers to reduce disadvantages, ensuring that policy decisions are made based on the relevance of these studies to the field.
- Phenomenological studies can be conducted on the impact of disadvantaged school conditions on teachers' professional identities.
- Quantitative, qualitative, and mixed-use research can be conducted on the problems of disadvantaged school administrators and the needs and expectations of school stakeholders.
- Longitudinal studies can be conducted on the professional development process in the context of disadvantaged schools.

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Appendix 1

Interview Questions on Professional Learning and Development in a Disadvantaged School Context

Dear participant, this research is being conducted by Dr. Nurdan ÖDEMİŞ KELEŞ to examine the professional learning and development experiences of a teacher working in a disadvantaged school, focusing on their teaching stories and narratives. The first section contains personal information, while the second section contains "Interview Questions." The questions and your responses will be recorded with your permission and later analyzed by the researcher. The interview is planned to last approximately 40-45 minutes. The information obtained from the study will be used solely for research purposes, and your personal information will be kept confidential. Your participation in the interview is voluntary, and you may withdraw from the interview at any time. Thank you for your contribution to the research by answering the questions.

Dr. Nurdan ÖDEMİŞ KELEŞ
Adnan Menderes University
nurdan.keles@adu.edu.tr

A. Personal Information

Age:

Gender: ☐ Female ☐ Male

Branch:

Professional Seniority:

Type of school:

Tenure at current school:

Date of service at current school:

Date and duration of interview:

B. Interview Questions

1. How did you decide to become a teacher? What influenced you in making this decision?
 - What kind of school did you start working at?
 - What emotions did you experience?
 - What were the most distressing, worrying, hopeful, and happy events you encountered at school?
2. Could you tell us about your predominant feelings and thoughts regarding your professional learning and development in the early years of your teaching career?
 - What actions did you take based on these feelings and thoughts?
3. The school you currently work at is described as a "disadvantaged school." What are your thoughts on this?
 - What are the disadvantages? Are there also advantages?
 - What do you think are the reasons for these disadvantages?
 - How does teaching at this school make you feel? What are your thoughts?
4. What training do you think you need to receive to strengthen your professional skills?

5. Are there any activities at your school or within the ministry to meet your professional learning and development needs? If yes, what are these activities?
 - Are the activities at the school parallel to those at the ministry, or are they mutually supportive?
 - What do you think about the adequacy and effectiveness of these activities? Why?
6. What are the impacts of your relationships with school stakeholders—since you have to deal with more challenges than in other schools—on your professional learning and development? Can you tell us how they make you feel and think?
 - Relationships with administrators
 - Relationships with parents
 - Relationships with students
 - What are the children like? What are their dreams and goals? What do they tell you about outside of class? What do they expect from you?
 - Your Ministry/System Relationships
7. What were the most upsetting, worrying, or satisfying experiences you've experienced at this school? Could you share them?
8. Because you work at a disadvantaged school, do you feel you need more development opportunities, support, guidance, and encouragement than your other colleagues regarding your professional learning and development?
 - If yes, why? What would you recommend be done in this regard?
 - If no, why do you think so?
9. What are your final thoughts?



The ecological background of education in Turkish cinema

Talha Göktentürk ¹, Sevgen Özbaş ², Mehmet Hilmi Sağlam ³, Emre Yazıcı ⁴

Abstract

Educational films, beginning with *Çalığışu* in the 1960s, have increasingly expanded their presence in Turkish cinema. These films not only reflect societal perceptions of education but also provide a condensed overview of the history of Turkish education. Thus, education in Turkish cinema has emerged as a significant cultural phenomenon. This study examined the most critically acclaimed Turkish film with an educational theme from each decade since the 1960s, as determined by Internet Movie Database (IMDb) scores (*Çalığışu*, *The Chaos Class*, *A Season in Hakkari*, *Bullshit*, *On the Way to School*, and *Brother's Keeper*). Phenomenology was used as the research design to examine how education is represented as a cultural and educational phenomenon in Turkish cinema. The data were analyzed using open coding within the thematic analysis method, using NVivo 8 software within the ecological framework. The findings revealed ecological patterns influencing the teacher-student relationship and identified the depiction of the "burnout school" in *The Chaos Class*. Qualitative models were developed for each film, and three key themes emerged: (1) The behaviorist approach is prominently reflected in the films, including those set in the 21st century; (2) Throughout cinematic history, characters such as teachers, students, school staff, and families are depicted as being influenced by complex ecological factors; and (3) In every decade, films provide rich insights into the ecological background of education, particularly in the areas of values education, teaching methods, classroom and school management, and measurement and evaluation. Thus, Turkish cinema not only serves as a mirror reflecting the trajectory of educational history but also holds the potential to shape society's perceptions of education.

Keywords

Turkish cinema
Education
Behavioral approach
Constructivist approach
The ecological model

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Introduction

Cinema has long been a powerful medium for capturing and reflecting the complexities of human experience. While the technology of photography introduced the ability to depict three-dimensional images, cinema expanded this capability by adding movement and flow, creating a new narrative form (Usai, 1996). Since its inception, countless films have been produced worldwide, each offering unique perspectives on reality (Walters, 2008). Films, though not direct reflections of reality, serve as windows into different cultural, social, and political contexts, providing audiences with rich, multidimensional narratives (Escher, 2006).

Turkish cinema, like other national cinemas, mirrors the cultural, geographical, and social realities of its time and place. The role of cinema in Turkish society has evolved from its early uses by official and semi-official institutions to communicate social messages (Beyoğlu, 2018) to its current place in the private sector, producing films that reflect the country's changing identity. Over time, Turkish cinema has shifted from a fairy-tale narrative style to a more realistic and individual-centered focus, particularly from the 1980s onward (Kıbaroğlu, 2015; Yılmaz, 2011). This evolution reflects a deeper exploration of the individual's relationship with society, framed within the country's socio-cultural dynamics.

Despite the extensive production of films, there has been limited academic exploration of how Turkish cinema portrays educational environments and the broader ecological factors influencing them. This study seeks to address this gap by using an ecological model to examine how educational themes, particularly the teacher-student relationship, are depicted in Turkish cinema. While specific dimensions of education-themed Turkish films, such as teacher image, measurement and evaluation, classroom management, and values education, have been examined in previous studies (Akcan & Polat, 2016; Doğan, 2017; Kezer & Çetiner, 2019; Tofur, 2017; Ünal, 2020), the Turkish cinematic portrayal of education, with its unique cultural and socio-political backdrop, has not received the same level of scholarly attention through a systematic ecological framework. This gap in the literature presents an opportunity to understand how Turkish films reflect the complexities of education, particularly in the face of socio-economic disparities, linguistic diversity, and regional differences.

By situating this research within Turkey, a country marked by diverse ecological variables ranging from deeply personal factors to national-level influences (Göktentürk, 2021; Göktentürk et al., 2023), this study contributes to a broader understanding of how educational systems function within specific cultural and societal frameworks. Turkey's history of educational reforms (Aksit, 2007), socio-political challenges (Giorgetti, 2019), and cultural diversity (Kaya, 2010) makes it an ideal context to explore the intersection of education and cinema. Furthermore, understanding these portrayals in Turkish films can offer new insights into the ways educational environments are shaped by broader social forces, making the findings relevant not only to Turkey but also to international discussions on education and society.

To frame this analysis, the ecological model, developed by Zumbo (Zumbo et al., 2015), is employed. This model allows for a comprehensive examination of the individual's interactions within multiple layers of influence, from personal characteristics to broader societal and institutional factors. Previous studies have applied ecological frameworks to understand education (Göktentürk et al., 2023; Sağlam et al., 2023; Sağlam & Goktenturk, 2024; Toprak Ay & Göktentürk, 2023), but none have systematically explored Turkish cinema's role in reflecting these ecological dynamics. By adapting Zumbo's model to this study, we aim to offer a nuanced understanding of how Turkish films depict the complexities of educational environments and their broader socio-cultural contexts. Thereby, this study addresses the gap in literature by applying an ecological model to examine educational themes in Turkish cinema. It aims to contribute to both cinema studies and educational research by offering a framework to understand how films can serve as mirrors of educational realities, shaped by ecological factors unique to Turkey. Through this approach, the study provides a deeper exploration of the cultural, social, and political forces at play in educational narratives. More specifically, it has the

potential to contribute to both education and cinema studies by offering a systematic framework for interpreting educational films across time, by making visible the ecological factors that shape teacher and student experiences, and by identifying recurring patterns that may inform future research, teacher education, and discussions of educational policy. In this way, the study expands the academic conversation on how education is portrayed in cinema and why such portrayals matter.

A Guide to Understanding the Background of Education in Turkish Cinema: The Ecological Model

In Turkish cinema, the description of the process through the eyes of the teacher and the student is typical. To examine the environmental factors presented in films, the study adopts an ecological approach, which should be considered a critical perspective within the Turkish education system (Göktentürk, 2021; Göktentürk et al., 2023; Ministry of National Education [MoNE], 2024). This viewpoint, presented as an ecological system theory on child development, is based on the principle that a diverse environment has an impact on both the individual and the society in which the child lives (Bronfenbrenner, 1977, 1979a, 1979b). Studies conducted in line with this theory, which has significantly influenced social sciences for approximately 40 years, have revealed that it would be wrong to examine any stakeholder in education circles independently of the ecological background (Ashiabi & O'Neal, 2015; Rosa & Tudge, 2013). Similarly, this model continued to advance in a variety of academic sectors in addition to education (Tudge et al., 2016).

After Bronfenbrenner's theory, the socio-ecological framework was developed to make the model more systematically applicable (Kilanowski, 2017). The model places the individual at the center and builds layers around the person, from the closest to the furthest. These strata extend to variables at the community level. In different studies, one or more of the necessary layers are adapted for research purposes (Ssewanyana et al., 2020; Townsend & Foster, 2013). Drawing from this foundation, Zumbo (2015) refined and expanded Bronfenbrenner's ecological insights to develop a more structured stratification system. His model offers a precise framework that responds to the evolving needs of educational research by addressing new variables within these ecological layers. In this study, Zumbo's model has been adapted into a four-layer structure to fully capture the environmental influences on both the teacher and the student. The framework used in this analysis is presented in Figure 1.

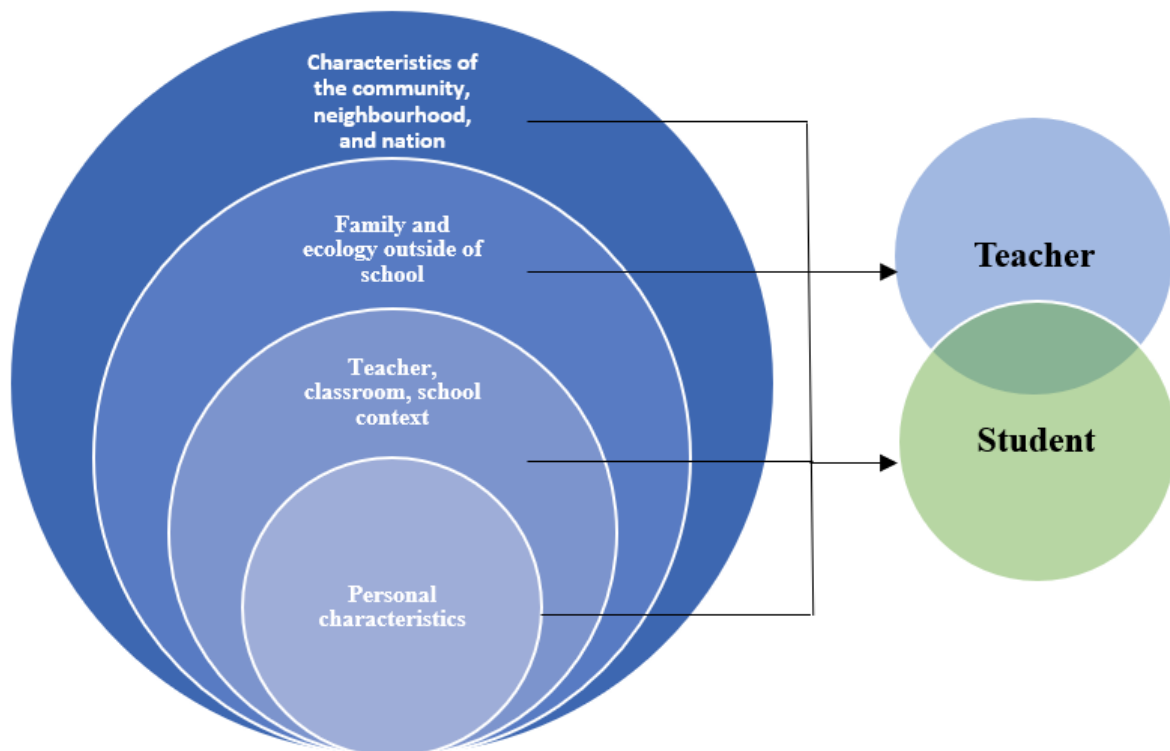


Figure 1. Ecological model for examining the education theme in Turkish cinema

The model organizes independent variables into four layers to explain the ecological background of both teachers and students in Turkish films. The first layer focuses on personal characteristics of the teacher or student, while the second layer encompasses environmental variables such as school culture, libraries, and playgrounds within the classroom or school boundaries. The third layer explores family and living environment factors, and the fourth layer reflects the broader education system, national traits, and societal influences on teachers and students.

This approach is particularly relevant given Turkey's rich and diverse ecological variables, which range from personal factors to national-level influences (Göktentürk, 2021). By systematically examining these layers, the study seeks to provide a comprehensive understanding of how Turkish films reflect and interpret the educational processes within these varied contexts. The use of Zumbo's ecological layers allows for a nuanced exploration of these dynamics (Göktentürk et al., 2023; Sağlam et al., 2023; Sağlam & Goktenturk, 2024), making it possible to capture the full scope of influences on teacher-student interactions as depicted in Turkish cinema.

The ecological framework's emphasis on *in vivo* measurement (Zumbo, 2015, 2017) — capturing variables as they naturally occur in context — aligns well with the goal of analyzing films, which often serve as cultural mirrors reflecting the societal values, norms, and challenges of the time (Chapman, 2003; Grodal, 2009). By applying this model, the study moves beyond a simple content analysis of educational themes, delving into the deeper, context-driven factors that influence the portrayal of education in Turkish cinema. This theoretical approach not only enhances the academic rigor of the study but also positions it within the broader discourse on the role of ecological factors in education, offering new insights into how these factors are depicted and understood in different cultural contexts.

The ecological model, adapted for this study, provides a robust framework for analyzing how educational themes are depicted in Turkish cinema by examining the interplay between teachers and students within their broader ecological contexts. Turkish cinema often portrays the educational process through the experiences of teachers and students, highlighting the significant role that environmental factors play in shaping these experiences (Demir, 2020; Orta, 2007; Yetimova, 2019). By situating the analysis within the ecological framework, this study aims to uncover the complex relationships between individual characteristics and the broader societal and cultural influences that permeate educational environments.

In line with the ecological model adopted in this study, the research question is as follows: "How is education reflected in educational Turkish films when examined through an ecological perspective?" Thus, the behaviorist approach, which directed the Turkish education system from the 20th century to the beginning of the 21st century, will be handled. Further, the individual-centered paradigm, and the ecological environment, largely neglected by the constructivist approach (Bada, 2015), will be addressed. In this respect, the ecology-based model constitutes the main framework of the research.

Recent methodological discussions indicate that films and documentaries can function not only as pedagogical tools but also as valuable sources of secondary qualitative data when they are analyzed systematically in relation to a social phenomenon (Daniel et al., 2025). Likewise, phenomenological and film-based studies in education have shown that films can be used to examine pre-service teachers' perceptions, metaphors, and professional development in relation to educational themes (Çam, 2023; Tofur, 2018). These studies demonstrate that films are capable of revealing how educational meanings are experienced, interpreted, and narrated.

However, existing studies have generally focused either on the pedagogical use of films or on the analysis of specific educational elements in individual films. A systematic examination of the phenomenon of education itself across Turkish films from different decades remains limited. In this

respect, the present study is expected to contribute to the literature in several ways. First, it provides a diachronic framework for understanding how education has been narratively constructed in Turkish cinema. Second, it shows how teacher-student relationships are shaped by ecological layers extending from personal characteristics to national-level conditions. Third, it offers a conceptual basis for future qualitative and quantitative studies on recurrent patterns identified in the films, such as institutional burnout, socio-economic deprivation, and linguistic barriers.

Method

The central assumption of the study is that education in Turkish cinema can be approached as a phenomenon. Phenomena emerge when reality cannot be fully grasped in a direct or exhaustive way and when meanings extend beyond the individual into broader structures of experience (Husserl, 1999). Due to their nature, they can be studied by reducing them to a framework for research (Norlyk & Harder, 2010). In the reduction process, a framework should be created from the past to the research moment, and the research phenomenon that turns into an object of study should be specific (Giorgi, 1997). In this respect, the study adopts scientific phenomenology as a methodological orientation rather than philosophical phenomenology as a purely abstract position. Studies based on scientific phenomenology provide a framework and an understanding that facilitate the application of systematic methods (Giorgi, 2000). In film-based inquiry, phenomenology does not treat films as direct reality; rather, it approaches them as narrative representations through which lived experiences, perceptions, and social meanings become visible and open to interpretation. In this respect, films can be examined phenomenologically when they are treated as meaning-bearing depictions of a social phenomenon and analyzed systematically in relation to that phenomenon. Recent studies have shown that films and documentaries can function as qualitative data sources in such analyses (Daniel et al., 2025), while phenomenological and film-based studies in education have used films to examine professional development, educational perceptions, and classroom meanings (Çam, 2023; Tofur, 2018). Likewise, this study aims to create a framework and an understanding of the ecological background of students and teachers in Turkish cinema. Because education in Turkish cinema can be approached as a phenomenon, educational films were examined in this study as representations reflecting people's perceptions of reality through the lens of Zumbo's ecological framework (Göktentürk et al., 2023; Zumbo, 2015). By presenting the data through this lens, the study offers novel insights into how education is portrayed and affected by external ecological layers, addressing a gap in the existing literature on Turkish cinema and educational research. This methodological rigor ensures that the analysis aligns with the study's theoretical framework, providing a transparent and systematic approach to understanding the complex relationships depicted in the films.

Data Source and Selection of Films

As a qualitative study, this research used selected Turkish films as its data source. The films that are the subject of the study were determined by criterion sampling (Creswell, 2009). The period of 1960, when educational themes first appeared with feature film, was chosen as the starting point for the films in the study. Additionally, the periods when the behaviorist and the constructivist approaches dominated the Turkish education system determined the titles of the films examined. Films selected for a more systematic reflection of the transformations in Turkish society are divided into 10-year periods: 1960-69; 1970-79; 1980-89; 1990-99; 2000-09; 2010-2022. For each ten-year period, Turkish films with educational themes were first identified using Internet Movie Database's (IMDb) filtering system. Among the films listed within each period, the one with the highest IMDb rating at the time of the research was selected for analysis. In this way, each decade was represented by the educational film with the greatest observable audience-based impact within its own period.

Internet Movie Database (IMDb) scores were used as a criterion for identifying the film with the highest observable impact, in line with the literature (Canet et al., 2016). IMDb ratings are accepted as a significant index in terms of the quality of the movies due to their power of influence as the largest movie database (Kanika, 2017). For the same reason, determining the score of a film that will be released

on IMDb is the subject of different studies, such as machine learning (Bristi et al., 2019). A Bayesian calculation is used to determine the film scores. The formula used to calculate the overall movie score is presented below. In this calculation, the votes of all participants are equally included in the system. In the actual system of IMDb, there are criteria such as users with more points (i.e., some users' points are more valuable than others). In order to keep the system safe, the original formula is not shared with users (Azzeh, 2017).

$$\bar{p}_j = \frac{1}{n} \sum_{i=1}^n r_{ij}$$

$$IMDb\ Score_j = \frac{n}{(n + MinR)} \times \bar{p}_j + \frac{MinR}{(n + MinR)} \times \bar{p}$$

" $\bar{p}_j$ " refers to the selected film. "n" refers to the total number of votes. *MinR* refers to the minimum number of votes required to be evaluated among the first 250 films. The commonly accepted threshold is 2500. The movies with the highest scores in the selected periods and containing the educational theme were included in the research. The films that are the subject of the examination in their final form are presented in Figure 2.

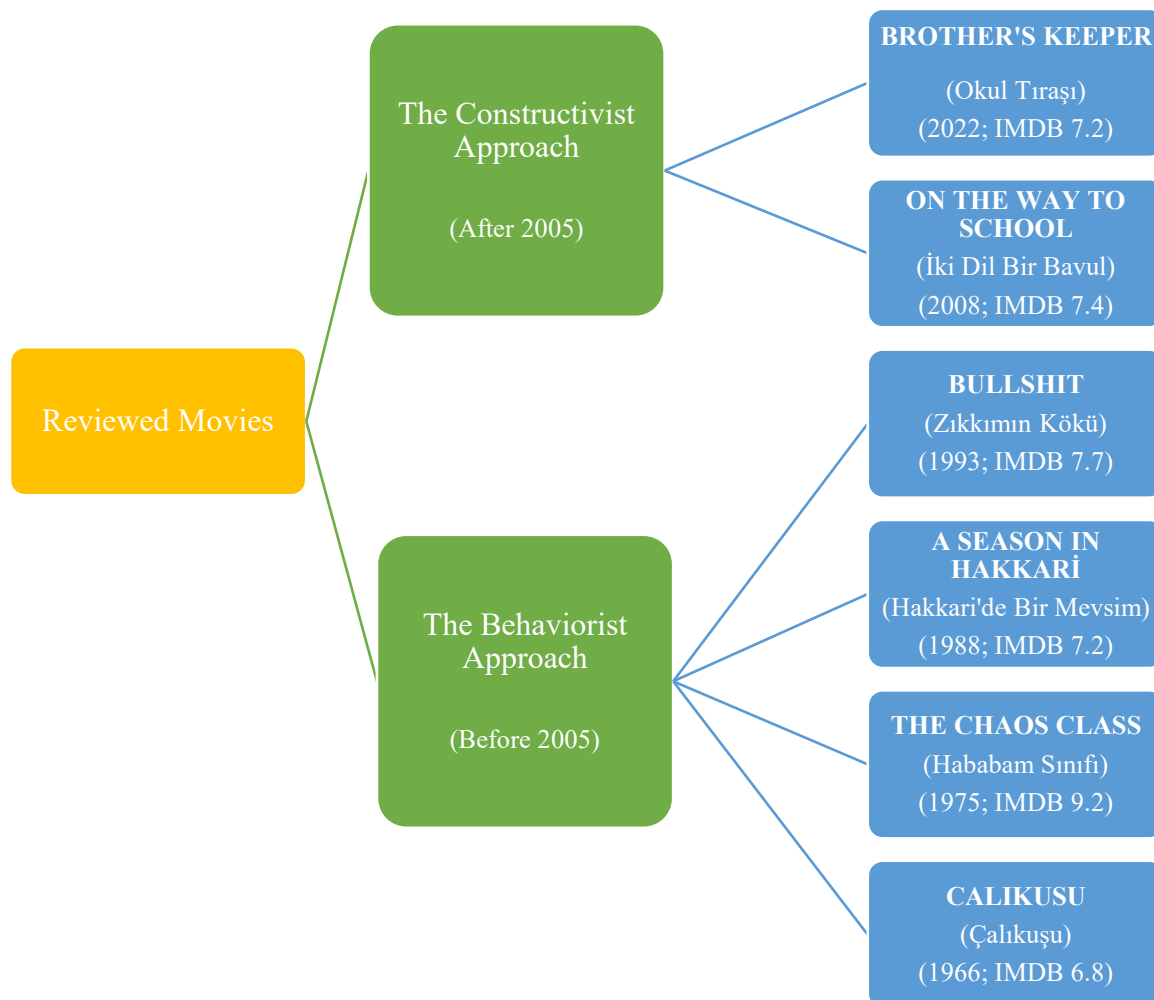


Figure 2. Selected Films Across Educational Periods in Turkish Cinema

Selected Film Corpus

Turkish cinema has a rich history of addressing educational themes, with films that reflect the social, political, economic, and cultural dynamics of their time (Akıncı Yüksel, 2015). To gain a deeper understanding of how Turkish films depict educational environments and their complexities, it is useful

to focus on key films from different decades, as each decade in Turkish history represents a distinct sociocultural period that influences both the educational system and its portrayal in cinema (Akcan & Polat, 2016). The emergence of prominent films dealing with educational themes in Turkish cinema can be traced back to the 1960s and beyond, with IMDb ratings providing a useful metric for selecting the most influential films from each decade (Canet et al., 2016). Each of these films serves as a lens to explore how education is influenced by broader social, economic, and environmental factors. The final corpus consisted of six Turkish films selected from successive ten-year periods. These films constituted the analytical corpus of the study, as each represented a distinct historical moment in the portrayal of education in Turkish cinema. Together, they made it possible to examine how educational themes were depicted across different sociocultural periods and how these depictions corresponded to the ecological framework.

For the 1960-69 period, *Çalikuşu* (IMDb 6.8), adapted from Reşat Nuri Güntekin's novel, was selected as the representative film. As one of the earliest prominent educational films in Turkish cinema, it marks the rise of education as a visible cinematic theme in the 1960s. This film, set in the late Ottoman Empire, tells the story of Feride, a teacher facing professional challenges and environmental hardships. *Çalikuşu* reflects the societal expectations placed on teachers, particularly women, during this time (Demirel Değirmenci, 2021). The film portrays the teacher not only as a role model but also as an individual deeply shaped by the values of the society in which she operates (Akcan & Polat, 2016; Ünal, 2020). Taken together, these studies show that *Çalikuşu* is significant not only as one of the earliest cinematic explorations of education in Turkey but also as a film reflecting both the individual and environmental challenges of the teaching profession.

For the 1970-79 period, *Hababam Sınıfı* (The Chaos Class, IMDb 9.2) was selected as the representative film. It emerged as a major cultural phenomenon in the 1970s. Directed by Ertem Eğilmez, this film is based on Rıfat Ilgaz's book and offers a comedic yet critical depiction of the education system. *The Chaos Class* presents a school environment rife with disciplinary issues, reflecting deeper systemic problems in education. It has been praised for its realistic portrayal of educational shortcomings, including ineffective evaluation methods, lack of motivation among students and teachers, and the burnout experienced by various stakeholders (Doğan, 2017; Kezer & Çetiner, 2019; Öztunç & Şanlı, 2019; Ünal, 2020). Taken together, these studies position the film as a key text for examining the intersection of education and social issues in Turkish cinema.

For the 1980-89 period, educational themes continued to gain prominence in Turkish cinema with films like *A Season in Hakkari* (IMDb 7.3), *Teacher* (IMDb 7.2), and *Teacher Kemal* (IMDb 7). Among these, *A Season in Hakkari* was selected as the representative film of the decade. The film stands out for its portrayal of a teacher who is alienated from both his profession and his community (Ünlü & Serarslan, 2012). It highlights the teacher's struggle to adapt to a remote and harsh environment, portraying the rural-urban divide as a central conflict (Oğurlu, 2019). Despite these challenges, the teacher's perseverance and commitment to his students create a productive learning environment (Bıçak, 2021). Through its depiction of regional and socio-economic disparities, the film offers valuable insights into the societal factors shaping education in rural Turkey, making it an important example for examining environmental influences on education.

For the 1990-99 period, *Bullshit* (IMDb 7.7), adapted from Muzaffer İzgü's novel was selected as the representative film. The film tells the story of Muzaffer, a student whose education is deeply affected by poverty and living conditions. As Öztürk (2004) shows, both the novel and the film emphasize the role of socio-economic factors in shaping the student's educational journey. In this respect, *Bullshit* was selected for this study because it powerfully depicts how external factors, particularly poverty, create barriers to educational success. Therefore, the film provides critical insights into the broader socio-economic issues that impact education, making it a crucial text for analyzing the ecological dimensions of educational environments in Turkish cinema.

For the 2000-09 period, *On the Way to School* (IMDb 7.4) was selected as the representative film because of its focus on linguistically diverse educational settings. The film focuses on a teacher working in southeastern Turkey, where the heritage language (Kurdish) and the second language (Turkish) create significant barriers to learning (Yetimova, 2019). The film also highlights the theme of poverty, further complicating the teacher's role as a mediator between different cultural and linguistic groups (Akcan & Polat, 2016; Akıncı Yüksel, 2015). Accordingly, the film offers a strong example of how language barriers and socio-economic disparities function as ecological factors affecting education.

For the post-2010 period, *Brother's Keeper* (IMDb 7.4) was selected as the representative film. Although it has already attracted scholarly attention in relation to educational themes (Demirtaş, 2024), it has not yet been examined extensively from an ecological perspective. Taken together, these six films constituted the analytical corpus of the study. Their chronological distribution and thematic diversity made it possible to examine how educational narratives in Turkish cinema changed across periods and how these narratives reflected different ecological layers.

Data Analysis

In this study, qualitative data were analyzed using thematic coding aligned with the ecological framework, drawing on the methods recommended by Braun and Clarke (2006) for thematic analysis. The analysis process began with familiarization with the data, including multiple viewings of selected films and detailed note-taking to capture initial impressions and patterns (Creswell, 2016).

Codebook development and coding process. A comprehensive codebook was developed in alignment with the ecological model. The codebook was informed by the four ecological layers, with each layer acting as a broad thematic category under which codes were nested. The process of creating the codebook involved identifying key themes from the films, such as teacher-student dynamics, environmental challenges, socio-economic factors, and systemic issues, which were mapped to relevant layers within the model. Each film was analyzed systematically, applying a hybrid approach of deductive and inductive coding. Deductive codes were derived from the theoretical model (e.g., "school management" or "classroom management") while inductive codes emerged organically from the data, capturing unique nuances specific to each film. This approach ensured that the coding process remained grounded in the theoretical framework while allowing for flexibility in identifying new themes (Charmaz, 2006).

After developing the initial codebook, the codes and themes were subjected to an expert review to ensure their validity and reliability (Miles et al., 2014). The expert chosen for this review had extensive experience in qualitative data analysis and a thorough understanding of the ecological framework used in the study. Before providing feedback, the expert was required to view all selected films to understand the context fully. The review process aimed to identify discrepancies between codes and the content they represented, as well as any inconsistencies between codes and themes. The expert also offered suggestions for consolidating certain codes under broader thematic categories where applicable.

Based on the expert's feedback, several revisions were made to improve coherence. Discrepancies were addressed by refining certain codes, and overlapping themes were merged to ensure a clear and consistent thematic structure. A second round of expert review followed these revisions, leading to full alignment between the expert and the research team (Miles & Huberman, 1994). This external validation strengthened the reliability of the codebook and ensured that the coding process was transparent and aligned with the theoretical framework.

Analysis of codes and themes. After coding, codes were grouped into higher-order themes, which were continually refined throughout the analysis process. These themes were linked to the ecological framework, providing a multi-layered understanding of the teacher-student relationships and broader environmental influences depicted in Turkish cinema. Inter-coder reliability was ensured through

multiple iterations of coding by different members of the research team, followed by discussions to resolve discrepancies (Miles & Huberman, 1994). The external expert's validation further contributed to the reliability and accuracy of the thematic analysis. Finally, the results were synthesized into a cohesive narrative that connects the themes identified in the films to the broader ecological model.

Results

The research findings are organized chronologically, based on the periods during which the films were produced. Each film adheres to a linear timeline, portraying a specific time frame with a natural progression. The findings are presented in ten-year increments, which allows for the creation of a systematic framework. This approach enables the construction of a comprehensive overview, capturing the ecological background of teachers, students, and schools in Turkish education from the past to the present. The reports for each film are therefore arranged in a corresponding chronological order.

Calikusu (Çalikuşu): The Ecological Background Influencing the Life of Teachers in the Ottoman Empire (1966)

The analysis of *Çalikuşu* (1966) through the lens of Zumbo's ecological model reveals the profound impact of the Ottoman Empire's complex ecological background on the professional life of teachers, particularly female educators like the protagonist, Feride. The film's narrative aligns well with the four-layer ecological framework, demonstrating how individual characteristics, school and classroom environments, family and societal influences, and broader national dynamics interplay to shape the educational experiences depicted in the film. The created model is presented in Figure 3.

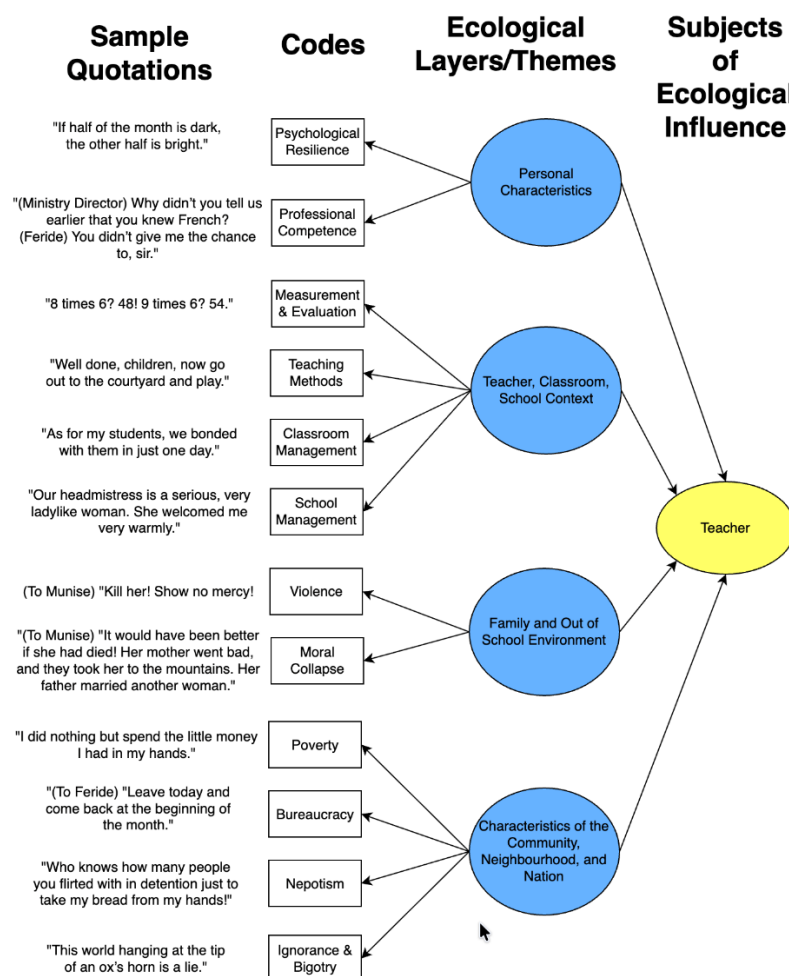


Figure 3. The Ecological Model of *Calikusu* (Çalikuşu). Colors: Yellow for teachers, blue for the ecological model's layers/themes, colorless rectangles for the codes from analysis.

Layer 1: Personal Characteristics. Feride, the central character, embodies the traits of resilience and dedication, which are essential in navigating the challenging conditions of early 20th-century Ottoman society. Her *professional competence* is notable, as it is shaped by her education in a French school, which positively influences her communication skills and classroom management. Despite the adverse conditions she faces, including financial difficulties in the classroom and the village of Zeyniler, Feride manages to maintain a level of professionalism that allows her to connect with her students effectively. This layer underscores the significance of individual traits in determining a teacher's ability to adapt and thrive within the broader ecological context.

Layer 2: Teacher, Classroom, and School Context. The classroom in *Çalikuşu* reflects a teacher-centered structure with rigid authority, following the behaviorist approach typical of the era. Measurement and evaluation focus on rote memorization, limiting both creative and critical thinking. The strict class order emphasizes discipline over intellectual exploration. Feride's strained relationship with the school administration highlights the systemic inefficiency and bureaucratic challenges that hinder educational reform. These issues mirror broader societal constraints, preventing effective teaching and learning.

Layer 3: Family and Ecology Outside of School. The non-school environment plays a crucial role in shaping the educational experience depicted in *Çalikuşu*. The film vividly portrays the pervasive ignorance and moral degradation in the surrounding community as significant barriers to educational progress. Moreover, the stark gender inequality prevalent in Ottoman society—where the professional and personal lives of women are heavily restricted—directly impacts Feride's ability to perform her duties as a teacher. Domestic violence, peer bullying, and the deep-seated gender inequalities of the time further emphasize the oppressive nature of the external environment. These social factors create significant barriers to education, as students bring the weight of these external influences into the classroom. Feride's efforts to provide a positive learning experience are constantly challenged by these external pressures, illustrating how family and societal contexts can profoundly affect the educational process.

Layer 4: Characteristics of the Community, Neighborhood, and Nation. At this level, *Çalikuşu* critiques the socio-political and economic conditions of the Ottoman Empire, illustrating how poverty, bureaucratic inefficiencies, and underdevelopment shape the educational landscape. Rural communities suffer from extreme poverty, lacking basic infrastructure like school buildings and educational materials, which hinders teachers like Feride from providing quality education. Bureaucratic stagnation further exacerbates these challenges, as the film portrays an inflexible state system that stifles educational reform and innovation, prioritizing order over meaningful learning. Teachers are left powerless, navigating a rigid structure that offers little support. The film also underscores the lack of human development in rural areas, where the state's neglect perpetuates cycles of poverty and socio-economic disparities. Ultimately, *Çalikuşu* reflects a broader national struggle to modernize, exposing systemic failures that prevent progress and reform in education and society at large.

Overall, *Çalikuşu* presents a teacher-centered but ecologically burdened educational world in which Feride's resilience and professional competence are persistently constrained by bureaucratic inefficiency, gender inequality, poverty, and moral decline. The film shows that education cannot be understood solely within classroom boundaries, because family, community, and national conditions directly shape the teacher's professional life. In this respect, *Çalikuşu* offers a multi-layered ecological model in which individual dedication coexists with powerful structural limitations.

The Chaos Class (Hababam Sınıfı): A Burnout School (1975)

The Chaos Class (Hababam Sınıfı), released in 1975, provides a critical depiction of a dysfunctional educational environment, one that mirrors the systemic shortcomings of Turkish education during the era. Through the lens of Zumbo's ecological model, the film primarily foregrounds the *Teacher, Classroom, and School Context* layer and presents a distinctive model of a burnout school.

Because *Private Çamlıca High School* is depicted as a boarding school, stakeholder behaviors are represented almost entirely within school-related roles and institutional interactions. In this respect, even when the film presents decisions or dispositions that may seem individual, these are constructed not as expressions of an autonomous personal sphere but as extensions of stakeholder roles such as teacher, student, administrator, or school staff. Accordingly, these behaviors were interpreted through classroom practices, school management, and stakeholder relations rather than as part of an independent personal domain. Therefore, the film was analyzed within the *Teacher, Classroom, and School Context* layer. The ecological model developed from this analysis is presented in Figure 4.

Classroom Management. The film portrays a chaotic disciplinary climate, where traditional methods of classroom management have collapsed under the weight of institutional neglect and disinterest. Disciplinary punishment is ineffective, as both teachers and students have become disillusioned with the value of education. This is exacerbated by the authoritarian language used by teachers, which is characterized by teasing, humiliation, and targeting specific students. The breakdown of authority is most evident in how teachers oscillate between authoritarianism and indifference, reflecting a broader system of ineffective management. At times, teachers resort to praise and advising, but these gestures are often undermined by more dominant negative interactions like the use of “you-messages” and threats.

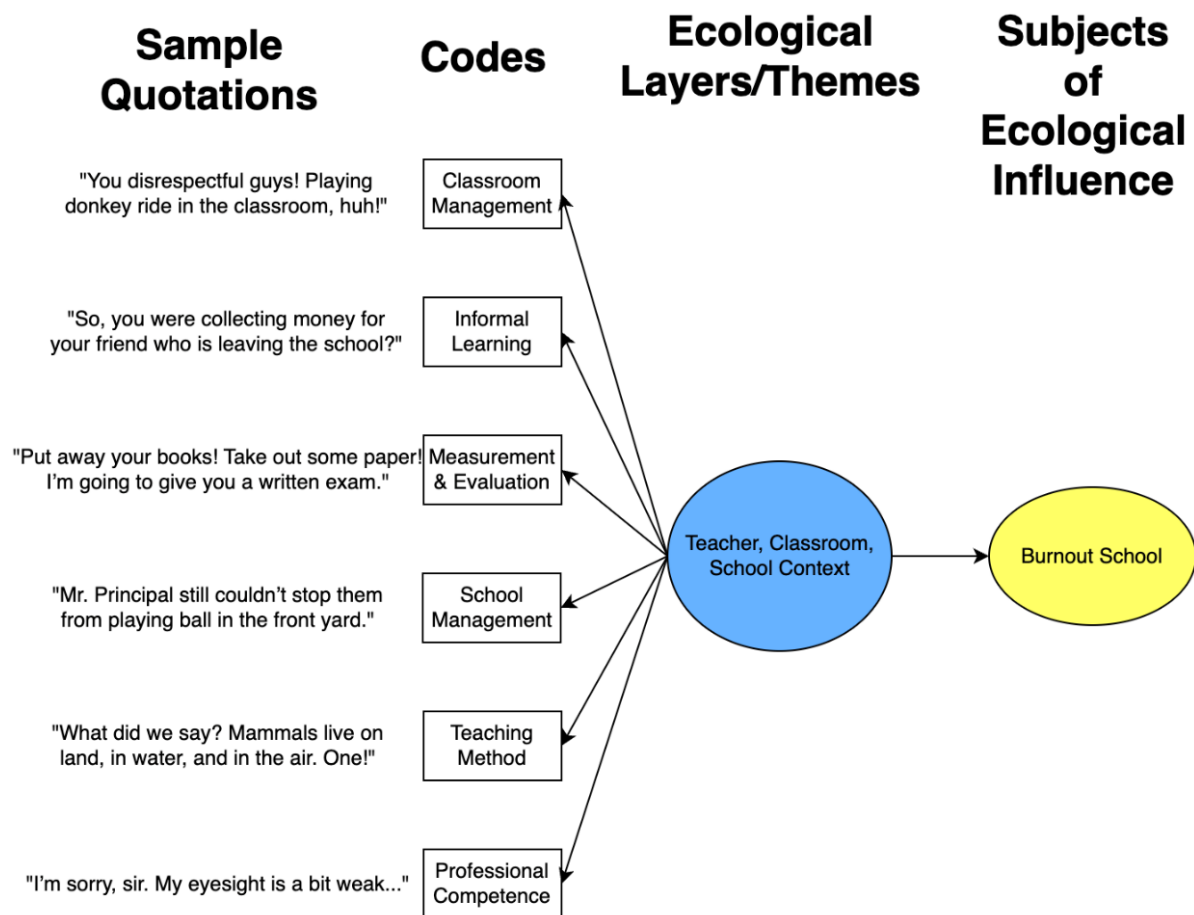


Figure 4. The ecological model of *The Chaos Class* (Hababam Sınıfı). Colors: Yellow for the school, blue for the ecological model's layers/themes, colorless rectangles for the codes from analysis.

Informal Learning. Within this disordered school environment, informal learning assumes a unique role, often fostering values like justice, honesty, idealism, respect, fidelity, and helpfulness. However, these ideals are juxtaposed with a corrupt system where these values are not consistently upheld. The students engage in various forms of cheating, often with the assistance of school staff like Hafize Ana, a janitor who helps the students undermine the educational process. This duality between the formal and informal education systems highlights the ethical dilemmas that pervade the school. The informal learning environment, although intended to promote moral development, becomes tainted by the pervasive corruption within the school.

Measurement and Evaluation. Evaluation practices in *The Chaos Class* are emblematic of the behaviorist approach, focusing almost exclusively on measurement at the remembrance level. Both oral and written examinations are used, but the purpose of these evaluations is reduced to formalities. Students frequently cheat with the knowledge and, at times, the assistance of the staff, rendering these assessments meaningless. The emphasis on rote memorization without fostering critical thinking further deepens the disconnect between the school's stated educational objectives and the actual learning environment.

Professional Competence. Teachers in the film are depicted as physically present but mentally disengaged from their roles. Their lack of professional ethics and class management competence is evident throughout, contributing to the overall atmosphere of neglect and apathy. This professional inadequacy is a core reason for the school's dysfunction, as the teachers' inability to manage their classrooms or engage with students effectively leaves the school environment in disarray.

School Management. The film's portrayal of school management is a sharp critique of institutional dysfunction. The principal is depicted as a figure more concerned with economic management and personal gain than the well-being of the students. Work distribution and professional orientation are neglected, contributing to an overall atmosphere of professional burnout among the teachers. The school's institutional culture is one of disinterest, corruption, and inefficiency, where educational success is neither expected nor prioritized. The film underscores the lack of proper governance and leadership within the school, which leads to further deterioration of the learning environment.

Violence is a recurrent theme in *The Chaos Class*, with instances of aggression between principals, students, and teachers. This pervasive violence is both a symptom and a cause of the school's collapse. Obedience to authority is demanded, but respect for authority is absent, resulting in a climate where violence and coercion replace genuine engagement and discipline. The film paints a grim picture of a school where fear and intimidation have become the primary tools for maintaining order, further alienating students from the learning process.

Teaching Methods. Teaching methods in *The Chaos Class* are limited and outdated, with a heavy reliance on question-answer sessions and presentation-based teaching. The lack of creativity and the failure to engage students with more innovative or interactive approaches to learning highlight the school's systemic issues. Organizing activities such as creative drama or engaging students in meaningful discussions is absent, reinforcing the rigid and uninspired instructional framework.

Overall, *The Chaos Class* portrays a school in which nearly all educational processes are absorbed into institutional dysfunction. Classroom management, informal learning, assessment, teaching methods, violence, and school administration converge to form a burnout school model characterized by behaviorist routines, professional disengagement, and systemic collapse. In this film, the model is constructed primarily from school-based ecological factors, as the film does not provide sufficient data to analyze out-of-school conditions systematically. Rather than presenting isolated educational problems, the film depicts the school itself as the central ecological source of deterioration.

A Season in Hakkari (Hakkari'de Bir Mevsim): The Struggle of an Isolated Teacher in a Harsh Environment (1983)

A Season in Hakkari (Hakkari'de Bir Mevsim) provides a compelling portrayal of the challenges faced by a teacher sent to a remote, rural village in southeastern Turkey. Through Zumbo's ecological framework, the film illustrates how various layers of influence—from personal characteristics to societal factors—shape the teacher's experiences and the broader educational environment. The four layers of the ecological model—Personal Characteristics, Teacher, Classroom, and School Context, Family and Ecology Outside of School, and Characteristics of the Community, Neighborhood, and Nation—are used to analyze the factors contributing to the teacher's struggle in this isolated setting. The created model is presented in Figure 5.

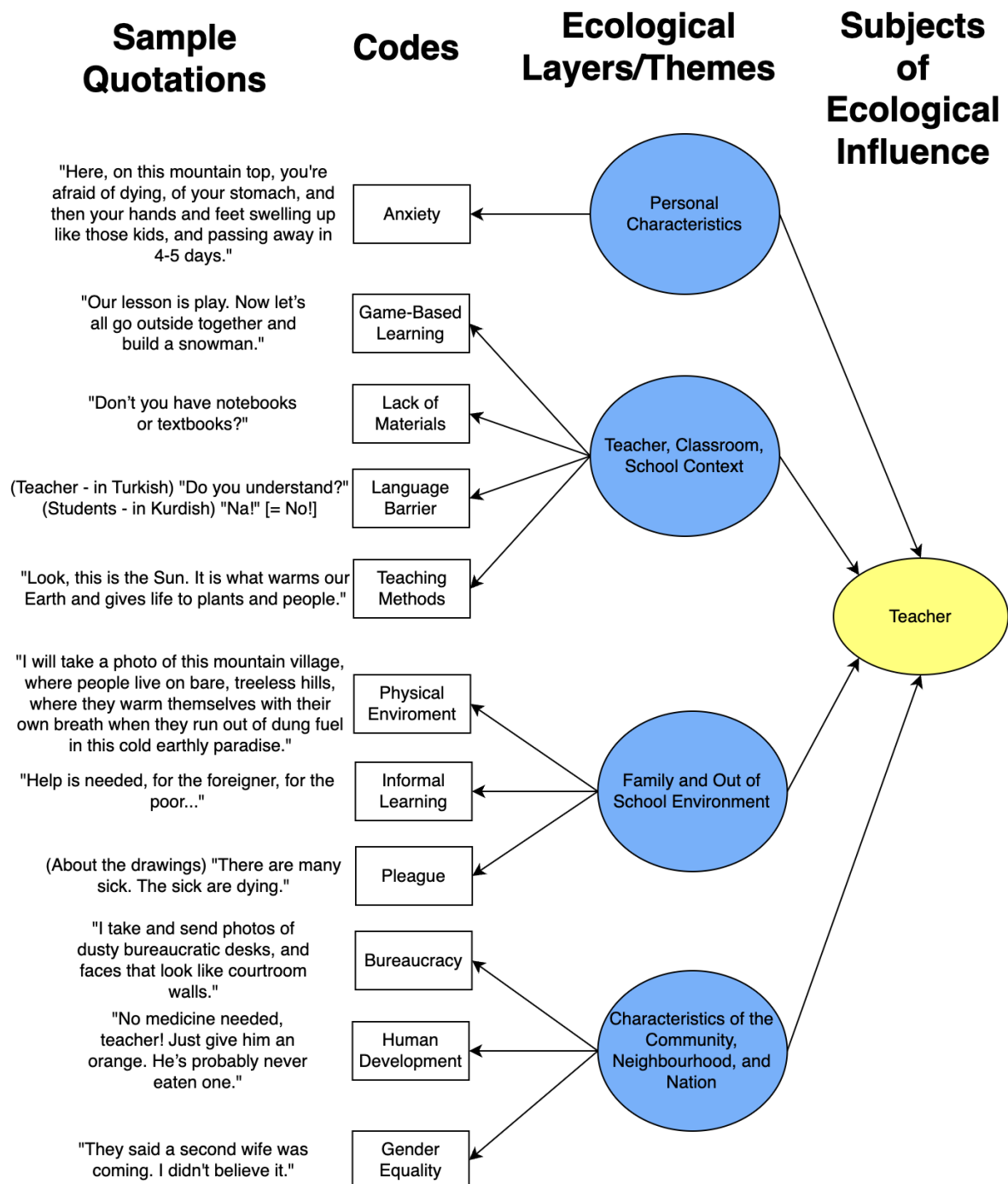


Figure 5. The ecological model of *A Season in Hakkari* (Hakkari'de Bir Mevsim). Colors: Yellow for teachers, blue for the ecological model's layers, colorless rectangles for the codes from analysis.

Layer 1: Personal Characteristics. In *A Season in Hakkari*, the teacher's personal characteristics are shaped primarily by the intense anxiety he experiences as a result of being placed in an unfamiliar, isolated environment. The overwhelming challenges of adapting to rural life, coupled with the emotional isolation and cultural differences, create a sense of profound anxiety that defines much of his professional and personal experience. The film portrays the teacher as someone ill-prepared for the harsh realities of the village. His urban background leaves him struggling to navigate the local customs, language barriers, and the extreme physical conditions. The anxiety generated by this new environment is not just personal but also professional, as the teacher constantly questions his ability to perform his duties effectively. The culture shock and feelings of alienation compound his anxiety, leaving him emotionally detached from both the community and his students.

Layer 2: Classroom and School Environment. The classroom and school environment in *A Season in Hakkari* is starkly under-resourced, with a severe lack of basic educational materials, poor infrastructure, and minimal administrative support. The teacher is left to manage his classroom in an environment that is physically and emotionally taxing. The harsh weather, dilapidated school building, and absence of a structured educational system all contribute to a challenging learning environment. Classroom management is particularly difficult, as the teacher must cope with the language barrier, a recurring issue throughout the film. Most students speak Kurdish as their first language, while the teacher communicates in Turkish, creating a significant obstacle to effective learning. The lack of educational materials further exacerbates the situation, limiting the teacher's ability to engage the students in meaningful learning. Additionally, the film presents the teacher's struggle with maintaining professional competence in an environment that offers little support, reflecting a broader systemic issue in rural education. The limited educational methods available in this context reinforce a behaviorist approach, where rote learning and basic question-answer techniques dominate. The teacher's efforts to implement more engaging pedagogical methods are stifled by the overwhelming lack of resources and the school's isolation from national educational reforms. This layer highlights the profound impact of material and institutional constraints on the educational process in remote areas.

Layer 3: Family and Ecology Outside of School. The broader ecological context outside the school plays a crucial role in shaping both the teacher's and the students' experiences. The film vividly depicts the economic hardships faced by the local population, where poverty is pervasive, and access to basic necessities is limited. These socio-economic conditions directly impact the students' ability to engage in education, as they are often preoccupied with family responsibilities and survival needs, leaving little room for academic pursuits. The teacher also confronts cultural norms that conflict with his urban values, particularly concerning gender roles, family structures, and traditional practices such as polygamy. These cultural dynamics further alienate him from the community and complicate his efforts to integrate into the local society. The ecological influence of the family and the broader community creates barriers to the teacher's attempts to foster a productive educational environment, as students are heavily influenced by the socio-cultural practices of their families.

Layer 4: Characteristics of the Community, Neighborhood, State, and Nation. At the broader societal level, *A Season in Hakkari* highlights the challenges posed by the remote and isolated nature of the village, which significantly hinders educational efforts. The film shows how the local structure, shaped by geographical and socio-cultural factors, delays the achievement of educational goals. The community's distinct cultural characteristics and local dynamics create barriers that complicate the teacher's ability to implement standardized educational practices. The socio-cultural differences within the region are reflected in the teacher's struggles to adapt to the local customs and languages, which are different from the urban environment he is familiar with. However, rather than focusing on divisions, the film suggests that these ecological differences—both social and cultural—present unique challenges to the teacher's efforts to connect with his students and the community.

Overall, *A Season in Hakkari* presents education as a struggle shaped by isolation, material scarcity, and socio-cultural distance. Across all ecological layers, the teacher's anxiety, the under-resourced school setting, the community's harsh living conditions, and broader regional inequalities

interact to constrain educational practice. The film therefore constructs an ecological model in which rural education is defined by the simultaneous pressure of personal, institutional, and macro-level challenges.

Bullshit (Zıkkımın Kökü): The Ecological Background of Students' Educational Life (1993)

The film *Bullshit (Zıkkımın Kökü)*, adapted from Muzaffer İzgü's novel, provides a powerful depiction of how socio-economic factors influence a student's educational experience. Through Zumbo's ecological model, the film's portrayal of the protagonist Muzaffer's life is examined across four layers: Personal Characteristics, Teacher, Classroom, and School Context, Family and Ecology Outside of School, and Characteristics of the Community, Neighborhood, and Nation. The created model is presented in Figure 6.

Layer 1: Personal Characteristics. At the core of Muzaffer's character is an intense love of reading, which serves as a crucial personal trait that influences his educational journey. Despite the challenging socio-economic conditions, Muzaffer's passion for knowledge and books drives him to excel academically. This intrinsic motivation to learn and grow intellectually becomes a key factor in his ability to overcome the numerous obstacles he faces. This personal trait stands in stark contrast to the external difficulties he encounters and plays a pivotal role in his ability to persist in his education despite the overwhelming obstacles. The film emphasizes how individual characteristics, such as a student's love of learning, can serve as a form of resilience in the face of adversity. However, this personal characteristic is also constantly tested by the socio-economic hardships that threaten to undermine his academic potential. This layer demonstrates the complex relationship between personal motivation and external factors, showing how Muzaffer's passion for education acts as both a coping mechanism and a catalyst for his success.

Layer 2: Classroom and School Environment. The school environment in *Bullshit* reflects the systemic issues of the Turkish education system during the 1990s, particularly in underfunded rural areas. The film portrays the classroom as a place where students are subjected to rigid, behaviorist teaching methods focused on memorization and repetition. Evaluations, both oral and written, are based on students' ability to recall information rather than engage in critical thinking or creativity. This educational approach limits students' opportunities for intellectual growth and development. The film critiques the lack of pedagogical innovation, where students are treated as passive recipients of knowledge rather than active participants in their learning. Teachers in the film, though well-meaning, are constrained by the broader system, which prioritizes discipline and rote learning over fostering a more holistic educational experience. Muzaffer's classroom interactions highlight the disconnection between what is taught and the students' real-life experiences, further contributing to their disengagement from the learning process. Despite these challenges, the classroom also serves as a space of relative stability for Muzaffer, where his love for reading and learning is nurtured, albeit within the confines of a rigid educational system. This layer underscores the importance of classroom environments in shaping a student's educational trajectory, even when the teaching methods are limited.

Layer 3: Family and Ecology Outside of School. The socio-economic realities of Muzaffer's family and community play a significant role in shaping his educational experience. Poverty is a recurring theme in the film, with Muzaffer's family struggling to provide for basic needs, let alone support his academic pursuits. Muzaffer is forced to work outside of school to contribute to the household income, which limits his ability to focus on his studies. This dual burden of school and work creates a significant challenge, as Muzaffer is constantly torn between his responsibilities at home and his desire to excel academically. The film also portrays the broader community context, where education is often seen as secondary to the immediate economic needs of the family. However, despite these obstacles, Muzaffer finds opportunities for learning outside the formal school setting, such as through his local library. This informal learning environment provides him with an outlet to pursue his intellectual interests, demonstrating how community resources can sometimes mitigate the negative effects of socio-economic hardship.

Overall, *Bullshit* reveals how a student's educational life is shaped by the interaction between personal resilience and socio-economic deprivation. Although Muzaffer's love of reading sustains his motivation, the film shows that rigid school practices, poverty, family responsibilities, and limited opportunities outside school continuously shape and restrict his educational path. In this respect, the film offers a student-centered ecological model of persistence under structural disadvantage.

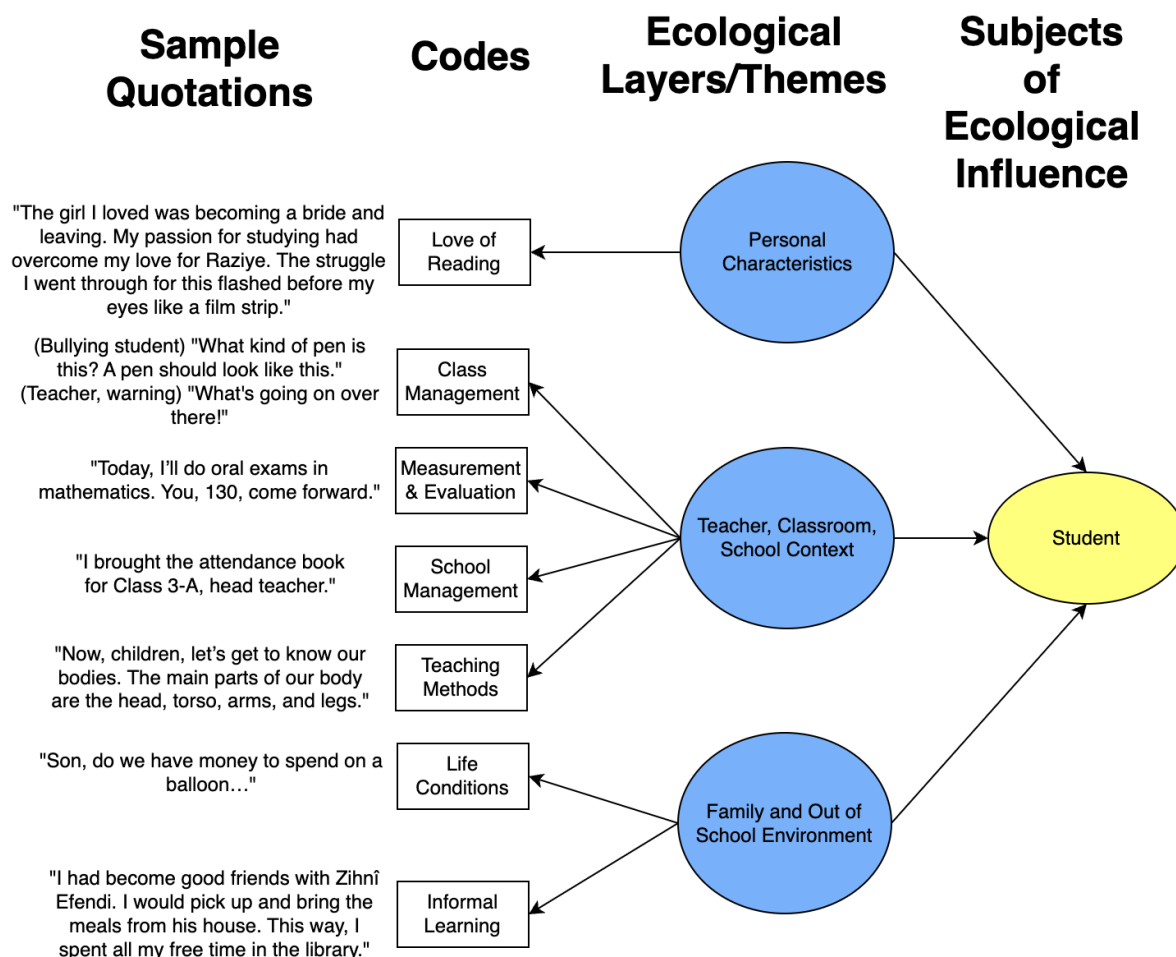


Figure 6. The ecological model of *Bullshit* (Zıkkımın Kökü). Colors: Yellow for students, blue for the ecological model's layers, colorless rectangles for the codes from analysis.

On the Way to School (İki Dil Bir Bavul): Addressing Educational Challenges in a Multilingual Context (2008)

On the Way to School (İki Dil Bir Bavul) presents the educational challenges faced by a teacher working in a predominantly Kurdish-speaking region in southeastern Turkey, where the national curriculum is delivered in Turkish. The analysis of this film through Zumbo's ecological model examines how four layers—Personal Characteristics; Teacher, Classroom, and School Context; Family and Out of School Environment; and Characteristics of the Community, Neighborhood, and Nation—interact to shape the educational environment portrayed in the film. The created model is presented in Figure 7.

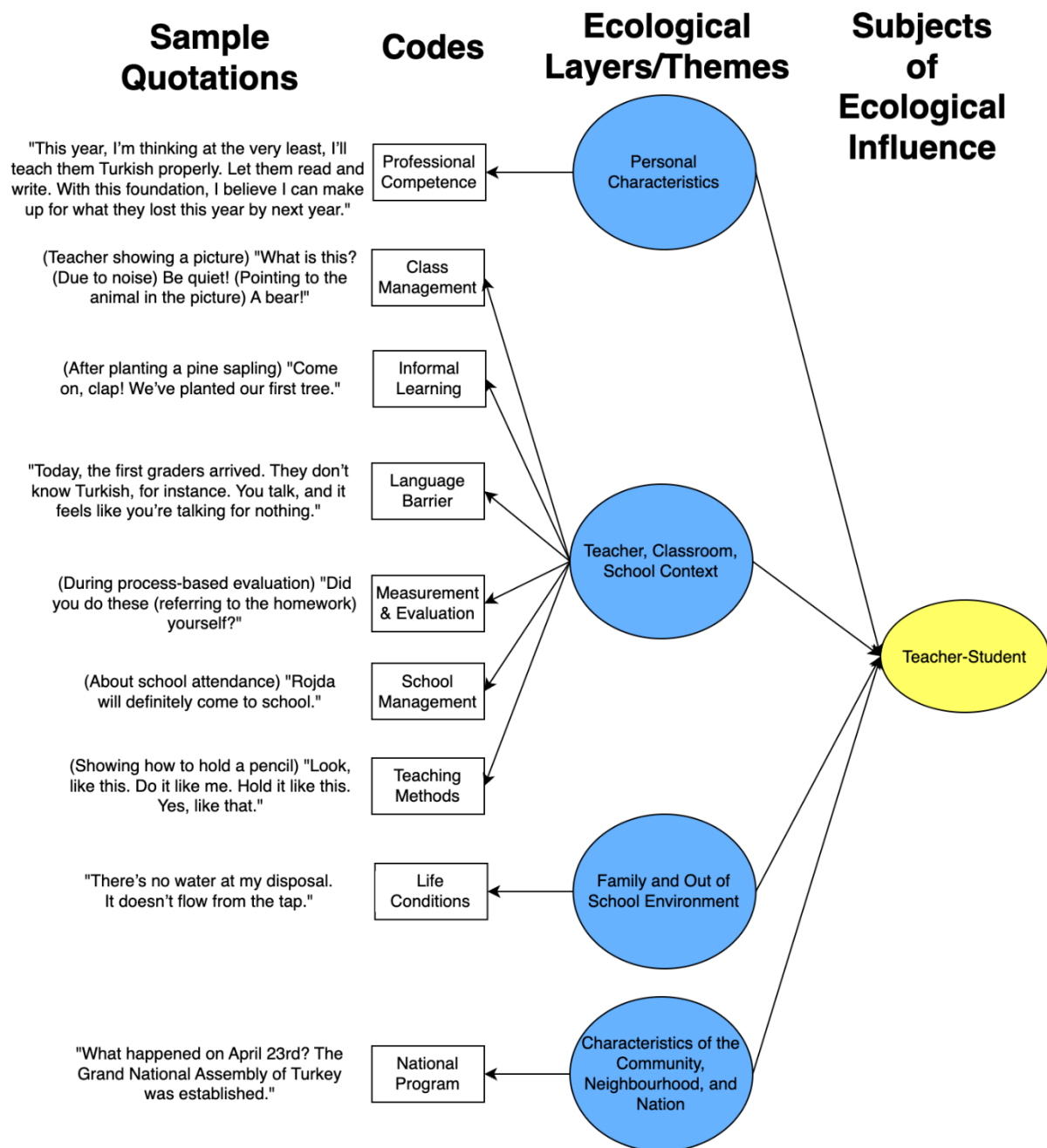


Figure 7. The ecological model of *On the Way to School* (İki Dil Bir Bavul). Colors: Yellow for teachers, blue for the ecological model's layers, colorless rectangles for the codes from analysis.

Layer 1: Personal Characteristics. In this layer, the teacher's personal characteristics are integral to his ability to navigate the multilingual classroom. The film emphasizes his professional competence and dedication to his role, despite being sent to a remote and unfamiliar environment. His motivation to teach in such a challenging context stem from his strong sense of duty, yet the film also reveals the psychological toll this situation takes on him. As the language barrier complicates his efforts, the teacher's frustration grows, revealing the emotional burden placed on educators working in isolated regions. This layer highlights the importance of individual resilience and competence in addressing the linguistic and cultural challenges of the classroom.

Layer 2: Teacher, Classroom, and School Environment. The classroom environment in *On the Way to School* is marked by limited resources and a lack of administrative support. The teacher operates in an isolated setting without any visible bureaucratic oversight, which forces him to juggle multiple

responsibilities beyond the scope of typical teaching duties. These conditions reflect the broader systemic challenges faced by educators in remote regions. Due to these constraints, the teaching methods and assessment processes depicted in the film are heavily influenced by a behaviorist approach. The teacher frequently uses you-messages in classroom management, and there is little evidence of the constructivist approach, which is still not fully integrated into the educational practices of the region. This layer illustrates how the lack of resources and support systems restricts the potential for innovative teaching practices and perpetuates a focus on rote learning.

Layer 3: Family and Ecology Outside of School. The socio-economic realities of the students' family environments play a crucial role in their educational experiences. Poverty is a pervasive issue, limiting the students' access to educational resources and affecting their ability to fully engage in the classroom. At home, the students are immersed in their heritage language, Kurdish, which contrasts with the Turkish language used at school, creating a cultural and linguistic disconnect. This dual linguistic reality further complicates the students' academic performance, as they struggle to bridge the gap between home and school life. Despite these challenges, the film highlights how certain cultural values, such as respect for the teacher, support the creation of a positive learning environment, allowing the students to engage with their education despite the obstacles.

Layer 4: Characteristics of the Community, Neighborhood, and Nation. The implementation of the national education program in *On the Way to School* plays a central role in shaping the students' experience. On one hand, the Turkish education system introduces Kurdish-speaking students to Turkish as their second language, which helps them integrate into the national culture and acquire the linguistic skills necessary to participate in the broader national educational framework. By being exposed to Turkish, the students become familiar with the cultural and social norms of the country. Through events like the celebration of April 23rd, Turkey's national Children's Festival, the film shows how such activities serve as cultural touchpoints, reminding students that they are part of a larger national community with shared traditions and values.

However, the film also highlights the challenges that arise during the implementation of the national curriculum in a multilingual setting. The teacher, despite his best efforts, finds it difficult to apply the exact program due to the linguistic needs of the students, who have little to no understanding of Turkish at the start of the school year. Instead of strictly following the national curriculum, the teacher is compelled to focus on teaching Turkish as a second language, as this becomes the immediate priority for the students' academic development. While the national program aims to foster unity and cultural integration, the lack of flexibility in adapting the curriculum to the linguistic realities of the classroom creates significant obstacles for both the teacher and the students.

Overall, *On the Way to School* demonstrates that education in a multilingual rural setting is shaped by the interaction of personal dedication, limited school resources, poverty, and national language policy. The film shows that the teacher's professional role extends beyond instruction to adaptation, mediation, and survival within a linguistically unequal context. In this sense, its ecological pattern is built on the tension between constructivist expectations and behaviorist realities in practice.

Brother's Keeper (Okul Tıraşı): The Violent School (2021)

Brother's Keeper (2021) offers a harrowing depiction of a boarding school where violence permeates every level, from the administration to the students. Through the lens of Zumbo's ecological model, the film explores how the environment, institutional practices, and broader societal factors contribute to a culture of violence and neglect, ultimately impacting both teachers and students. The created model is presented in Figure 8.

Layer 1: Personal Characteristics. In *Brother's Keeper*, both teachers and students display personal characteristics shaped by the harsh environment of the boarding school. The teachers are portrayed as emotionally detached and overwhelmed by the demands of their roles, which diminishes their professional competence and leads to symptoms of burnout. The school's environment generates a sense of frustration, which results in the teachers' lack of motivation and empathy toward the students.

Burnout manifests in their emotional withdrawal and reduced ability to engage effectively in their roles as educators. Students, on the other hand, demonstrate a mixture of resilience and vulnerability. While some students manage to cope, many struggle under the psychological toll of the boarding school environment, where emotional support is minimal, and they are left to navigate their education under challenging circumstances. This layer emphasizes how the individual characteristics of both teachers and students are influenced by the stress of the school context, with burnout emerging as a consequence for the teachers, further impacting the school's overall atmosphere.

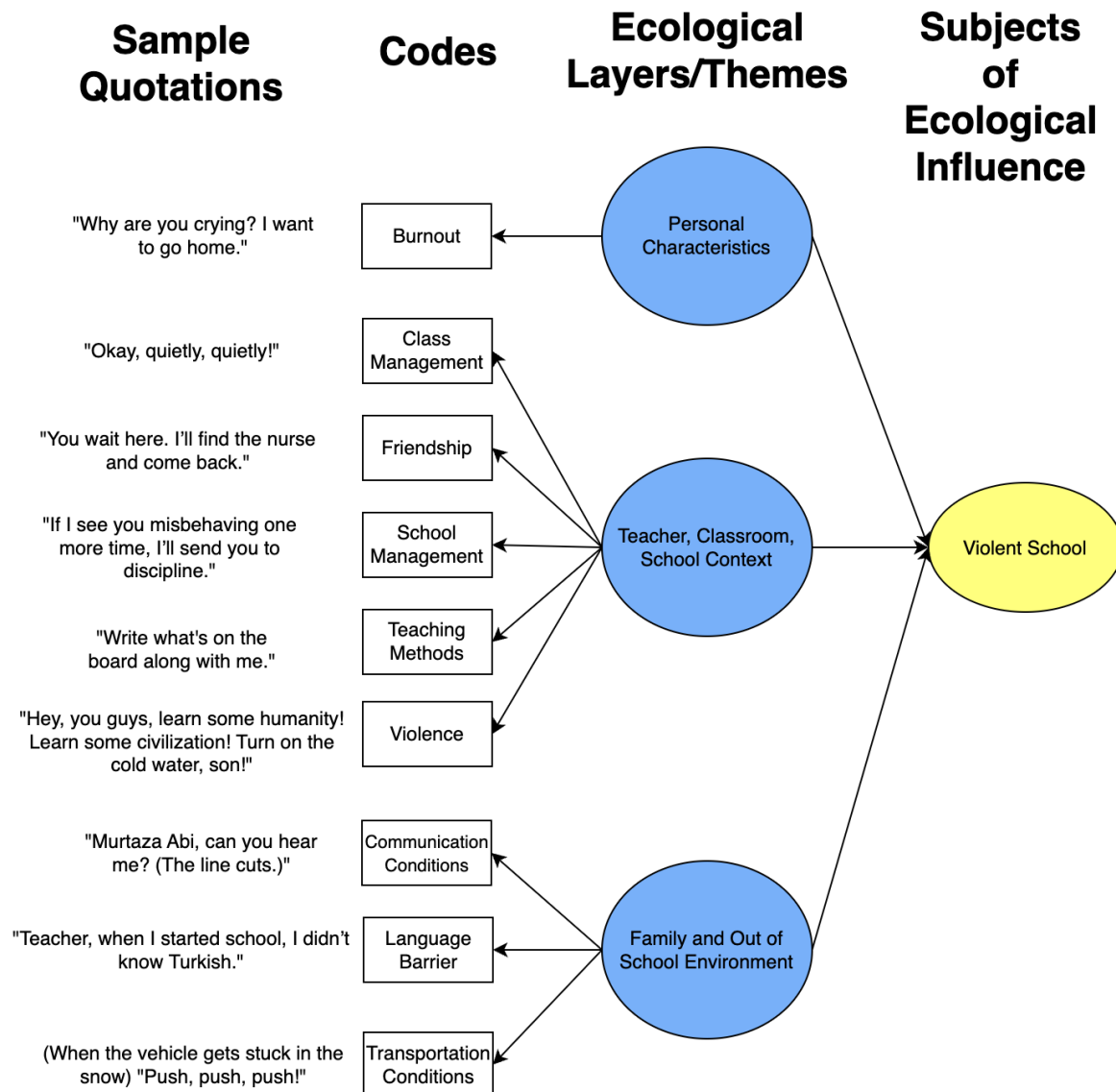


Figure 8. The ecological model of Brother's Keeper (Okul Tıraşı). Colors: Yellow for teachers and students, blue for the ecological model's layers, green for the themes from analysis.

Layer 2: Classroom and School Environment. The school environment in *Brother's Keeper* is marked by strict authoritarian control, where disciplinary methods take precedence over pedagogy. The teachers often resort to physical violence, such as slapping students, as a primary means of maintaining discipline. A notable disciplinary practice in the film is the shaving of students' hair in a distinctive manner whenever there is a perceived problem with behavior. This practice not only humiliates the students but also reinforces the atmosphere of fear and control that dominates the school environment. Authoritarian communication styles, including scolding and threats, are commonly used to enforce rules and maintain order, further alienating the students. Classrooms are structured around traditional,

behaviorist teaching methods, focusing on rote learning and memorization, leaving little room for critical thinking or creative engagement. The lack of proper health care and basic resources further compounds the difficulties faced by both teachers and students. A key scene in the film depicts a student's medical emergency, which highlights the administrative inefficiencies and the limited access to proper care within the school. The rigid structure and lack of flexibility within the school system hinder the educational experience, demonstrating the need for a more supportive, adaptable, and compassionate educational environment.

Layer 3: Family and Ecology Outside of School. The socio-cultural backgrounds of the students, particularly those from isolated areas, add complexity to their educational experience. One significant challenge for *some* students, as depicted in the film, is the language barrier. These students come from homes where Kurdish is spoken, and when they start school, especially in the first grade, they struggle to understand Turkish, the language of instruction. While most of the movie is presented in Turkish for the audience, specific scenes show the difficulty some students face as they transition into an environment where they are required to use Turkish in all academic settings. This language barrier complicates their ability to engage with the curriculum and adapt to the school environment. The school's rigid disciplinary approach and lack of resources do little to support these students' linguistic adjustment. The disconnection between the students and their families is compounded by the remote location of the boarding school. With limited opportunities to maintain regular contact, the emotional distance created by the separation adds to the students' sense of isolation. While the boarding school is intended to provide a stable educational environment, it often fails to address the specific linguistic and emotional needs of some students, further complicating their adjustment to this isolated and challenging setting.

Overall, *Brother's Keeper* presents a violent school environment in which educational life is shaped by authoritarian discipline, neglect, emotional isolation, and institutional failure. The interaction of burnout, resource scarcity, language-related difficulties, and boarding-school separation produces a dense ecological pattern affecting both teachers and students. Rather than depicting violence as incidental, the film presents it as a systemic condition embedded in the structure of the school.

Creating a Unified Framework of Educational Themes in Turkish Cinema

The analysis of these six films reveals a coherent ecological framework that demonstrates how Turkish cinema has portrayed the educational journey over time. While each film uniquely depicts different aspects of education, certain patterns emerge across the ecological layers of *Personal Characteristics*; *Teacher, Classroom, and School Context*; and *Family and Out of School Environment*. However, *The Chaos Class* stands as an exception, as it primarily focuses on one layer: *Teacher, Classroom, and School Context*. In this film, professional competence is portrayed as part of the school's burnout environment rather than a separate theme. The unified framework is presented in Figure 9.

Early films like *Çalığıuşu* and *The Chaos Class* reflect a behaviorist approach to education, characterized by teacher-centered methods, strict discipline, and rote memorization. *The Chaos Class* confines its exploration of educational challenges within the school environment, depicting resource scarcity, institutional burnout, and outdated pedagogical practices. The film focuses on the internal dynamics of the school, and while the influence of family and external socio-economic factors is not explored, this can be considered a limitation of the film's scope rather than an absence of such influences in reality.

In contrast, more recent films like *On the Way to School*, *Brother's Keeper*, and *A Season in Hakkari* introduce additional complexities such as linguistic barriers, socio-cultural isolation, and the clash between urban and rural life, particularly in remote areas. These films extend the analysis beyond the school environment, highlighting how both in-school and out-of-school factors shape educational experiences.

In *A Season in Hakkari*, the focus is on a teacher's struggle to adapt to a rural, culturally isolated community. The film emphasizes the interaction between the teacher's personal characteristics and broader socio-economic conditions. As the teacher attempts to educate students in a remote village, the film underscores the isolation and challenges faced in rural education, revealing how community, socio-cultural differences, and national-level factors influence the educational process. This portrayal demonstrates the deep impact of socio-economic factors on the education system, emphasizing how both teachers and students are shaped by the larger ecological context.

Similarly, *On the Way to School* portrays the teacher's challenges in adapting to a multilingual classroom, reflecting the system's attempt to embrace constructivist ideals. However, behaviorist methods still dominate, largely due to systemic constraints and a lack of resources. *Brother's Keeper* delves into the emotional and social isolation experienced by students in rural boarding schools, underscoring the impact of the school's structure on student well-being.

Bullshit presents an alternative perspective by focusing on the personal resilience of a student navigating both economic hardship and a rigid educational system. While the film retains the behaviorist approach seen in earlier depictions of education, it bridges the gap between in-school experiences and external socio-economic challenges, highlighting the broader struggles faced by students from disadvantaged backgrounds.

The unified framework developed in this study, summarized in *Figure 9*, provides not only a picture of recurring ecological problems but also a diachronic view of how educational stakeholders respond to them across different periods. Despite the 2006 curriculum reform, which promoted constructivist methods, behaviorist practices such as rote memorization and authoritarian discipline continue to be depicted in these films. This persistence reflects the gap between policy changes and the realities of educational practice, particularly in under-resourced environments. At the same time, the teacher profile undergoes a meaningful transformation. In *Çalılıkusu*, the teacher is portrayed as a figure who attempts to overcome structural deficiencies through personal sacrifice, moral commitment, and individual effort. In later films, however, this compensatory role gradually weakens. In *The Chaos Class*, institutional disorder and professional inadequacy become normalized within a burnout school model; in *A Season in Hakkari* and *On the Way to School*, teachers continue to struggle but respond through constrained adaptation and pragmatism rather than transformative agency; and in *Brother's Keeper*, prolonged deprivation is accompanied by emotional withdrawal and burnout. Thus, while bureaucratic problems, material scarcity, and unequal educational conditions remain visible across decades, the teacher profile shifts from self-sacrificing endurance toward fatigue, limited agency, and, in some cases, professional exhaustion.

A similar continuity-with-variation is observed in the responses of administrators and the surrounding social environment. The films do not indicate a clear linear transition from passive acceptance to rights-based collective action. Rather, earlier narratives tend to present structural disruptions as conditions to be endured or managed through personal effort, whereas later films make frustration, improvisation, and partial adaptation more visible. Even so, these responses rarely develop into sustained institutional initiative. In this respect, Turkish cinema suggests not that ecological barriers disappear over time, but that the ways of negotiating them become more explicit, fragmented, and emotionally costly.

Ecological Themes / Layers

Calikusu (1966)	1. Personal Characteristics 2. Teacher, Classroom, School Context 3. Family and Out of School Environment 4. Characteristics of the Community, Neighbourhood and Nation
Caos Class (1975)	Teacher, Classroom, School Context
A Season in Hakkari (1983)	1. Personal Characteristics 2. Teacher, Classroom, School Context 3. Family and Out of School Environment 4. Characteristics of the Community, Neighbourhood and Nation
Bullshit (1993)	1. Personal Characteristics 2. Teacher, Classroom, School Context 3. Family and Out of School Environment
On the Way to School (2008)	1. Personal Characteristics 2. Teacher, Classroom, School Context 3. Family and Out of School Environment 4. Characteristics of the Community, Neighbourhood and Nation
Brother's Keeper (2021)	1. Personal Characteristics 2. Teacher, Classroom, School Context 3. Family and Out of School Environment

Figure 9. Unified framework of educational themes in movies

Discussion

This study aimed to explore how Turkish cinema reflects educational themes through an ecological framework, focusing on six films that span several decades. The findings reveal a complex interplay of personal, institutional, and societal factors that shape the educational experiences portrayed in these films. The study highlights a persistent behaviorist approach to education across different periods, despite the formal adoption of constructivist ideals in the 2006 curriculum reform (MoNE, 2006).

From a diachronic perspective, one of the most notable findings is that the persistence of ecological barriers is accompanied by a change in the form of educational response. Bureaucratic obstacles, material deprivation, and regional inequality recur across the films; however, the capacity of teachers and other stakeholders to confront these difficulties does not remain stable. In the earlier period, especially in *Çalikuşu*, educational disruption is countered through the teacher's personal dedication and willingness to compensate for structural shortcomings. In later periods, this compensatory pattern becomes increasingly fragile. The teacher in *A Season in Hakkari* struggles under the weight of isolation and anxiety, the teacher in *On the Way to School* relies on practical adaptation to meet immediate classroom needs, and *Brother's Keeper* presents a context in which emotional withdrawal and burnout become more visible. Accordingly, the films suggest a historical movement from idealized endurance toward constrained adaptation and institutional fatigue.

Another prominent feature of this study is that the films provide a broader framework for understanding the experiences of teachers and students. The analysis of *Çalikuşu* highlights various challenges, such as the difficulties faced by female teachers (Demirel Değirmenci, 2021), the role of values education as part of informal learning (Ünal, 2020), and the potential of teachers to serve as role models (Akcan & Polat, 2016). The findings also reveal that teachers are significantly affected by issues such as ignorance, moral decline, and poor economic conditions. Bureaucratic inefficiencies make professional life challenging, with nepotism and incompetence emerging as significant obstacles (Ak & Sezer, 2018). This film reflects the persistence of nepotism from the Ottoman era to the present and provides evidence of the ongoing psychological and physical abuse experienced by female teachers for over a century (Ak & Sezer, 2018; Bölükbaşı, 2015; Robinson, 2000). These findings suggest a more traumatic and chronic problem affecting professional success, as the negative environment inhibits teachers' potential, presenting a narrative where the teacher is depicted as struggling rather than thriving.

The Chaos Class offers a comprehensive portrayal of a school consumed by negative influences, providing a model for understanding a "burnout school" through an ecological lens. Previous studies have examined various aspects of the film individually (Akcan & Polat, 2016; Doğan, 2017; Kezer & Çetiner, 2019; Tofur, 2017; Ünal, 2020), but this study reveals how the deteriorations at the national level are mirrored in the school's informal learning processes. The breakdown of the school's structure is evident in its methods, with teachers experiencing both mental and physical professional inadequacy. The film depicts a deliberate representation of a dysfunctional school, where all stakeholders—teachers, students, parents, principals, and staff—are affected by burnout as part of a complex ecological pattern (Ünal, 2020; Wallace & Pocklington, 2013). Burnout is particularly prevalent among teachers (Friedman, 1991; García-Carmona et al., 2019) and students (Walburg, 2014), contributing to a school culture marked by professional disengagement and systemic failures. The film's portrayal emphasizes the need to address burnout at the institutional level to improve the educational environment. *The Chaos Class* not only highlights educational issues of its time but also offers insight into the broader impact of burnout on school stakeholders. Teachers exhibit a lack of interest, students display negative attitudes, and even support staff are shown violating norms. This comprehensive portrayal underscores the importance of understanding burnout more deeply by identifying the school-based sub-themes that define a "burnout school."

Studies on *A Season in Hakkari* have often focused on simple realities (Bıçak, 2021; Oğurlu, 2019; Ünlü & Serarslan, 2012). While previous research noted the influence of rural-urban conflict (Oğurlu, 2019), this study reveals a systematic pattern of negative ecological impacts. The teacher is portrayed as struggling with depressive tendencies and negative interactions with educational macrostructures, such as schools and the broader education system. Socio-economic factors serve as mediators that exacerbate the adverse effects of the ecological background on the educational process. The ongoing relevance of these challenges, such as economic difficulties (Leibowitz et al., 2015; Özdemir & Orhan, 2019) and regional disparities (Aygül & Korkmaz, 2018), suggests that the themes presented in the film remain pertinent today, highlighting the long-term validity of these issues.

Bullshit provides a critical depiction of socio-economic realities affecting students, aligning with the narratives of *A Season in Hakkari* and *On the Way to School*. The film underscores the persistent impact of economic conditions and bureaucratic challenges on student life, suggesting that these issues are deeply entrenched in Turkish education. The ongoing relevance of these factors is supported by contemporary studies highlighting the effects of bureaucracy (Züngür, 2022) and economic conditions (Elitok Kesici & Ceylan, 2020) on students.

On the Way to School focuses on the challenges of second language teaching and the broader ecological factors impacting teachers' professional lives. The film portrays the teacher as a motivated role model, navigating the complex dynamics between heritage and second language education (Yetimova, 2019). Unlike earlier studies that primarily highlighted the effects of poverty (Akıncı Yüksel, 2015), this study emphasizes the broader ecological context. The film also underscores the disparities in academic opportunities and outcomes based on geographic location (Anıl, 2009), contrasting the rural eastern setting with urban schools in films like *The Chaos Class*.

Brother's Keeper, set in the 21st century and the constructivist period of the Turkish education system (MoNE, 2006), provides a model that reflects the enduring influence of behaviorist approaches. The film underscores the significant impact of socio-economic and cultural factors on school stakeholders, illustrating the complex interplay between ecological contexts and educational practices. Notably, the most prominent educational films in Turkish cinema often highlight severe challenges in Turkey's eastern provinces, issues that continue to be reported in contemporary literature (Özdemir & Erol, 2021).

Finally, the study revealed that education-based films in Turkish cinema exhibit a rich ecological pattern across the 20th and 21st centuries. More importantly, this pattern is not limited to the repetition of the same problems; it also reflects changes in how these problems are experienced and negotiated. The selected films do not provide strong evidence of a clear transition toward rights-based or institutionally transformative responses among administrators or the wider social environment. Instead, they portray a movement from normalized endurance toward more visible frustration, local improvisation, and limited forms of adjustment. In this sense, the historical change reflected in Turkish cinema lies less in the disappearance of structural barriers than in the increasing fragility of those expected to cope with them.

The findings also suggest that these films may be used as reflective materials in teacher training. More specifically, they can help pre-service and in-service teachers examine how classroom management, teacher identity, professional burnout, socio-economic inequality, language barriers, and school culture are shaped by broader ecological conditions. In this respect, films such as *Çalılıkusu*, *The Chaos Class*, *A Season in Hakkari*, *On the Way to School*, and *Brother's Keeper* may be incorporated into teacher education courses to support discussion, case-based interpretation, and critical reflection on the relationship between educational practice and context. Such use would allow teacher candidates not only to evaluate instructional methods, but also to recognize how institutional, familial, and societal conditions influence teaching and learning processes (Çam, 2023; Tofur, 2018).

Although the ecological model that forms the framework of the study has been studied in different areas, its use in the analysis of motion pictures/movies, according to the knowledge of the authors, has been realized for the first time with this study. Therefore, the results are rewarding for many researchers in a wide range of fields, from cinema to education. The findings might provide the basis for further quantitative investigations in a subsequent study. In particular, the factors affecting the burnout school and the variables affecting the professional lives of teachers and the educational lives of students can pave the way for structural equation modelling and other correlational studies. In addition, it is possible to carry out new studies based on the principle that cinema is an alternative source of reality.

Conclusion

In conclusion, this study has undertaken a comprehensive examination of the representation of education in Turkish cinema, seeking to uncover patterns and insights across various films. The results have shed light on the consistent ecological pattern that has permeated Turkish cinema throughout its history. Notably, the films analyzed up to 2022 provide little evidence of creative thinking skills as a visible educational priority. Furthermore, the dynamic relationship between cinema and societal conditions, with movies shaping their content to resonate with audiences and generate economic returns, highlights the interplay between education, economy, and social dynamics.

One of the principal contributions of this study is the broader framework it offers to both educators and students. Analyses of specific films, such as *Calikusu*, *The Chaos Class*, *A Season in Hakkari*, *Bullshit*, and *On the Way to School*, illuminate a range of issues faced by educators and students, including the challenges of female teachers, values education, teacher role modeling, bureaucracy, economic hardships, and systemic challenges that have persisted over time. These findings emphasize the need for systemic changes in education, professional development, and economic support for educators.

Moreover, this research underscores that the issues depicted in these films continue to be relevant in contemporary society, demonstrating the enduring impact of socioeconomic and cultural factors on the educational landscape. The films, produced in various periods and socio-cultural contexts, provide a glimpse into the multifaceted nature of educational challenges in Turkey. Lastly, the application of an ecological model to analyze these films represents a novel approach within the academic discourse. The findings of this study have implications beyond the realm of cinema and education, presenting a unique opportunity for interdisciplinary research.

This study offers a valuable perspective on how cinema can serve as a mirror reflecting the educational and societal challenges of its time. The ecological model employed here has unveiled rich patterns and potential areas for future exploration. It provides a steppingstone for future research in various fields, from cinema studies to educational policy, allowing for more in-depth investigations into the ecological and systemic factors affecting education in Turkish society. In essence, the films explored in this study not only tell a story but also offer a mirror through which we can gain insight into the evolution of education and society in Turkey. They serve as a compelling reminder of the importance of addressing systemic challenges in education and fostering an environment that enables both educators and students to thrive.

Suggestions

Based on the findings and discussions of this study, several suggestions are proposed to enhance future research and practical applications in the fields of education and cinema. This study has highlighted the potential of ecological frameworks in analyzing educational themes in Turkish cinema. Future research could extend this approach by incorporating quantitative methods, such as structural equation modeling, to explore the relationships among the factors identified in the films. Investigating models like the “burnout school” and examining the impact of socio-economic and cultural factors on teachers' and students' lives could deepen the understanding of these dynamics and validate the patterns observed in this study.

The analysis emphasizes the role of cinema as a reflective medium that mirrors societal attitudes towards education, revealing persistent challenges such as economic hardships, bureaucratic inefficiencies, and cultural conflicts. Educators and policymakers could leverage films as tools in professional development programs to provide insights into the socio-cultural dynamics of educational environments. This approach can foster a deeper awareness of the ecological factors affecting education and support educators in adapting their teaching strategies to better meet the needs of diverse classrooms. When considered together with the broader teacher education literature, such films may also contribute to discussions of how listening (Kurudayıoğlu et al., 2021; Uzun & Aytan, 2024), reading (Göktentürk et al., 2025), speaking (Ensar & Gündüz, 2022), and writing practices (İpek & Karatay, 2023;

Karatay et al., 2023), together with classroom management, shape student participation and development. In light of the motivation-related patterns observed especially in Bullshit, future studies could also examine how students' intrinsic motivation and teacher practices interact with ecological constraints in shaping educational outcomes, particularly in view of recent evidence on teacher-related motivational factors (Göktentürk & Oluşan, 2026).

Despite educational reforms (MoNE, 2006), this study underscores the continued prevalence of behaviorist approaches in Turkish education, as reflected in the films analyzed. Bridging the gap between policy and practice remains crucial, particularly in under-resourced and linguistically diverse settings. More targeted interventions are needed to fully implement constructivist ideals in classrooms, ensuring that policy changes translate into meaningful improvements in teaching and learning.

Recognizing cinema as a valuable source of educational insight, future studies could explore how other media, such as television series and documentaries, depict educational environments and influence public perceptions. Expanding the scope of research in this direction could offer further understanding of the cultural narratives surrounding education in Turkey and beyond.

Lastly, it is important to note that this study is limited to films produced up until 2022. Future research could incorporate more recent works to capture evolving trends in the depiction of education. Additionally, expanding the analysis to include a broader range of films, including those with lower visibility, could enrich the understanding of how various ecological factors shape educational portrayals.

Appendix

Readers can reach the findings of qualitative analysis (i.e., themes and codes) by using the following link.

<https://educationandscience.ted.org.tr/article/view/2460/supplement>

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An examination of the Türkiye Century Education Model science curriculum in terms of 21st-century skills using Q methodology

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Abstract

This study examines classroom teachers' perceptions of the extent to which the updated Science Curriculum within the Türkiye Century Education Model (TYMM) supports the development of 21st-century skills. We used Q methodology to capture teachers' subjective viewpoints. Thirty-nine classroom teachers working in Kırşehir ranked 32 statements representing key 21st-century skills through a Q sort procedure. Factor analysis yielded three distinct perspectives, accounting for 60% of the total variance. Overall, teachers appraised the TYMM curriculum positively, especially for promoting collaboration, inquiry-oriented learning, and problem-solving. At the same time, they perceived the curriculum as less supportive in areas such as digital content creation, entrepreneurship, and flexibility. Teachers also pointed to implementation barriers, including limited technological infrastructure, insufficient instructional materials, and gaps in teachers' digital literacy. Finally, by leveraging Q methodology's capacity for multidimensional analysis, the study offers an original, teacher-centred account of how 21st-century skills are framed and perceived in curriculum work. The findings may inform education policy decisions, the design of teacher education and professional learning, and ongoing curriculum development.

Keywords

21st-century skills
Classroom teachers' perceptions
Q methodology
Science curriculum
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Introduction

Technological and social transformations have pushed education systems to move beyond a narrow focus on knowledge transmission toward more multifaceted structures that cultivate intellectual, digital, and social capacities. Curricula sit at the centre of this shift. By systematically organising learning experiences within and beyond school, they aim to develop the knowledge, skills, attitudes, and values required by contemporary society (Demirel, 2023). At this point, a brief terminological clarification is necessary regarding the use of curriculum and syllabus in this study. In some international traditions, curriculum refers to a broader framework that includes aims, content, pedagogy, and assessment, whereas syllabus may be used to denote a more bounded plan for content

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coverage and sequencing. In Türkiye's education policy discourse and much of the national literature, however, these terms are often used interchangeably (Demirel, 2023). Accordingly, this study uses the two terms synonymously, with meaning determined by context.

As a core instrument for developing qualified individuals, curricula need to remain flexible and open to revision in order to respond to changing social and technological conditions (Kart & Şimşek, 2020; Kırkeser, 2021). Scientific advances and technological innovations, in particular, require learning processes that can be updated and implemented in practice (Bilir, 2025; Karakaya et al., 2024; Rüzgar, 2025). For this reason, contemporary curriculum design increasingly calls for approaches that are responsive to learners' evolving needs, foreground critical thinking and life skills, and sustain flexibility over time (Demir & Çelik, 2020; Karataş, 2024).

In Türkiye, recent years have seen a range of reform initiatives intended to align curricula with the demands of the era and to equip learners with broader competencies (Board of Education, 2017; Ministry of National Education [MoNE], 2024a). Within this context, MoNE introduced the Türkiye Century Education Model (TYMM) in 2024 as part of a comprehensive curriculum update. TYMM is presented as a student-centred model that foregrounds skills through a learning outcomes framework and seeks to structure learning and teaching processes more systematically (Board of Education, 2025; MoNE, 2024a). Beyond academic attainment, it aims to support students' social and emotional development, with particular attention to higher-order thinking skills such as critical thinking, problem solving, and creativity (Karataş, 2024; Turkish Education Association, 2024).

Importantly, TYMM is framed not only as a conceptual orientation but also as a reform initiative accompanied by implementation steps. According to MoNE's needs analyses, input was gathered from 17,000 students and from teachers through evaluation commissions established across 81 provinces. Based on these inputs, MoNE reported a need to reduce curricular cognitive load and to shift toward a more skills-oriented structure (MoNE, 2024a). In line with this direction, the model's functionality is being examined through pilot implementations initiated in the 2024-2025 academic year, alongside systematic in-service training intended to support teachers' enactment of the updated curricula (MoNE, 2024d, 2024e). For example, the "Research, Development, and Training Project" targeting vocational subject teachers in Imam Hatip High Schools is intended to strengthen teacher competencies and support effective implementation (MoNE, 2024b).

In addition, guide documents and implementation guidelines are intended to assist teachers with instructional planning, the selection of teaching strategies, and assessment practices (MoNE, 2024c). These resources aim to enhance teachers' capacity to translate TYMM's intended learning outcomes into classroom practice. Within this broader reform architecture, 21st-century skills are positioned as a set of knowledge, skills, and competencies that support learners' participation and success in an increasingly digital and complex world (Boyacı & Özer, 2019; Hamarat, 2019).

The curriculum adopts an integrated approach to students' development by attending to cognitive, affective, and social dimensions. This orientation is informed by 21st-century skills emphasised in the international literature (Partnership for 21st Century Learning [P21], 2019) and by research that links social and emotional competencies, such as self-awareness and self-regulation, with learning and academic outcomes. The curriculum also foregrounds inquiry-based learning and interdisciplinary connections, seeking to position learners not as passive recipients of information but as active participants in knowledge construction. Framed alongside education for sustainable development (UNESCO, 2017) and values education, this pedagogical architecture reflects a vision of developing learners who are academically competent, environmentally sensitive, socially responsible, and oriented toward national and spiritual values (Arslankara & Arslankara, 2024; Sezer & Dedeoğlu, 2024). Building on this conceptual background, the present study offers an evaluation of the curriculum from teachers' perspectives.

Although 21st-century skills are classified in different ways across the literature, one of the most widely used frameworks is that of P21 (Çoban et al., 2019; Yalçın, 2018). The P21 framework clusters these skills under three broad domains: (1) learning and innovation skills (critical thinking, problem solving, creativity, communication, and collaboration), (2) information, media, and technology literacy, and (3) life and career skills (initiative, flexibility, leadership, productivity, and responsibility) (P21, 2019). This framework highlights competencies that are widely considered central for learners' academic participation and longer-term life and career trajectories.

Within this broader skills discourse, TYMM is presented as a reform that seeks alignment with global competency frameworks while also foregrounding local and national value orientations. Some comparative accounts situate TYMM alongside international curriculum reforms in countries such as Canada, Finland, and Indonesia, where science and basic education curricula emphasise competencies including critical thinking, collaboration, media literacy, individualised learning, and interdisciplinary competence development (Amadi, 2023; Surya et al., 2022; Wang et al., 2018). However, the literature also suggests that such comparisons often remain at the level of surface features and provide limited explanatory depth regarding the theoretical assumptions underpinning TYMM and how these assumptions shape curriculum design (Arslankara & Arslankara, 2024; Sahlberg, 2015).

From this standpoint, recent discussions point to differences in the epistemological and axiological orientations attributed to TYMM in contrast to reforms commonly associated with Western curricular traditions. While some accounts characterise Canadian and Finnish reform trajectories as informed by Enlightenment and humanist traditions (Sahlberg, 2015), TYMM has been discussed as drawing on the Ottoman educational tradition as an epistemological reference point (Arslankara & Arslankara, 2024). Relatedly, the reform has been described as placing greater emphasis on positioning the learner within a social and national-religious value system, whereas some Western models foreground individual autonomy and secular value orientations (MoNE, 2024a; Wang et al., 2018). These distinctions are relevant because they can influence multiple curriculum components, including the articulation of educational aims and the ways in which key competencies are framed.

The 2024 curricula position competencies aligned with P21, such as critical and creative thinking, communication, research, decision making, the use of information technologies, and entrepreneurship, as cross-curricular skills across subject areas (MoNE, 2024a). These competencies are framed as important not only for academic learning but also for preparing learners for future social and occupational participation. In this respect, the science curriculum is particularly salient, as it is organised through learning areas that are intended to support the development of these skills.

For example, the unit "Let's Get to Know Matter: Mixing and Separating" is intended to strengthen students' critical thinking and scientific inquiry by engaging them in observation, classification, and hypothesis testing. The unit "In Pursuit of Light" promotes creative thinking through hands-on investigations that require communication and collaboration. Similarly, "Sustainable Cities and Communities" foregrounds decision making and problem solving by inviting students to analyse environmental issues and develop solutions. A particularly clear illustration appears in the "Electricity That Makes Our Lives Easier" unit, where the learning outcome focuses on "critically evaluating the use of renewable and non-renewable energy sources in electricity production." Such examples indicate how 21st-century skills are embedded within the intended learning outcomes of science instruction. International scholarship likewise highlights science education as a productive context for developing competencies such as critical thinking, problem solving, communication, and digital literacy (Alifah & Sukartono, 2023; Gu & Belland, 2015; Haryani et al., 2024).

Research on TYMM has so far tended to focus on the reform's philosophical underpinnings (Arslankara & Arslankara, 2024; Kurul, 2024; Sezer & Dedeoğlu, 2024) or on curriculum content and structure (Şanlı & Kırkeser, 2025; Taş et al., 2024). However, there remains a lack of practitioner-oriented, teacher-based evidence that examines how 21st-century skills are integrated into the renewed TYMM science curriculum from classroom teachers' perspectives. In particular, systematic, data-

informed accounts are scarce regarding how classroom teachers interpret TYMM, which skills they prioritise, and what implementation challenges they encounter. Addressing this gap is important for supporting sustainable curriculum implementation and for strengthening the practical enactment of TYMM in schools.

Accordingly, this study aims to examine how classroom teachers perceive the TYMM science curriculum and to identify whether these perceptions cluster into distinct viewpoints regarding the curriculum's role in developing 21st-century skills. Teachers' perceptions constitute an important source of evidence for evaluating the trajectory of education reforms and their practical viability in school settings (Akça et al., 2023).

In line with this aim, the study goes beyond describing teachers' views by examining the rationales underpinning these views and the implementation experiences to which they are connected. Q methodology is particularly suitable here because it offers a systematic way to elicit and compare subjective judgements while also enabling the identification of shared viewpoints through quantitative analysis. By integrating qualitative perspectives with factor-analytic techniques, Q methodology provides a robust basis for examining how teachers appraise the extent and ways in which TYMM supports 21st-century skills. Through this approach, teachers' viewpoints were analysed to illuminate perceived strengths as well as areas for improvement.

The study addressed the following main research question: *How do classroom teachers' perceptions of the TYMM science curriculum differ with respect to fostering 21st-century skills?* To elaborate this question, four sub-questions were posed:

- What points of consensus emerge among teachers regarding 21st-century skills?
- Which 21st-century skills do classroom teachers prioritise?
- What opportunities and challenges do classroom teachers identify in relation to implementing TYMM?
- How are teachers' perceptions distributed across the identified viewpoints?

Method

This study aims to systematically examine classroom teachers' subjective viewpoints regarding the TYMM science curriculum, drawing on the role of teacher perceptions in shaping the success of education reforms. As a mixed-method approach, Q methodology offers a design that attends qualitatively to individuals' subjective perceptions while also supporting these data quantitatively through factor-analytic procedures (Stephenson, 1982; Watts & Stenner, 2012). By making teachers' multidimensional and value-laden judgements visible, including both cognitive and affective dimensions, the method enables analysis not only of what teachers think but also of which ideas they prioritise and the rationales underpinning those priorities.

In the context of a comprehensive, multi-actor curriculum reform such as TYMM, conventional surveys or fully open-ended interviews may be limited in capturing patterned viewpoints and shared priorities. Q methodology was therefore selected because it allows individuals to express their intellectual priorities through a ranked sorting task and to make the contextual grounds of these priorities visible. In this way, the method moves beyond purely descriptive accounts and enables teachers' views to be examined as conceptually organised patterns (Ramlo, 2021; Watts & Stenner, 2012), supporting more in-depth and multi-layered evidence about the feasibility of curriculum reforms.

These methodological advantages were operationalised through a structured Q sorting and rationale-elicitation process. The Q-sort, a core component of the approach, required participants to place the statements presented to them on a forced distribution grid according to a specified condition of instruction. The Q set used in this study was developed in line with the research questions and comprised 32 statements reflecting teachers' views and perceptions of the TYMM science curriculum.

The statements were designed to provide conceptual breadth and contrast, allowing participants to position their viewpoints through similarities and differences across the set.

After completing the Q sort, participants provided follow-up written rationales for the statements placed at the extreme ends of the distribution (+4 and -4). This step made the interpretive and contextual grounds of the numerical configurations more visible. The forced distribution format also supports clearer statistical differentiation of viewpoints during analysis. Through this integrated design, the study generated both quantitative and qualitative data: Q sorts constituted the quantitative component, while participants' written rationales constituted the qualitative component (Watts & Stenner, 2012). The factor-analytic results derived from Q sorts revealed the structural dimensions of teachers' perceptions, whereas written rationales provided depth regarding the reasoning and contextual conditions shaping those perceptions (Ramlo, 2021). Accordingly, teachers' perceptions of the TYMM science curriculum were interpreted holistically, not as isolated individual experiences but as viewpoints situated within and interacting with wider systemic conditions.

Population and Sample

The study group comprised 50 classroom teachers working in public primary schools in the central district of Kırşehir province during the 2024-2025 academic year. Participants were selected using predefined criteria. Although Q methodology commonly recommends a range of 40 to 60 participants, its purpose is not statistical generalisation but the identification of viewpoint diversity and depth of representation. Therefore, valid and meaningful results can also be obtained with smaller participant groups (Ramlo, 2021).

Participants were recruited through criterion sampling. This purposive sampling strategy enables in-depth and contextually grounded data collection in qualitative research by intentionally selecting individuals who have relevant knowledge and experience related to the phenomenon under investigation (Creswell & Creswell, 2022). Three criteria guided participant selection:

- actively working as a classroom teacher in the 2024-2025 academic year,
- having reviewed the TYMM science curriculum and participated in related in-service training,
- voluntary participation in the study.

Of the 50 classroom teachers who participated voluntarily, 39 (see Table 1) were included in the analysis because their Q sort rankings and follow-up written rationales were complete and suitable for analysis. This sample size meets the recommended minimum 2:1 participant-to-item ratio for a Q set consisting of 32 statements, supporting the reliability of the analysis (Watts & Stenner, 2012). This sampling structure enables a systematic examination of both shared and divergent patterns in teachers' perceptions.

Table 1. Demographic characteristics of participants

Demographic information	Variable	f
Gender	Female	17
	Male	22
Professional seniority	11-15 years	15
	16+ years	24
Education	Bachelor's degree	34
	Postgraduate degree	5
Number of TYMM-related in-service trainings received	1	2
	2 or more	37

Data Collection Tools

The Q set used in this study comprised statements reflecting eight core 21st-century skills highlighted in the TYMM science curriculum: critical thinking, creativity, collaboration, communication, digital literacy, problem solving, flexibility, and entrepreneurship. At least five statements were developed for each skill domain, resulting in an initial pool of 40 statements. This draft Q set was reviewed by six academics from the fields of primary education, science education, and Turkish language education in terms of content coverage, conceptual coherence, and language clarity. Based on expert feedback, some statements were simplified, ambiguities were addressed, and overlapping content was removed. At the end of this process, the final Q set included 32 statements, with four statements representing each skill domain. This structure strengthened the conceptual adequacy of the Q set and supported participants' use of the statements in a clear, balanced, and consistent manner during the sorting procedure.

Data Collection

Data were collected in two stages via the Q-TIP web platform (<https://qtip.geography.wisc.edu/#/>), following the technical requirements of Q methodology. Teachers who volunteered to participate were identified before the administration, and sessions were conducted at times and locations preferred by participants. In the first stage, participants received a brief orientation to the online system and were then presented with the 32-statement Q set. They were asked to rank the statements on a nine-column forced distribution grid ranging from -4 to +4. After completing the ranking, participants were given an opportunity to review their placements and make revisions where they considered it necessary to better reflect their viewpoints (Ramlo, 2021).

In the second stage, each participant provided written rationales for the two statements placed at +4 and the two statements placed at -4. The follow-up rationale stage took between 20 and 45 minutes. These accounts helped to illuminate the conceptual structure, pedagogical context, and perceptual justifications underpinning teachers' rankings. In this way, the study generated qualitative data that captured not only numerical priorities but also the contextual grounds of those priorities. This two-stage procedure enabled a more comprehensive, reliable, and interpretable analysis of teachers' perceptions of the TYMM science curriculum. An example Q sort produced by one participant (P5) is presented in Figure 1, and sample statements are provided in Table 2.

-4	-3	-2	-1	0	1	2	3	4
18	8	4	5	3	1	17	14	2
31	19	7	9	11	6	20	16	23
		24	25	12	10	22		
		29	26	21	13	28		
			32	27	15			

Figure 1. Sample Q sort (P5)

Table 2. Sample statements from the Q set

Statement No.	Statement
10	The curriculum supports students with different abilities to conduct research together.
8	The new curriculum offers opportunities for students to develop their artistic expression skills.
7	The curriculum enables students to develop innovative solutions.
12	The curriculum enhances students' collaborative problem-solving skills.

Data Analysis

Data analysis proceeded in two stages, quantitative and qualitative, in line with the study's mixed-method design. In the first stage, a correlation matrix was constructed from participants' Q sorts, and Principal Component Analysis was conducted. To determine the number of factors, the Kaiser-

Guttman criterion (eigenvalue > 1.0) was used as an initial guide to identify candidate factors. The final factor solution was then selected by considering multiple criteria together. Factors were retained if they (i) had an eigenvalue of at least 2.00, (ii) explained at least 5% of the total variance, (iii) included at least two participants who loaded statistically significantly on the factor, and (iv) yielded a conceptually interpretable pattern.

The significance threshold for factor loadings was calculated using the common Q methodology formula $1.96 \times (1/\sqrt{N})$, where N denotes the number of statements in the Q set ($N = 32$) (McKeown & Thomas, 2013; Watts & Stenner, 2012). For a 32-statement Q set, this yielded a loading threshold of ± 0.35 , which was used to identify meaningful loadings. Based on the combined criteria above, a three-factor structure accounting for 60% of the total variance was judged to provide the most meaningful solution. Varimax rotation was applied to enhance interpretability, and meaningful factor loadings were identified using the ± 0.35 threshold. All quantitative analyses were conducted using Ken-Q (version 2.0).

In the qualitative component, participants' written rationales for the statements placed at the extreme ends of the distribution (+4 and -4) were analysed. These accounts were examined using the thematic analysis procedures outlined by Braun and Clarke (2021), including pre-coding, theme identification, review, definition, and reporting. Qualitative analysis was conducted by a team of three researchers using MAXQDA 2022. Coding was organised around predefined overarching themes derived from the research questions (e.g., critical thinking, digital literacy, entrepreneurship). To support coding consistency, researchers first coded independently and then compared and discussed their coding in joint evaluation meetings, reaching agreement on the final codes. This integrated analytic strategy combined numerical patterns with qualitative reasoning, enabling a systematic examination of both convergence and divergence across the identified factors and clarifying how teacher perceptions differed in structure and content.

Validity and Reliability

In this study, validity was addressed in terms of conceptual representation and content validity. The Q set was developed around eight core 21st-century skills identified within the P21 (2019) framework (critical thinking, creativity, collaboration, communication, digital literacy, problem solving, flexibility, and entrepreneurship). The draft set was reviewed by six academics with regard to content coverage, language clarity, and representativeness. Following expert review, the content validity ratio (CVR) was calculated for each statement using Lawshe's (1975) formula. The resulting values were evaluated against the critical values recommended for a six-expert panel (average CVR = 0.99). Item-level content validity index (I-CVI) values ranged from 0.83 to 1.00, satisfying the acceptance criteria outlined by Polit and Beck (2006). The scale-level content validity index (S-CVI) was 0.92. During this process, statements that were repetitive, ambiguous, or conceptually weak were removed, and revisions were made to ensure clarity and simplicity. Ultimately, a balanced Q set was established with four statements representing each skill domain, and this structure strengthened the conceptual coherence and content validity of the set.

Reliability was addressed through methodological consistency and interpretive credibility. The forced distribution structure used in Q sorting enabled participants' subjective judgements to be analysed systematically. In addition, participants were asked to provide written rationales for the statements they placed at the extreme ends of the distribution (+4 and -4). These accounts were examined through qualitative thematic analysis, which enhanced the accuracy of content interpretation. This procedure strengthened interpretive credibility and supported the validity of the findings by enabling data and analysis triangulation through the joint consideration of quantitative patterns and qualitative rationales.

The use of Ken-Q 2.0 for quantitative analysis and MAXQDA 2022 for qualitative analysis helped ensure the systematicity, transparency, and traceability of the research process. The participant-to-item ratio (39 participants and 32 statements) met the commonly recommended minimum, which supported the stability of the factor structure and contributed to the transferability of the findings and their potential re-use in similar contexts (Ramlo, 2021; Watts & Stenner, 2012). In this way, a coherent research process was established holistically, addressing validity and reliability at both the content and methodological levels.

Findings

This section examines whether classroom teachers evaluated the updated TYMM science curriculum similarly or whether their perceptions diverged with respect to the integration of 21st-century skills. Participants were coded as P1, P2, and so forth, regardless of gender. An asterisk (*) was used to indicate statistically significant factor loadings. Participants were ordered by factor weights, and the same coding convention was maintained when reporting the qualitative findings. To foreground qualitative content, participant statements are presented in italics. Participants' factor loadings and their distribution across factors are reported in detail in Table 3.

Table 3. Participants' Factor Loadings

No.	Participant code	Factor group-item number	Factor 1	Factor 2	Factor 3
38	P1	F1-1	.904*	-.286	.026
23	P2	F1-2	.899*	-.319	.023
12	P3	F1-3	.893*	-.256	-.096
22	P4	F1-4	.893*	-.170	-.058
17	P5	F1-5	.871*	-.150	.217
34	P6	F1-6	.871*	-.290	.118
5	P7	F1-7	.862*	-.111	.238
30	P8	F1-8	.857*	-.320	-.006
36	P9	F1-9	.854*	-.047	.099
33	P10	F1-10	.850*	.180	-.166
39	P11	F1-11	.847*	-.177	-.026
6	P12	F1-12	.844*	.274	.149
20	P13	F1-13	.787*	-.283	-.339
31	P14	F1-14	.727*	-.191	.186
35	P15	F1-15	.712*	-.104	.424
32	P16	F1-16	.705*	.034	-.261
8	P17	F1-17	.691*	.059	-.172
18	P18	F1-18	.653*	-.287	-.266
7	P19	F1-19	.634*	.435	-.204
16	P20	F1-20	.628*	.048	.006
26	P21	F1-21	.615*	.164	.122
4	P22	F1-22	.601*	.320	.172
15	P23	F1-23	.598*	.380	.074
28	P24	F1-24	.572*	-.434	-.336
25	P25	F1-25	.503*	.172	-.457
9	P26	F1-26	.481*	.011	.132
14	P27	F1-27	.476*	.424	-.290
3	P28	F1-28	.470*	-.290	-.136
11	P29	F1-29	.434*	.054	.382
29	P30	NS	.265	.142	-.081
2	P31	NS	.231	.132	.135

Table 3. Continued

No.	Participant code	Factor group-item number	Factor 1	Factor 2	Factor 3
37	P32	F2-1	.326	.751*	-.313
13	P33	F2-2	.525	.705*	.087
19	P34	F2-3	.483	.578*	.014
21	P35	F2-4	.21	.56*	-.046
1	P36	F2-5	.161	.541*	.056
10	P37	F2-6	.442	.472*	.239
27	P38	F3-1	.291	-.125	-.696*
24	P39	F3-2	.439	-.118	.671*
Eigenvalue			16.79	4.10	2.50
Percentage of variance explained			43	11	6

Note. * indicates statistically significant factor loadings ($| \text{loading} | \geq 0.35$). NS denotes participants who did not load significantly on any factor.

Within the data analysis, Principal Component Analysis was conducted based on the correlation matrix derived from participants' Q-sorts, and Varimax rotation was applied to improve interpretability. In line with the criteria specified in the Method section, the three-factor solution was identified as providing the most meaningful structure. This three-factor solution accounts for 60% of the total variance across Q-sorts.

Table 3 reports factor loadings for all participants. For factor interpretation, only participants whose Q-sorts loaded statistically significantly on a single factor were included, consistent with the analytic principles recommended by Ramlo (2021). Each factor array was constructed using the weighted average of the representative participants' z-scores. This structure was used to map teachers' perceptions of the skills that TYMM aims to develop in students in a systematic manner. The three factors (Factors 1, 2, and 3) represent meaningful clusters reflecting teachers' evaluations of different skill domains within the curriculum.

The distinguishing features of the factors were interpreted by considering factor loadings, Q-sort values (Q-SV), z-scores, and significance levels (p) together. For presentation purposes, statistically significant factor loadings are marked with an asterisk (*). In addition, loadings significant at $p < .05$ are coded in blue, those significant at $p < .01$ in red, and consensus statements endorsed across all factors are coded in green. The statements that differentiate the factors are reported in the relevant tables with their Q-SV and z-scores, and the content-based rationales for these distinctions are presented to provide a basis for factor naming.

Finally, the quantitative patterns identified through factor analysis were supported by qualitative evidence obtained from participants' follow-up written rationales. These qualitative accounts were included not only to complement numerical findings but also to clarify the meaning and interpretive depth of the factors. In this way, teachers' perspectives were examined holistically, integrating statistical structure with content-based interpretation.

Findings Regarding Items Agreed Upon by Teachers in the Context of 21st-Century Skills

The findings indicate that classroom teachers share common views on several 21st-century skills. Across the three factors, participants reached consensus on seven statements. These consensus statements were identified through Q analysis and are reported in Table 4 together with their Q-sort values (Q-SV) and z-scores. Positive Q-SV and z-scores indicate alignment with the relevant factor, whereas negative values indicate an inverse orientation.

Table 4. Consensus statements regarding 21st-century skills within TYMM

Statement No.	Statement	Factor 1		Factor 2		Factor 3	
		Q-SV	z score	Q-SV	z score	Q-SV	z score
10	The curriculum supports students with different abilities to conduct research together.	2	0.78	1	.27	0	-0.03
11	The curriculum develops students' research skills for common goals.	1	.678	2	.7	1	.262
12	The curriculum enhances students' collaborative problem-solving skills.	0	.46	1	.085	1	.589
19	The curriculum offers opportunities to develop students' digital content creation skills.	-1	-.423	-1	-.503	-2	-.916
23	The curriculum enhances students' ability to generate solutions to real-life problems.	-1	-.537	0	-.273	-1	-.654
27	The curriculum supports students' ability to adapt to different research styles.	-2	-1.165	-4	-1.354	-4	-1.603
28	The curriculum helps students quickly adapt to new technologies and methods.	-2	-1.077	-2	-.883	-1	-.558

The strongest areas of agreement suggest that the curriculum is perceived as supporting collaboration, research, and problem solving. For instance, *"The curriculum supports students with different abilities to conduct research together"* (Statement 10) is placed on the positive side across the three factors (Factor 1: Q-SV = 2, $z = 0.78$; Factor 2: Q-SV = 1, $z = 0.27$; Factor 3: Q-SV = 0, $z = -0.03$). In a similar vein, *"The curriculum develops students' research skills for common goals"* (Statement 11) and *"The curriculum enhances students' collaborative problem-solving skills"* (Statement 12) are positioned on the positive side or close to neutral across factors (see Table 4). This pattern indicates shared recognition of TYMM's emphasis on collective learning processes.

However, a shared concern emerges regarding the development of digital skills and adaptation to technological change. Table 4 indicates negative placements across the three factors for *"The curriculum offers opportunities to develop students' digital content creation skills"* (Statement 19; Q-SV = -1 to -2; $z = -0.423$ to -0.916) and *"The curriculum helps students quickly adapt to new technologies and methods"* (Statement 28; Q-SV = -1 to -2; $z = -0.558$ to -1.077), pointing to a commonly perceived gap in relation to digital transformation and technological adaptation. Similarly, *"The curriculum supports students' ability to adapt to different research styles"* (Statement 27) receives consistently low placements across factors (Q-SV = -2 to -4; $z = -1.165$ to -1.603), suggesting strong consensus that the curriculum offers limited flexibility in responding to individual differences. Overall, teachers evaluate TYMM positively in terms of its contribution to collaboration and inquiry-oriented learning processes. At the same time, they agree that substantial improvement is needed in areas such as digital transformation, responsiveness to individual differences, and technological adaptation.

Quantitative and Qualitative Findings Related to Factor 1 (Focus on Critical Thinking and Creativity)

Factor 1 represents a viewpoint in which teachers prioritise critical thinking and creativity. This factor is the strongest, explaining 43% of the total variance with an eigenvalue of 16.79. Twenty-nine participants loaded significantly on this factor, indicating that a substantial proportion of the sample converged around a broadly similar perspective. The Q sorts of participants associated with Factor 1 are presented in Figure 2.



Figure 2. Factor 1 (Critical Thinking and Creativity Orientation) Q sort

When examining the statements that Factor 1 teachers evaluated negatively, three items related to digital literacy (-1), problem solving (-1), and flexibility and adaptability (-2), together with two items related to entrepreneurship (-4), stand out. These items reflect a shared critique that the TYMM science curriculum does not produce the expected impact in these domains. In this section, statements highlighted in red indicate those for which Factor 1 participants diverged significantly from participants in the other factors. This pattern points to differences in orientations, particularly regarding critical thinking, creativity, communication, digital literacy, and entrepreneurship.

A closer look at the relevant statements suggests that Factor 1 teachers express more negative orientations in areas such as communication, digital literacy-related affordances, and entrepreneurship, while adopting a more positive orientation toward collaboration and inquiry-oriented problem solving. Table 5 presents the distinguishing statements for Factor 1 with the highest and lowest Q-SV and z-score values.

Table 5. Q-SV and z-score values of distinguishing statements for Factor 1

Statement	2	6	7	8	13	16	14	17	32	31
Q-SV	4	3	3	1	1	0	0	0	-4	-4
z score	1.45	1.26	1.25	.74	.56	.26	.18	.15	-1.64	-1.84

Factor 1 indicates that teachers' views foreground students' critical thinking and creativity. The statements loading on this factor suggest that the curriculum encourages students to consider and evaluate different perspectives. For example, the statement "*Students evaluate different perspectives*" (Statement 2, Q-SV = 4, $z = 1.45$) strongly reflects this orientation. Likewise, "*Enables students to develop innovative solutions*" (Statement 7, Q-SV = 3, $z = 1.25$) indicates that the curriculum is perceived as supporting creativity alongside problem solving. The combination of high Q-SV values (≥ 3) and comparatively higher z-scores indicates strong convergence in teachers' perceptions that the TYMM science curriculum places a strong emphasis on developing critical thinking and creativity. This pattern suggests that these competencies are widely perceived as central within the reform.

In contrast, teachers' evaluations of entrepreneurship-related skills within the same factor are negative, as indicated by the low Q-SV and z-score values for the relevant statements. In addition, teachers' accounts in this group point to structural constraints affecting implementation, including limitations in technological infrastructure, teachers' competencies, and students' capacity to assume responsibility. For Factor 1, critiques of the curriculum's overall structure also come to the fore, and teachers note that a teacher-centred orientation is still perceived as prevalent.

Across the qualitative dataset, teachers reported encountering a range of difficulties when enacting the revised TYMM science curriculum. Teachers frequently referred to resource disparities between schools, limited access to digital tools, and insufficient opportunities to produce technology-supported content. One teacher described this as follows: *"Since the technological conditions and opportunities are not the same in every school, it does not appeal to every student, and sufficient content cannot be created due to the lack of adequate technological tools."* (P38)

Teachers also highlighted challenges related to their pedagogical capacity and working conditions. They noted that hardware limitations, classroom management difficulties, and inadequate physical school environments can negatively affect the feasibility of curriculum implementation. One teacher summarised these constraints as follows: *"The physical school environment is inadequate, the student classroom environment is lacking, and the teacher's equipment is inadequate."* (P17)

These critiques extended beyond teachers' conditions to include students' competencies in assuming individual responsibility, problem solving, and planning. Participants suggested that contextual influences, including limited parental support and low social awareness, may hinder students' development of these skills. One teacher expressed this view as follows: *"Children are somewhat inadequate in this sense because they are not sufficiently made aware by their parents about taking responsibility at home in real life."* (P23)

Participants also commented on the perceived effectiveness of curriculum components related to cultural transmission, student-centred learning, and Turkish language education. One teacher evaluated the cultural dimension of the curriculum as follows: *"The new curriculum allows us to transmit our Turkish culture from generation to generation through the Turkish language, both verbally and in writing; we learn the characteristics of our society better."* (P12)

In addition, teachers stated that higher-order competencies such as innovative thinking, cognitive flexibility, and a critical stance are not sufficiently developed in practice. They noted that this limitation, together with reliance on digital resources, may increase the risk of superficial learning and weaken deep learning and critical inquiry. One participant remarked: *"Since the new curriculum is based on children learning through research, children are curious about everything and learn by instantly researching the topic they are curious about thanks to the internet."* (P34)

Alongside these critiques, some teachers also emphasised that the curriculum supports collaboration and shared learning processes. From this perspective, when implemented as intended, the curriculum can increase students' willingness to engage in collaborative inquiry and can support higher-order cognitive development. One teacher expressed this as follows: *"When implemented in line with the objectives of the new curriculum, it increases the desire for collaborative research among students and supports their higher-level cognitive development."* (P22)

The quantitative results align with these qualitative accounts. Statements such as *"Students evaluate different perspectives"* (Q-SV = 4, $z = 1.45$) and *"Enables students to develop innovative solutions"* (Q-SV = 3, $z = 1.25$) indicate positive evaluations in these areas. By contrast, negative evaluations are evident for statements related to entrepreneurship (Q-SV = -4, $z = -1.84$) and digital literacy (Q-SV = -2, $z = -1.165$).

Taken together, the findings suggest that TYMM has considerable potential to support 21st-century skills such as creative thinking, problem solving, and collaboration. However, teachers' accounts indicate implementation-level limitations, particularly regarding digital transformation,

individual competencies, and entrepreneurship. The consistent overlap between qualitative and quantitative evidence suggests that teachers' perceptions are shaped not only by individual experiences but also by pedagogical conditions and wider systemic realities.

Quantitative and Qualitative Findings Related to Factor 2 (Communication and Digital Literacy)

Factor 2 reflects a viewpoint in which teachers foreground communication and digital literacy. This factor accounts for 11% of the total variance, with an eigenvalue of 4.10, and constitutes the second strongest thematic cluster in the study. Six participants loaded on Factor 2, indicating a coherent conceptual pattern despite the smaller number of defining participants. The participant configuration for Factor 2 is presented in Figure 3.

-4	-3	-2	-1	0	1	2	3	4
The curriculum supports students' ability to adapt to different research styles.	The curriculum encourages students to develop innovative business ideas.	The curriculum enhances students' resource management and planning skills.	The curriculum enhances students' ability to draw evidence-based conclusions.	The curriculum raises students' awareness of online safety and ethical issues.	The curriculum enables students to develop innovative solutions.	The curriculum includes activities aimed at improving students' written communication skills.	The new curriculum enhances students' ability to use various communication tools effectively.	The curriculum develops students' skills in effectively using digital tools.
The new curriculum develops students' ability to take risks and use initiative.	The new curriculum develops students' ability to generate and evaluate alternative solutions.	The curriculum helps students quickly adapt to new technologies and methods.	The curriculum offers opportunities to develop students' digital content creation skills.	The curriculum encourages students to evaluate different perspectives.	The curriculum supports students with different abilities to conduct research together.	The new curriculum enhances students' ability to evaluate and analyse online information.	The curriculum aims to develop students' listening and comprehension skills.	The new curriculum focuses on developing students' oral communication skills.
		The new curriculum develops students' ability to analyse and evaluate information.	The curriculum includes activities that require students to use their imagination.	The new curriculum encourages students to generate original ideas.	The new curriculum offers opportunities for students to develop their artistic expression skills.	The curriculum encourages effective teamwork among students.		
		The new curriculum develops students' ability to evaluate arguments and construct their own arguments.	The curriculum develops students' ability to adapt to changing conditions.	The new curriculum develops students' ability to analyse complex problems.	The curriculum enhances students' collaborative problem-solving skills.	The curriculum develops students' research skills for common goals.		
			The new curriculum increases students' ability to cope with uncertainty.	The curriculum enhances students' ability to generate solutions to real-life problems.	The new curriculum offers opportunities for students to develop their leadership skills.			
				The curriculum helps students develop systematic problem-solving strategies.				

Figure 3. Factor 2 (Communication and Digital Literacy) Q sort

When examining the views associated with Factor 2, negative orientations toward several skill domains are evident. In particular, statements related to entrepreneurship (Q-SV = -2), critical thinking (Q-SV = -2, -1), digital literacy (Q-SV = -1), and flexibility and adaptability (Q-SV = -4, -2) stand out due to their low rankings. These statements reflect a shared perception among Factor 2 teachers that the curriculum offers limited support for these skills. In this section, statements highlighted in red indicate those for which Factor 2 participants diverged significantly from participants in the other factors. A closer examination of the distinguishing statements suggests a mixed pattern. While several statements foregrounding verbal communication and the effective use of communication/digital tools are placed strongly on the positive side (e.g., Statements 13, 15-17), less favourable placements are observed for creativity- and critical thinking-related statements, along with entrepreneurship and flexibility/adaptability. Table 6 presents the distinguishing statements specific to Factor 2 together with their Q-SV and z-score values.

Table 6. Q-SV and z-score values of distinguishing statements for Factor 2

Statement	13	15	16	17	14	18	32	2	5	1	4	31	3	24	29
Q-SV	4	4	3	3	2	2	1	1	0	-1	-1	-1	-2	-3	-4
z score	1.88	1.85	1.78	1.64	1.35	.88	.21	.12	-.05	-.33	-.38	-.57	-.95	-1.31	-1.87

Factor 2 indicates that teachers' views foreground students' development in communication and digital literacy. The statements defining this factor point to perceived support for students' verbal communication (Statement 13, Q-SV = 4, $z = 1.88$) and for listening and comprehension (Statement 15, Q-SV = 4, $z = 1.85$). In addition, *"students' effective use of various communication tools"* (Statement 16, Q-SV = 3, $z = 1.78$) and *"developing skills to effectively use digital tools"* (Statement 17, Q-SV = 3, $z = 1.64$) indicate that the curriculum is viewed as promoting communication- and technology-oriented learning. The positive placement of these statements, together with comparatively higher z-scores, suggests that communication and digital literacy are prominent within this viewpoint.

However, to contextualise this positive quantitative pattern, the qualitative evidence also points to several constraints raised by participants across the sample. Themes such as limited creativity, risk aversion, and digital addiction were salient. Participants stated that students showed limited development in generating new ideas and thinking independently. These concerns are reflected in comments such as *"Children's idea generation skills are insufficient"* (P37) and *"Children are weak in inventing new ideas and discoveries"* (P13). Similarly, teachers stated that risk-taking is not sufficiently supported, noting that *"There are no activities that develop risk-taking skills appropriate to the students' level of development."*

Perceived lack of change and limited curriculum impact also emerged as key critiques within this factor. Some teachers reported that they did not observe meaningful change in students, suggesting that the curriculum did not produce a noticeable difference in practice. Participants also frequently referred to students' passivity, limited critical thinking, and receptive learning orientations. One teacher described this as follows: *"The new generation of youth are not growing up to be solution-oriented because they like to be prepared by their families"* (P13), while another stated: *"Children do not have sufficient knowledge about arguments"* (P37).

Across the qualitative evidence, implementation challenges and educational inequalities also emerged as important concerns. Some teachers argued that differences in physical conditions and institutional resources across schools weaken feasibility. One participant expressed this view as follows: *"Its applicability is weak because there is no suitable environment for all schools."* (P1).

Quantitative and Qualitative Findings Related to Factor 3 (Problem Solving and Leadership Skills)

Factor 3 reflects a viewpoint that foregrounds problem solving and leadership skills. This factor accounts for 6% of the total variance, with an eigenvalue of 2.50, and constitutes the cluster with the most limited participant support in the study. Only two participants loaded on Factor 3, which suggests a distinct perspective while also indicating limited representativeness. Figure 4 presents the Q sorts of the participants associated with Factor 3.



Figure 4. Factor 3 (Problem Solving and Leadership Skills) Q sort

When examining the views associated with Factor 3, less favourable evaluations are apparent across several skill domains. Specifically, low rankings were observed for statements related to creativity (two items, Q-SV = -2), communication (one item, Q-SV = -3), digital literacy (two items, Q-SV = -3), problem solving (one item, Q-SV = -1), and flexibility/adaptability (three items, including Q-SV = -4 and -1). This pattern suggests a shared critique among these teachers that the relevant skills are not sufficiently supported within TYMM. In this section, statements highlighted in red indicate those for which the participants loading on Factor 3 diverged markedly from participants in the other factors. A closer look at these distinguishing statements points to pronounced differences in orientations, especially regarding creativity, communication, digital literacy, and problem solving. In line with these divergences, Factor 3 teachers' evaluations of skills such as creativity, communication, and entrepreneurship are generally negative, whereas they display a more positive orientation toward collaboration. Table 7 reports the distinguishing statements for Factor 3 together with their Q-SV and z-score values.

Table 7. Q-SV and z-score values of distinguishing statements for Factor 3

Statement	22	21	32	23	31	3	2	30	5	29	27	8	9	18	16	19	17	28
Q-SV	4	3	3	2	2	2	1	1	1	0	-1	-1	-2	-2	-3	-3	-4	-4
z score	1.62	1.18	1.11	1.1	.92	.79	.7	.7	.53	-.05	-.08	-.34	-.64	-1.33	-1.7	-1.76	-1.92	-1.96

Factor 3 foregrounds the development of students' problem-solving, analytical, and leadership skills. Among the statements most strongly endorsed by participants, those related to developing systematic problem-solving strategies (Statement 22, Q-SV = 4, z = 1.62) and strengthening the ability to analyse complex problems (Statement 21, Q-SV = 3, z = 1.18) are particularly salient. In addition, "producing solutions to real-life problems" (Statement 23, Q-SV = 2, z = 1.10) and "developing resource management and planning skills" (Statement 31, Q-SV = 2, z = 0.92) suggest that the curriculum is perceived as aiming to equip students with organisational competencies alongside cognitive skills. Overall, the positive placement of these statements (Q-SV = 2-4), together with comparatively higher z-scores, indicates that these competencies are viewed as salient within this viewpoint.

Complementary qualitative evidence emphasised innovative approaches to teaching and sensitivity to students' developmental levels. In this respect, and in contrast to Factor 2's stronger emphasis on student characteristics, Factor 3 combines a positive orientation toward innovation with critiques related to access constraints and assessment processes. Accordingly, this factor reflects a balanced mix of critical and constructive viewpoints.

Interpreting the quantitative patterns alongside the qualitative evidence across participants helps clarify how teachers' field-based observations shape their curriculum appraisals. Several participants argued that a longstanding, test-oriented system reduces students' opportunities to express themselves. They suggested that this emphasis constrains students' ability to articulate their ideas orally and in writing, which in turn may limit the development of creative thinking and communication. One teacher described this as follows: *"The test method that has been applied for many years has reduced students' ability to express themselves."* (P24) In addition, some teachers working in disadvantaged contexts reported concerns about age appropriateness and resource limitations that negatively affect instruction. The statement *"It is not age-appropriate for children, and our resources are insufficient"* (P27) reflects this view.

At the same time, teachers generally welcomed the curriculum's emphasis on learning by doing. One participant explained: *"The curriculum emphasises learning by doing and aims to get students to express their knowledge in writing. It also aims to balance the use of computers and tablets."* (P24) Finally, some teachers framed TYMM's support for innovative educational approaches as a positive development. They particularly highlighted sensitivity to individual differences, student-centredness, and encouragement of critical thinking. The statement *"I think it's right because it supports innovation"* (P27) indicates that this orientation is valued by teachers.

Comparative Summary of Factors

Factor analysis revealed three distinct clusters of teacher perceptions regarding how the TYMM science curriculum supports 21st-century skills. Following the detailed quantitative and qualitative profiles of each factor, a comparative synthesis is presented in Table 8 and discussed below.

Table 8. Comparative summary across factors

Skill	Factor 1 (Critical Thinking & Creativity)	Factor 2 (Communication & Digital Literacy)	Factor 3 (Problem Solving & Leadership)	Comment
Critical thinking	+1.45	-0.95	+0.79	F1 highest, F2 lowest.
Creativity	+1.25	-1.31	-0.64	Only F1 positive; F2 and F3 negative.
Collaboration	+0.74	+0.88	+1.10	Positive in all factors; highest in F3.
Communication	+0.15	+1.64	-1.33	F2 distinctly positive; F1 slightly positive; F3 negative.
Digital literacy	-1.16	+1.35	-1.70	F2 positive; F1 and F3 negative (lowest in F3).
Problem solving	+0.56	-0.38	+1.62	Highest in F3; F1 positive; F2 negative.
Flexibility/adaptability	-1.08	-1.87	-1.96	Negative in all factors.
Entrepreneurship	-1.84	-0.57	-1.76	Negative in all factors (lowest in F1).

Table 8 highlights both clear areas of convergence and notable divergences in teachers' perceptions of the TYMM science curriculum. Collaboration is the only skill domain evaluated positively across all groups. By contrast, entrepreneurship and flexibility/adaptability are evaluated negatively across all factors, suggesting that these are the domains teachers most strongly perceive as requiring strengthening. The most pronounced divergence concerns digital literacy and communication: both are evaluated positively in Factor 2, whereas digital literacy is evaluated negatively in Factors 1 and 3. For communication, Factor 3 reflects a negative orientation, while Factor 1 remains only modestly positive.

Teachers' appraisals of TYMM suggest that curriculum enactment is shaped by both structural constraints and pedagogical opportunities. The three perspectives identified through factor analysis reflect overlapping concerns and priorities in these areas.

Among the principal implementation challenges, limitations in technological infrastructure, reported as particularly salient in rural contexts, stand out. Participants indicated that shortages of digital tools and equipment prevent the curriculum from reaching students equitably and constrain the development of digital competencies. Teachers also suggested that easy access to digital information can foster reliance on ready-made answers and digital dependency, which may weaken students' capacity for critical thinking and original idea generation. In addition, teachers reported that they do not feel sufficiently equipped in innovative teaching strategies and technology integration, which they perceived as reducing the curriculum's effectiveness. The enduring influence of a test-oriented system was also described as constraining students' communication and critical thinking, while a lack of age-appropriate materials and resources was cited as another barrier that negatively affects learning processes.

At the same time, teachers highlighted several opportunities associated with TYMM. The curriculum's emphasis on collaborative learning environments was viewed as supporting students' social and academic development. Learning by doing was described as strengthening analytical thinking and leadership by linking theoretical knowledge to practical contexts. Teachers also noted that balanced use of digital tools can counter excessive digital dependency and support students' ability to express their learning in writing. In addition, the curriculum was seen as encouraging critical thinking by supporting the evaluation of different perspectives and inquiry-oriented learning.

Overall, teachers' perceptions of TYMM cluster into three viewpoints consistent with the factor structure. Across all factors, there is shared endorsement of the curriculum's support for collaboration and inquiry-oriented learning. By contrast, dissatisfaction is evident in relation to digital skill development, technological adaptation, entrepreneurship, and flexibility. This distribution suggests a perceived misalignment between the curriculum's intended aims and the conditions shaping its enactment in practice.

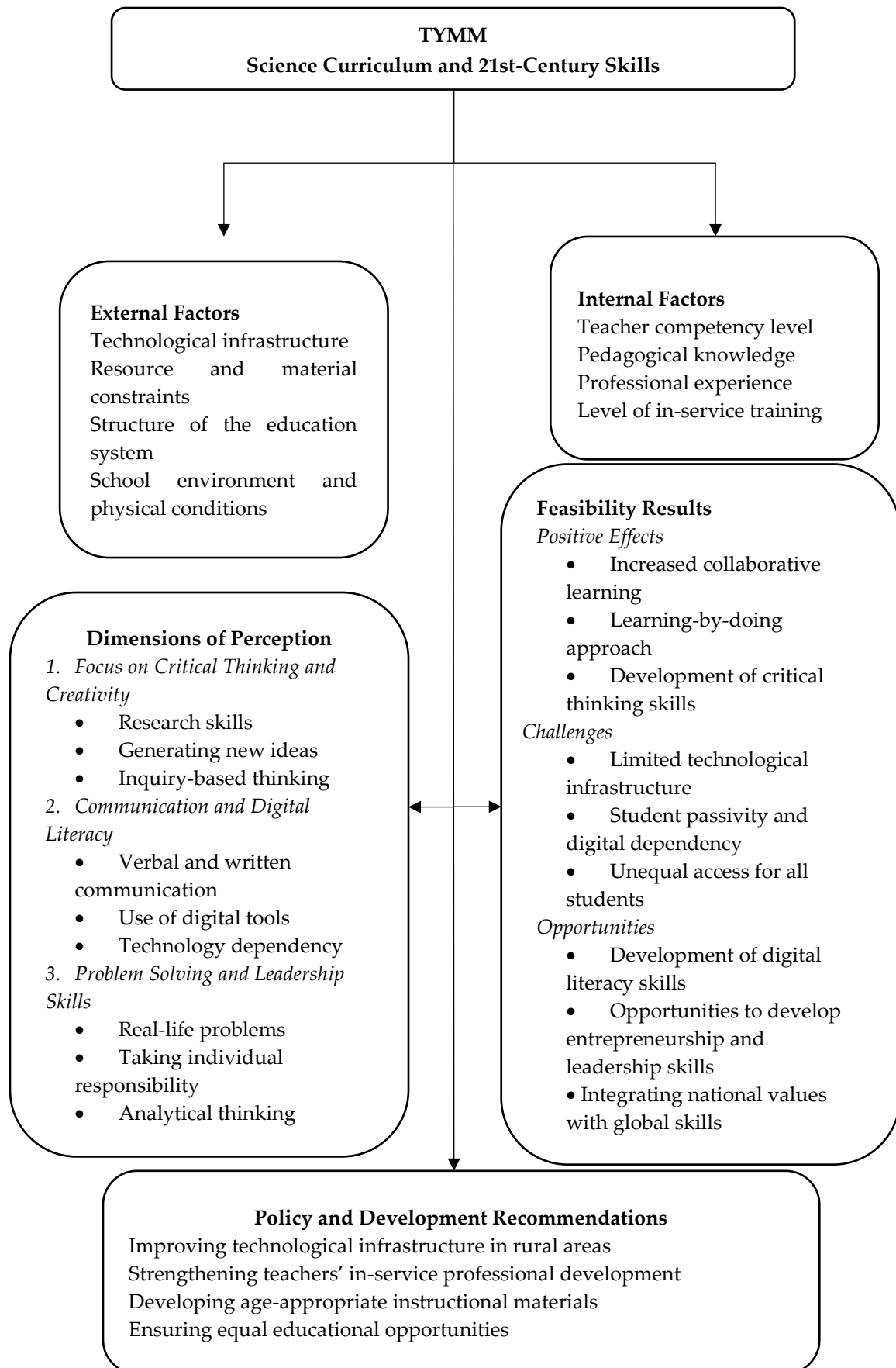


Figure 1. Teachers' Perceptions of the TYMM Science Curriculum: Factors, Effects, and Policy Recommendations

Results and Discussion

This study aimed to evaluate the updated science curriculum within the TYMM framework in relation to 21st-century skills, drawing on classroom teachers' perceptions. The Q methodology enabled the statistical grouping of teachers' subjective experiences and viewpoints, allowing a more comprehensive discussion of policy-practice alignment than would be possible through quantitative indicators alone.

The data indicate that teachers' views clustered into three thematic structures. Overall, the findings suggest that the curriculum is theoretically aligned with contemporary pedagogical approaches, yet this potential is not matched to the same extent in classroom enactment. Teachers emphasised the need to complement existing assessment practices with alternative, process-oriented models, noting that such approaches would be critical for making higher-order competencies, including creative thinking, critical inquiry, and problem solving, more visible and more readily developed.

In relation to critical thinking and creativity, teachers reported that the curriculum provides a conceptual basis for higher-order cognitive processes, such as analysis, synthesis, and evaluation (Bloom et al., 1956), as well as for the capacity to generate original ideas. The presence of creativity and problem-solving competencies among the future-oriented skills addressed in TYMM, in line with the contemporary skill priorities reflected in education indicators published by the Organisation for Economic Co-operation and Development (OECD, 2018), points to the curriculum's alignment with current educational directions. At the same time, as emphasised in the literature, it is necessary to create learning environments in which students can generate new ideas and do not hesitate to make mistakes (Alifah & Sukartono, 2023). Teachers' accounts suggest that students often avoid taking risks and that, although the curriculum foregrounds creative thinking, encouragement for such engagement is not sufficiently reinforced in practice. This pattern points to a need for entrepreneurship-oriented pedagogies that can translate creative thinking aims into classroom routines and for assessment approaches that foreground learning processes rather than outcomes alone.

The theme of digital literacy and communication suggests that structural conditions play a decisive role. While student-centred curriculum practices in digitalised learning environments are widely considered important, teachers reported that TYMM's strategic aims in this area, although incorporated into the curriculum, are not realised at the intended level due to infrastructure limitations and constrained pedagogical support in schools. Teachers' observations that students frequently turn to ready-made information and exhibit digital dependency further indicate constraints on the development of digital literacy (Amadi, 2023; Alifah & Sukartono, 2023). UNESCO's (2018) definition of digital literacy helps to contextualise these challenges; nevertheless, teachers described the effects of digital inequalities and socioeconomic differences on students' opportunities to engage meaningfully with technology (Amadi, 2023). In addition, variations in teachers' digital pedagogical competence (Chieng & Tan, 2021) and infrastructure shortcomings in disadvantaged contexts constitute major barriers to the effective use of technology as a cultural-cognitive tool in the sense highlighted by Vygotsky (1978). Accordingly, teacher professional development aimed at strengthening techno-pedagogical competence needs to be enhanced through an equity-oriented lens that explicitly addresses access and opportunity gaps.

Regarding leadership and problem-solving, teachers acknowledged the value of the curriculum's theoretical orientation toward these competencies but reported substantial implementation constraints linked to resource shortages and the continuing dominance of exam-oriented assessment. Bandura's (1995) self-efficacy theory and Kolb's (1984) experiential learning model suggest that higher-order competencies are more likely to develop in learning environments that provide opportunities for active participation, social interaction, and direct experience. Vygotsky's (1978) sociocultural perspective likewise emphasises that learning is constructed through social interaction. From this standpoint, classroom arrangements that enable students' active engagement and

peer collaboration appear critical. However, teachers' accounts indicate that current classroom environments and implementation conditions can hinder the realisation of these aims.

Overall, the study suggests that the TYMM science curriculum provides a framework that is theoretically aligned with 21st-century skills, while structural and practical constraints limit the translation of this pedagogical potential into classroom enactment. The evidence indicates that limitations in technological infrastructure, particularly in rural and disadvantaged contexts, and variation in teachers' professional competencies directly shape students' opportunities to develop the skills targeted in the curriculum. At the same time, the findings highlight that student-centred and collaborative learning environments support not only academic learning but also students' social and emotional development. Strengthening alignment between the curriculum's intended aims and school-level realities therefore requires system-level support that addresses structural conditions, including infrastructure, teacher capacity, and assessment systems.

Limitations

A primary limitation of this study is that, consistent with the nature of Q methodology, the findings are not intended to support statistical generalisation. Of the 50 classroom teachers who volunteered to participate, data from 39 participants with complete and analysable Q sort rankings and follow-up written rationales were included in the analysis. Accordingly, the findings should be interpreted as reflecting the perspectives of this participant group drawn from Kırşehir province.

Second, the 32-statement Q set represents a bounded selection of statements, which constitutes a limitation. A different or more extensive statement pool might have yielded different priorities and patterns of consensus in teachers' perceptions.

A third limitation concerns the depth of qualitative evidence. Because participants provided rationales only for statements placed at the extreme ends of the distribution (+4 and -4), it was not possible to capture more nuanced viewpoints that may be located around the middle of the distribution.

The forced distribution format of Q methodology can also be considered a limitation. This structure produces relative prioritisation, meaning that a statement may be placed at the positive end because it is perceived as less problematic than others, rather than because it is viewed as unequivocally strong.

Finally, because the curriculum under evaluation has not yet been fully implemented across all grade levels, the results are necessarily oriented more toward potential implications and early feasibility conditions than toward fully established implementation outcomes.

Recommendations

To support effective enactment of the TYMM science curriculum, assessment systems should undergo a substantive shift. Moving beyond traditional, knowledge-focused examinations, it is important to expand the use of alternative assessment approaches that enable students to demonstrate higher-order competencies such as thinking, creating, and problem solving. In this respect, developing continuous and systematic professional learning opportunities that strengthen teachers' assessment literacy would be a strategic step toward improving the quality and credibility of assessment practices.

At the same time, strengthening digital literacy remains a critical priority. The findings indicate that limitations in technological infrastructure, particularly in rural and disadvantaged contexts, create a major barrier to the development of 21st-century skills. To prevent the deepening of digital inequality, infrastructure investments should be planned through an equity lens and ensure meaningful access for all students. In addition, sustainable educational resources should be developed to support both students' digital literacy and teachers' techno-pedagogical competencies, and the quality and effectiveness of in-service professional development in these areas should be enhanced.

The perceptual structures identified in this study also open important directions for future research. The factor map could be enriched through more in-depth qualitative inquiry. For example, ethnographic or case-based studies with teachers representing each factor could provide insight into how these perceptions translate into classroom pedagogy. Furthermore, the subjective viewpoints elicited through Q methodology could inform the development of a quantitative perception scale, enabling these perspectives to be examined with larger samples. Applying a similar design from the perspectives of students or parents would also allow a comparative analysis of how curriculum reform is perceived across stakeholder groups.

Finally, the curriculum's student-centred and socially and emotionally supportive orientation should be reinforced more systematically. Learning materials that are age-appropriate, contextually rich, and designed to elicit higher-order thinking should be developed, and experiential activities should be increased in line with learning-by-doing principles. Collaborative learning environments that support competencies such as empathy, leadership, and responsibility should have a more prominent place in curriculum enactment. In this context, comparative and monitoring-oriented research that can evaluate longer-term curriculum effects is important for the continuity and further development of TYMM.

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The effect of material usage on academic achievement in teaching Turkish as a foreign language: a meta-analysis study

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Abstract

The primary objective of this study is to examine the effect of material usage on academic achievement in the teaching of Turkish as a foreign language. The study was conducted using the meta-analysis method in line with this objective. The meta-analysis method is a quantitative paradigm-based approach that brings together independent studies for a specific purpose, analyzes their numerical data, and reaches a conclusion. The study includes 33 meta-analysis-eligible studies conducted between 2015 and 2024, both domestically and internationally, on the teaching of Turkish as a foreign language. The National Thesis Center, Google Scholar, Ulakbim Keşif, YÖK Akademik, and Web of Science search tools were used in the data collection phase. Reliability and validity analyses were performed, and no publication bias was found. Subgroups were created in the study regarding the year of publication, type of publication, type of school, four basic language skills, and types of materials, and moderator/subgroup analyses were performed. Microsoft Excel and Comprehensive Meta Analysis (CMA) Version 4.0.0 software were used for data analysis. The research concluded that material use has a positive effect on academic achievement at a “very large ($d=1.126$)” level. Moderator analyses revealed that the effect values were large for all subgroups, and no significant differences were observed between them. Based on the findings of the study, it was concluded that in Turkish language teaching as a foreign language, all types of materials have a positive effect on academic achievement at every level and for every skill type.

Keywords

Teaching Turkish as a foreign language
Meta-analysis
Material use
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Introduction

Language teaching, as stated in the Common European Framework of Reference for Languages (CEFR), is primarily structured around receptive and productive skills. Receptive skills are defined as listening and reading, while productive skills are defined as speaking and writing (Harmer, 2001). Although the development of each language skill progresses independently, all skills interact with each other and each is important in terms of the individual's social and societal position (Richards & Rodgers, 2014). Listening is considered an important skill in language learning and represents the moment when

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the learner first interacts with the target language (Aksu, 2013; Demirel, 2011; İnal, 2021; Petursdottir & Carr, 2011). Individuals who want to acquire a language begin to understand by listening and, over time, reflect what they understand in their other skills. Individuals who begin to understand a foreign language by listening, eventually need speaking skills to engage in verbal communication (Arı, 2018; Magyar et al., 2022). Individuals who develop their speaking skills, begin to not only exist within the culture of the language they want to learn but also express their own existence verbally. Reading skills are defined as the ability to understand written materials in the target language. The ability to convey feelings and thoughts in writing is called writing skills (Roquet & Pérez-Vidal, 2017). Individuals' ability to perform these four basic language skills, namely reception and production, demonstrates their proficiency in that language (Karatay, 2011).

In language teaching, the use of materials that make learning concrete and easier is considered important. In education, material is defined as any tool, equipment, or resource used in the learning-teaching process to support the achievement of target outcomes (Heinich et al., 2002; Seferoğlu, 2006). These materials increase students' active participation in the learning process, make abstract concepts concrete, and ensure the retention of learned information. Indeed, people remember what they do and say the most, and what they read the least (Dale, 1969). The materials used in the teaching process are tools that enable the information to be conveyed to be made more concrete through the use of more senses, to become more interesting, and to involve students in the learning process. According to Yalın (2010), the use of tools in the teaching process enriches learning environments, attracts attention, facilitates recall, concretizes abstract things, ensures efficient use of time, and simplifies content by making meaning easier to understand. It accelerates learning and facilitates more permanent learning (Duman, 2013). This view is also supported in the international literature. According to Heinich et al. (2002), teaching materials serve the function of attracting attention, guiding learning, and facilitating understanding in the learning environment. Mayer's "Constructivist Multimedia Learning" theory (Mayer, 2021) states that the use of appropriate materials enhances the quality of learning by activating students' cognitive processes. Furthermore, Moreno and Mayer (2007) emphasize that multimedia tools make information more concrete and support learners' active participation. Indeed, studies have shown that the use of materials increases students' interest, making learning more effective and lasting (Issa et al., 2013).

The material to be used in teaching Turkish as a foreign language is largely determined by the student's language level (Duman, 2013). In the Common European Framework of Reference for Languages (CEFR), learners' language proficiency levels are defined from A1 to C2, and the use of materials appropriate for each level supports the development of language skills (Council of Europe, 2001, 2020). While more complex, authentic materials aimed at developing production skills are useful for advanced learners, concrete and visually-oriented materials facilitate participation in the learning process for beginners. For example, when teaching the topic of "vegetables," learning vocabulary through digital applications, reinforcing it with gamified classroom activities, or experiencing it in authentic learning environments (e.g., virtual garden applications) increases the retention of learning (Reinders & Benson, 2017). Furthermore, smart boards, projectors, mobile applications, digital textbooks, and interactive activities are among the important materials in teaching Turkish as a foreign language (Lee, 2021; Temizyürek & Birinci, 2016). National and international studies also reveal that the use of materials increases students' attention, activates cognitive processes, and has a positive effect on language skills (Berk & Açıık, 2021; Çakır & Kana, 2015; Demirel, 2019; Erol et al., 2021; Göker & İnce, 2019; Mayer, 2021; Melanlıoğlu & Atalay, 2016; Newfield, 2011).

Studies examining the use of different materials in teaching Turkish as a foreign language and revealing their effects on different skill types are available in the literature (Balcı & Dünder, 2017; Çalışkan, 2022; Çangal, 2020; Melanlıoğlu & Atalay, 2016; Turkbent, 2019). Meta-analysis combines the results obtained from these studies and leads to a more general conclusion about which material may be more effective for which skill in foreign language teaching. The purpose of meta-analysis studies is to combine the results of previous studies on a subject and analyze them to reach a conclusion (Şen &

Yıldırım, 2020). The large number of studies in the field, the difficulty of examining them individually and reaching a conclusion, and the need for systematic observation of the data call for meta-analysis. Meta-analysis studies are valuable because they present the studies examined comprehensively. There are a limited number of meta-analysis studies in the field of teaching Turkish as a foreign language. The first of these studies was conducted by Doğan and Özçakmak (2014) in 2014 on postgraduate theses related to the teaching of listening skills. Subsequently, meta-analysis studies by Aydın et al. (2015) on articles written on student attitudes and by Ergül et al. (2019) classifying master's theses written between 2009 and 2019 in terms of various variables are included in the literature. Furthermore, Gülden (2023) conducted a meta-synthesis study on works addressing the cultural dimension. A review of the literature reveals no studies examining the effect of material use in teaching Turkish as a foreign language. However, meta-analysis studies investigating the effects of material use on academic achievement, both domestically and internationally, are noteworthy. For example, Akar's (2020) study is a meta-analytic and thematic research examining the effects of interactive whiteboard (smart board) use on academic achievement and shows that interactive whiteboard use has a large and significant effect on academic achievement. Similarly, the meta-analysis conducted by Odabaş and Kahramanoğlu (2023) evaluated the overall effect of mobile device integration in education on academic achievement and found evidence supporting the positive effect of mobile device use on student achievement. A meta-analysis conducted by Dong et al. (2024) examined the effects of mobile learning on science achievement and found that mobile learning increased achievement ($g = 0.857$). These findings indicate that the use of materials has a significant positive impact on academic achievement not only in foreign language teaching but also at various educational levels. Şen and Yıldırım (2020) state that the stages of meta-analysis studies are determining the research topic, identifying the problem situation, conducting a search, identifying suitable studies, conducting quality control reviews, creating a data table, checking coding reliability, deciding on the effect size, conducting analysis, checking publication bias, interpreting effect size values, and reporting the results. This meta-analysis study aims to present master's theses and articles investigating the effect of material use on the four basic language skills in the context of different variables using descriptive statistics, to collect the results of the studies, to analyze them according to effect sizes, to discuss them, and to present them. The criteria for identifying suitable studies and data on coding reliability are presented in the methods section. Considering that the development of the four basic language skills is important in language learning, it is believed that a meta-analysis study on the effectiveness of the materials used on academic achievement will contribute to instructors working in the field of teaching Turkish as a foreign language, language learners, and future studies. The research question designed for this meta-analysis study is: "What is the overall effect of materials used in teaching Turkish as a foreign language on academic achievement?" Variables that may influence material usage were identified for the study. Accordingly, this meta-analysis study sought answers to the following sub-questions:

1. What are the descriptive statistics of studies examining the effect of material use on academic achievement?
2. What is the overall effect size of studies examining the effect of material use on academic achievement?
3. In the teaching of Turkish as a foreign language, the effect of material use on academic achievement:
 - a. How does it vary according to the year of publication?
 - b. according to the type of study?
 - c. according to the four basic language skills?
 - d. according to the type of material?
 - e. according to the type of school?

Method

This study collected and coded research investigating the effect of materials used in teaching Turkish as a foreign language on academic achievement, and the impact of these studies was revealed using the meta-analysis method. The meta-analysis method is defined as the analysis of analyses (Glass, 1976). Meta-analysis allows for the consistent and coherent integration of comprehensive quantitative findings, taking into account the magnitude of effects, and aims to produce meaningful generalizations through the systematic analysis of these findings (Cohen et al., 2001). This study used the meta-analysis method to combine the results of experimental studies on the effect of materials used in teaching Turkish as a foreign language on academic achievement. Following the formulation of the research question, a typical meta-analysis process involves six stages (Field & Gillett, 2010): 1) conducting a literature review; 2) determining and applying inclusion and exclusion criteria; 3) calculating the effect size for each included study; 4) performing the basic meta-analysis; 5) focusing on more comprehensive analyses such as conducting publication bias analysis and investigating moderator variables; and 6) reporting the results obtained. In this study, the stages listed in bullet points were followed.

Data Collection

Experimental studies are considered reliable studies within quantitative research methods (Büyüköztürk et al., 2015). The study is based on domestic and international studies that investigated the effect of materials used for the four basic language skills on academic achievement in data collection. The steps followed are listed below in order.

1. After entering the keyword “Turkish as a Foreign Language” in the search term section of the National Thesis Center, all works containing these words were included, regardless of word order, and the search field “all” was selected, resulting in 919 theses.
2. After entering the keyword “Turkish for Foreigners” in the search term section of the National Thesis Center, all fields were selected for the search, resulting in 433 theses.
3. Google Scholar, Web of Science, Ulakbim Discovery, and YÖK academic search tools were used for article searches. Google Scholar is noted as the most comprehensive search engine (Şen & Yıldırım, 2020). The keywords “Turkish as a Foreign Language,” “Turkish for Foreigners,” and “Impact” were entered together in the search field, and a total of 20 articles were found. International databases such as ERIC, Scopus, Springer Link, Taylor & Francis, Global, and Sage Journals were also examined, but no studies different from those obtained were found.
4. After the screening phase, a total of 1352 theses were reviewed during the selection phase, and 146 theses were selected that covered the period between 2015 and 2024, were prepared using quantitative research methods and techniques, and investigated the effect of material use. Of the 146 theses, 51 focusing on the four basic language skills were selected. Subsequently, theses providing the experimental and control group values and standard deviation values required for analysis were selected, and it was concluded that 27 theses were usable.
5. Out of the articles, three usable ones were selected based on the following criteria: publication between 2015 and 2024, non-derivation from theses, and provision of the necessary values for analysis.
6. Studies focusing on all four core language skills during the inclusion phase were treated as separate studies for each language skill and coded accordingly. Consequently, since one study was treated as four separate studies, the number of theses was calculated as 30.
7. The study includes a total of 661 experimental groups and 675 control groups from 30 theses and 3 articles, comprising a study group of 1,336 individuals. A summary of the selection process for the studies included in the study is provided in the PRISMA (2021) flow chart in Figure 1.

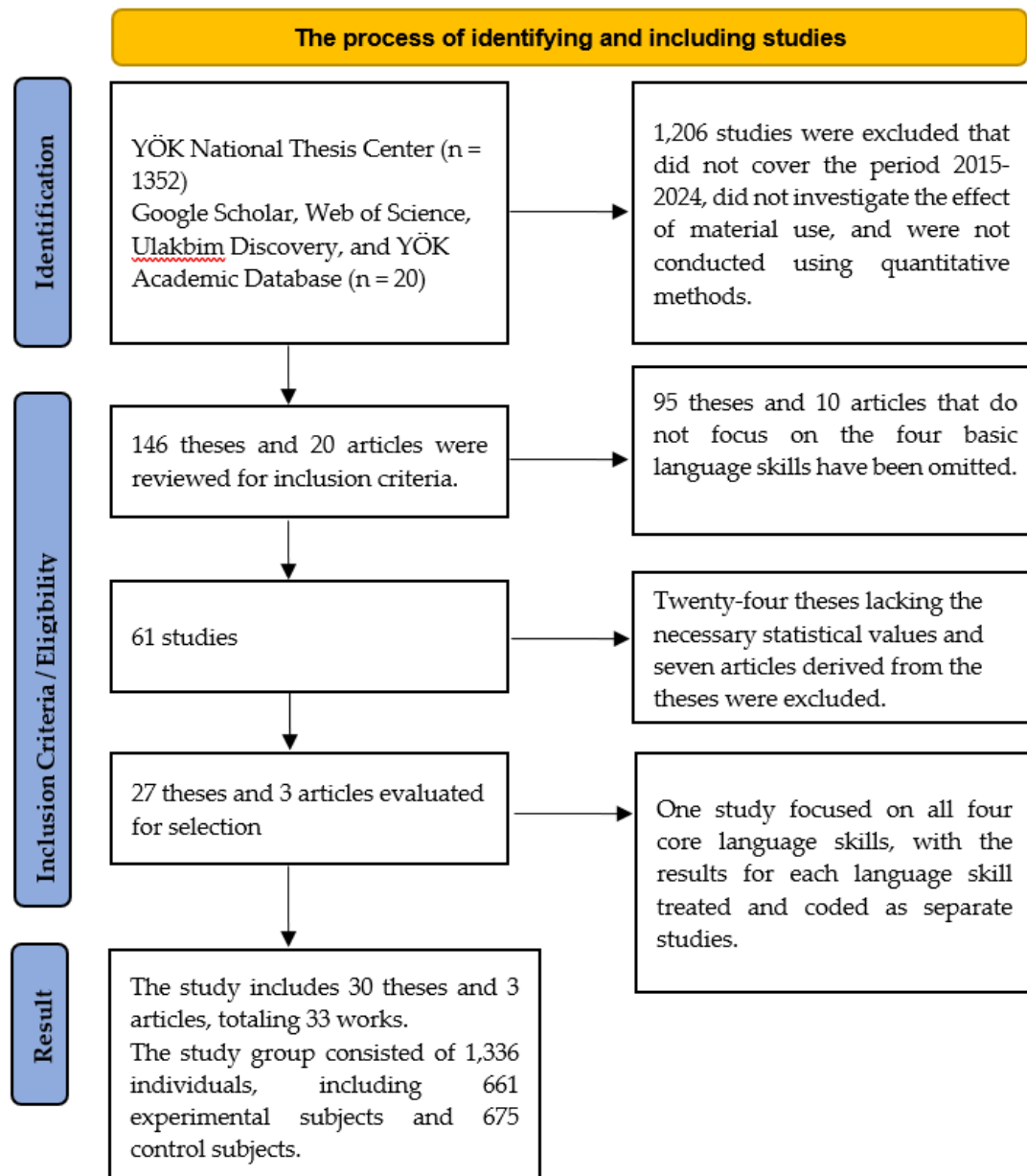


Figure 1. PRISMA flow diagram for the study selection process

A total of 33 studies, including 30 theses and 3 research articles, were selected from 1,372 studies using the aforementioned processes and meta-analysis was performed. In this context, the descriptive characteristics of the studies included in this research are presented in Table 1.

Table 1. Descriptive Characteristics of Studies

Study	The Four Basic Language Skills	Material Type	School Type	Type of Study
Arslan, 2023	Reading	Audio-Visual	Higher Education	Thesis
Balcı ve Dündar, 2017	Reading	Audio-Visual	Higher Education	Article
Baykan, 2023	Reading	Audio-Visual	Higher Education	Thesis
Çalışkan, 2022	Reading	Digital	Higher Education	Thesis
Gerek, 2022	Reading	Audio-Visual	Higher Education	Thesis
İnal, 2021	Reading	Digital	Elementary School	Thesis
Memiş, 2018	Reading	Audio-Visual	Higher Education	Thesis
Şimşek, 2024	Reading	Games and Activities	Higher Education	Thesis
Alan, 2019	Writing	Audio-Visual	Higher Education	Thesis
Aydın, 2019	Writing	Audio-Visual	Higher Education	Thesis
Çangal, 2020	Writing	Digital	Higher Education	Thesis
Dalioğlu, 2023	Writing	Audio-Visual	Higher Education	Thesis
Hamaratlı, 2015	Writing	Audio-Visual	Higher Education	Thesis
Harmankaya, 2023	Writing	Games and Activities	Higher Education	Thesis
İnal, 2021	Writing	Digital	Elementary School	Thesis
Kadan, 2020	Writing	Audio-Visual	Higher Education	Thesis
Melanlıoğlu and Atalay, 2016	Writing	Audio-Visual	Higher Education	Article
Özşavli, 2017	Writing	Audio-Visual	Higher Education	Thesis
Serpen, 2024	Writing	Audio-Visual	Higher Education	Thesis
Turkben, 2019	Writing	Audio-Visual	Higher Education	Article
Öncü Yiğit, 2024	Writing	Games and Activities	Higher Education	Thesis
Berk, 2019	Listening	Audio-Visual	Higher Education	Thesis
Çakır, 2015	Listening	Audio-Visual	Higher Education	Thesis
Ergun, 2023	Listening	Audio-Visual	Higher Education	Thesis
İnal, 2021	Listening	Digital	Elementary School	Thesis
Sevtekin, 2020	Listening	Audio-Visual	Middle School	Thesis
Şimşek, 2021	Listening	Audio-Visual	Higher Education	Thesis
Gün, 2015	Speaking	Digital	Higher Education	Thesis
İnal, 2021	Speaking	Digital	Elementary school	Thesis
Karagülle, 2020	Speaking	Games and Activities	Higher Education	Thesis
Özdemir, 2021	Speaking	Audio-Visual	Higher Education	Thesis
Seyhan, 2021	Speaking	Games and Activities	High School	Thesis
Tataroğlu, 2019	Speaking	Games and Activities	Higher Education	Thesis

When examining the information in Table 1, it is seen that the selected studies were conducted between 2015 and 2024. When the statistics related to the four basic language skills in the studies included in the meta-analysis are examined, it is seen that 8 (24.2%) studies focused on reading, 13 (39.4%) studies focused on writing, 6 (18.2%) studies focused on listening, and 6 (18.2%) studies focused on speaking skills. When examining the statistics on the type of material in the studies included in the meta-analysis, 7 (21.2%) studies focused on digital materials, 6 (18.1%) focused on game and activity-based materials, and 20 (60.7%) focused on visual and auditory materials. When examining the statistics regarding the type of school in the studies included in the research, 4 (12.1%) studies conducted in elementary schools, 1 (3%) study conducted in middle schools, 1 (3%) study conducted in high schools, and 27 (81.9%) studies conducted in higher education were included in the analysis.

Meta-analysis studies ensure that the researcher reviews the field being studied by scanning all sources and forms an opinion about the field. In this study, studies focusing on experimental research on the four basic language skills have been grouped under three main headings: digital applications, game- and activity-based applications, and applications using visual and auditory materials. The

diversity of the tools or methods used necessitates grouping them to make the research more understandable. When conducting meta-analysis studies, specifying which source search tools were used and which criteria were used to select the studies demonstrates that the studies are based on a scientific foundation (Şen & Yıldırım, 2020, p. 20).

Data Encoding

The studies to be used in the data coding phase were first collected in a file. Subsequently, three working files were created: “digital applications,” “game and activity-based applications,” and “applications using visual and auditory materials.” The relevant studies were numbered and placed into these files. This phase is referred to as the study coding phase. The coding phase is considered important to prevent confusion arising from the large number of studies and to facilitate data entry. After the data were coded in the files to be transferred to the data table, the data coding phase was initiated.

During the data coding phase, data from the studies were collected under fifteen different headings in the Excel file: the code of the study, the design of the study, the type of study, data related to the experimental and control groups, year of publication, material used, type of material, four basic language skills, type of school, and type of publication.

Errors may occur during the transfer of numerical data when coding data. These errors can affect the reliability of the study and lead to incorrect conclusions. In this meta-analysis study, to account for the possibility of errors during data coding, the data were recoded by an expert in the field, and differences between coders were examined. No inconsistencies were observed between coders for this study.

The explanation of coded data facilitates the meta-analysis studies for readers. Explanations regarding the coding performed in the study are stated below:

1. The types of materials used in the study have been grouped into three categories. These categories are named “digital materials” for studies using digital applications, “game and activity-based materials” for studies using game and activity-based applications, and “visual and auditory materials” for applications using visual and auditory tools.
2. It has been coded as an article or thesis depending on the type of publication.
3. To see which language skill the studies focused on, the studies were coded into four groups based on the four core language skills: listening, speaking, reading, and writing.
4. Depending on the institution where the work was conducted, higher education institutions, elementary schools, middle schools, and high schools have been coded.
5. No grouping has been made for the publication year variable.

Data Analysis

After the studies to be used in meta-analysis studies are determined according to specific criteria and the data table is created, the effect sizes of the studies are examined. The researcher must calculate the effect sizes using a common scale with the statistics obtained from the collected studies. Standardized mean difference, correlation, and odds ratios are the most commonly used effect size values in meta-analysis studies (Şen & Yıldırım, 2020).

In meta-analysis studies, studies conducted on a single group or on two groups are addressed by calculating effect sizes. It would not be accurate to mention a single method for combining data. Different methods are used in different studies for the same purpose (Shachar & Neumann 2002). In this study, studies with experimental and control groups and pretest and posttest scoring were included in the analysis.

A heterogeneity test is performed to select the statistical method to be used in meta-analysis studies. When $p > 0.05$ or $Q < df$, it is stated that the effect size of the studies examined is homogeneous. Conversely, when $Q > df$ or $p < 0.05$, it is stated that the studies are heterogeneous. This study is a heterogeneous study ($p < 0.05$) and a random effects model has been preferred. It is suggested that studies in the social sciences generally show diversity in terms of effect sizes and therefore should be analyzed using a random effects model (Field & Gillett, 2010; Pigott & Polanin, 2020).

The aim in analyzing the data is to determine the effect size value obtained by dividing the mean differences by the sum of the standard deviations (Hunter & Schmidt, 1990). In order to determine the effect sizes of the studies, it is necessary to look at a standardized mean difference because the studies differ from each other. The value obtained by dividing the mean differences observed in the studies by the standard deviation values is called the standardized mean difference (Şen & Yıldırım, 2020). In other words, it is called the effect size (Kablan et al., 2013). It is expressed in three ways: Cohen's d , Hedges' g , and Glass's (Δ). According to the Cohen's d value, the effect size is classified as follows: Values less than 0.15 are insignificant, values between 0.15 and 0.40 are small, values between 0.40 and 0.75 are medium, values between 0.75 and 1.10 are large, values between 1.10 and 1.45 are very large, and values of 1.45 and above are considered excellent (Ay Emanet & Kezer, 2021).

In this study, the data obtained from the data were coded using the Excel 2016 program. The obtained data were analyzed using the CMA 4.0 analysis program.

Findings

The findings section of the meta-analysis study must include the model used (random or fixed effects model) and the mean effect size values for both models, a forest plot for the studies included in the meta-analysis, the heterogeneity values of the studies, and the subgroup and moderator analyses of the studies (Şen & Yıldırım, 2020).

This meta-analysis study, which investigated the effect of material use on academic achievement and whether there were differences in terms of various variables, used 33 studies. In the first stage, descriptive statistics were presented; in the second stage, effect sizes related to academic achievement, heterogeneity distribution values, and confidence intervals were presented; and in the third stage, findings regarding whether there were any differences between subgroups were presented through moderator analyses.

Average effect sizes, heterogeneous distribution values, and confidence intervals of studies conducted on academic achievement

Heterogeneity tests are performed to determine the suitability of effect sizes for normal distribution. Data related to the test performed are presented in Table 2.

Table 2. Average Effect Size, Confidence Intervals, and Heterogeneity Distribution Table of Studies Included in the Meta-Analysis According to the Effect Model

Model Type	N	Z	Heterogeneity Value (Q)	Hedges'g	95% Confidence Interval		P
					Lower Limit	Upper Limit	
Fixed Effects Model	33	18.696	105.596	1.101	0.986	1.217	0.000
Random Effects Model	33	10.334	105.596	1.126	0.912	1.339	0.000

The confidence intervals, effect sizes, and statistics regarding the heterogeneous distributions of the studies included in the meta-analysis are presented in Table 2. According to the fixed effects model, material use had a positive effect on academic achievement with an effect size of 1.101 in favor of the experimental group; according to the random effects model, it had a positive effect with an effect size of 1.126 ($p=0.000$) in favor of the experimental group ($p=0.000$). Looking at the heterogeneity values, the Q value is seen to be 105.596. Looking at the chi-square table with 32 degrees of freedom, the critical value is seen to be approximately 53.672 at a 95% significance level. In this meta-analysis study, the calculated $Q=105.596$ value is greater than the critical value, indicating that the distribution is

heterogeneous. Due to the heterogeneous nature of the distribution in the study, analyses based on the random effects model were performed, aiming to eliminate biases arising from the heterogeneity of the sample (Yıldız, 2002).

Table 3. Forest Plot of Effect Sizes and Confidence Intervals for Studies Included in the Meta-Analysis

Study	E.S.	S.E.	V.	L.L.	U.L.	Z.	p.	-4	0	+4
Alan, 2019	2,517	0,419	0,175	1,697	3,338	6,013	0,000			
Arslan, 2023	0,526	0,351	0,123	-0,162	1,213	1,499	0,134			
Aydın, 2019	0,634	0,318	0,101	0,010	1,258	1,993	0,046			
Balcı ve Dündar, 2017	1,874	0,521	0,271	0,853	2,895	3,598	0,000			
Baykan, 2023	1,603	0,331	0,110	0,954	2,252	4,842	0,000			
Berk, 2019	0,797	0,263	0,069	0,281	1,312	3,030	0,002			
Çakır, 2015	1,108	0,351	0,123	0,420	1,796	3,155	0,002			
Çalışkan, 2022	0,870	0,373	0,139	0,140	1,601	2,336	0,019			
Çangal, 2020	0,528	0,227	0,051	0,084	0,973	2,330	0,020			
Dalioğlu, 2023	1,350	0,345	0,119	0,674	2,025	3,915	0,000			
Ergun, 2023	2,349	0,406	0,165	1,553	3,145	5,782	0,000			
Gerek, 2022	0,875	0,367	0,135	0,155	1,595	2,382	0,017			
Gün, 2015	0,407	0,359	0,129	-0,297	1,111	1,134	0,257			
Hamaratlı, 2015	1,104	0,403	0,162	0,315	1,893	2,742	0,006			
Harmankaya, 2023	1,032	0,392	0,154	0,264	1,800	2,633	0,008			
İnal, 2021-D	1,583	0,270	0,073	1,054	2,112	5,865	0,000			
İnal, 2021-K	1,729	0,276	0,076	1,187	2,270	6,260	0,000			
İnal, 2021-O	1,799	0,279	0,078	1,252	2,347	6,442	0,000			
İnal, 2021-Y	1,457	0,265	0,070	0,938	1,977	5,502	0,000			
Kadan, 2020	1,429	0,252	0,063	0,935	1,923	5,672	0,000			
Karagülle, 2020	0,849	0,361	0,130	0,142	1,555	2,353	0,019			
Melanlıoğlu ve Atalay, 2016	0,575	0,382	0,146	-0,173	1,323	1,506	0,132			
Memiş, 2018	0,801	0,396	0,157	0,025	1,577	2,024	0,043			
Özdemir, 2021	0,551	0,437	0,191	-0,306	1,407	1,260	0,208			
Özsavlı, 2017	0,634	0,365	0,133	-0,081	1,348	1,738	0,082			
Serpen, 2024	1,095	0,382	0,146	0,346	1,844	2,864	0,004			
Sevtekin, 2020	1,265	0,391	0,153	0,499	2,032	3,236	0,001			
Seyhan, 2021	0,189	0,413	0,170	-0,620	0,998	0,458	0,647			
Şimşek, 2021	1,425	0,400	0,160	0,641	2,209	3,562	0,000			
Şimşek, 2024	2,730	0,485	0,236	1,778	3,681	5,623	0,000			
Tataroğlu, 2019	0,095	0,332	0,110	-0,555	0,746	0,288	0,774			
Türkben, 2019	0,239	0,282	0,080	-0,315	0,792	0,845	0,398			
Yiğit, 2024	1,815	0,426	0,181	0,981	2,649	4,264	0,000			

In the forest plot presented in Table 3, the effect sizes and directions of the studies are shown on the right side of the graph, while the lines indicate the effect sizes within the 95% confidence interval between the lower and upper bounds. When examining the data on effect sizes, the lowest effect size is 0.095 in a positive direction, and the highest effect size is 2.730 in a positive direction. Thirty-three studies have a positive effect size.

Moderator Analysis Results of Studies Conducted on Academic Achievement

The study examined whether the effect of material usage on academic achievement in the teaching of Turkish as a foreign language differed across variables such as publication type, the four core language skills, material type, school type, and publication year. To determine the magnitude of effects across these variables, subgroups were formed and moderator analyses were employed.

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to publication type are presented in Table 4.

Table 4. Moderator Analysis Results by Publication Type of Studies

Publication Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Thesis	30	1.158	0.938	1.379			
Article	3	0.773	0.052	1.493			
Total	33	1.125	0.910	1.339	1.006	3.841	0.316

When the data in Table 4 regarding the effect of material usage on academic achievement is evaluated according to effect size classification, the effect size for theses was calculated as 1.158 at a 95% confidence interval, indicating a "very large" effect level; the effect size for articles was calculated as 0.773 at a 95% confidence interval, indicating a "large" effect level. When examining the heterogeneity between groups, the Q between value $Q=1.006$, $x^2=3.841$, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.316$).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to school type are presented in Table 5.

Table 5. Moderator Analysis Results of Studies by School Type

School Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Elementary school	4	1.641	1.117	2.164			
Middle school	1	1.265	-1.022	1.400			
High school	1	0.189	0.083	2.448			
Higher education	27	1.057	0.836	1.279			
Total	33	1.151	0.618	1.684	6.436	12.838	0.092

When the data in Table 5 regarding the effect of material usage on academic achievement is evaluated according to effect size classification, the effect size for elementary school was calculated as 1.641 at a 95% confidence interval, indicating an "excellent" effect level; the effect size for middle school was calculated as 1.265 at a 95% confidence interval, indicating a "very large" effect level; for high school, the effect size was calculated as 0.189 at a 95% confidence interval, indicating a 'negligible' effect level; for higher education, the effect size was calculated as 1.057 at a 95% confidence interval, indicating a "large" effect level. When examining the heterogeneity between groups, the Q between value is $Q=6.436$, and when compared to the $x^2=7.815$ value, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.092$).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to their publication years are presented in Table 6.

Table 6. Moderator Analysis Results by Publication Year of Studies

Publication Year	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
2015	3	0.868	0.168	1.568			
2017	2	1.158	0.242	2.074			
2018	2	0.686	-0.186	1.559			
2019	5	0.792	0.274	1.309			
2020	4	1.005	0.434	1.576			
2021	7	1.309	0.868	1.751			
2022	2	0.873	0.016	1.729			
2023	5	1.359	0.820	1.898			
2024	3	1.824	1.082	2.566			
Total	33	1.112	0.812	1.412	8.387	15.507	0.397

When the data on the effect of material usage on academic achievement in Table 6 is evaluated according to effect size classification, the effect size for 2015 was calculated as 0.868 at a 95% confidence interval, indicating a “large” effect level; the effect size for 2017 was calculated as 1.158 at a 95% confidence interval, indicating a “very large” effect level; for 2018, the effect size was calculated as 0.686 at a 95% confidence interval and represents a ‘medium’ effect level; for 2019, the effect size was calculated as 0.792 at a 95% confidence interval and represents a “large” effect level; For 2020, the effect size was calculated as 1.005 at a 95% confidence interval and represents a “large” effect level; For 2021, the effect size was calculated as 1.309 at a 95% confidence interval and represents a “very large” effect level; For 2022, the effect size was calculated as 0.873 at a 95% confidence interval, indicating a “large” effect level; For 2023, the effect size was calculated as 1.359 at a 95% confidence interval, indicating a “very large” effect level; For 2024, the effect size was calculated as 1.824 at a 95% confidence interval, indicating an “excellent” effect level. When comparing the Q between value examining heterogeneity between groups (Q=8.387) with the x² value (x²=15.507), the Q value is lower than the x² value, so it can be said that there is no significant difference between the groups (p=0.397).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to the four basic language skills are presented in Table 7.

Table 7. Moderator Analysis Results According to the Four Core Language Skills of the Studies

Language skill	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Listening	6	1.395	0.903	1.886			
Speaking	6	0.670	0.171	1.169			
Reading	8	1.345	0.904	1.787			
Writing	13	1.080	0.748	1.413			
Total	33	1.126	0.785	1.467	5.377	7.815	0.146

Table 7 presents data on the effect of material usage on academic achievement. When evaluated according to the four basic language skill classifications, the effect size for listening skills was calculated as 1.395 at a 95% confidence interval, indicating a “very large” effect level. The effect size for speaking skills was calculated as 0.670 at a 95% confidence interval, indicating a “moderate” effect level; for reading skills, the effect size was calculated as 1.345 at a 95% confidence interval, indicating a “very large” effect level; for writing skills, the effect size was calculated as 1.080 at a 95% confidence interval, indicating a “large” effect level. When examining the heterogeneity between groups, the Q between value is Q=5.377, and when compared to the x²=7.815 value, the Q value is lower than the x² value, so it can be said that there is no significant difference between the groups (p=0.146).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to the type of material used are presented in Table 8.

Table 8. Moderator Analysis Results by Type of Study Material

Material Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Digital	7	1.212	0.762	1.662			
Games and Events	6	1.052	0.520	1.585			
Audiovisual	20	1.114	0.831	1.397			
Total	33	1.127	0.908	1.345	0.220	5.991	0.896

Table 8 presents data on the effect of material usage on academic achievement. When evaluated according to effect size classifications by material type, the effect size for digital materials was calculated as 1.212 at a 95% confidence interval, indicating a “very large” effect level. For game- and activity-based materials, the effect size was calculated as 1.052 at a 95% confidence interval, indicating a “large” effect level. For visual and auditory materials, the effect size was calculated as 1.114 at a 95% confidence interval, indicating a “very large” effect level. When examining the heterogeneity between groups, the Q between value $Q=0.220$, $x^2=5.991$, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.896$).

Publication Bias

The funnel plot illustrating bias in the reliability of the meta-analysis study is shown below.

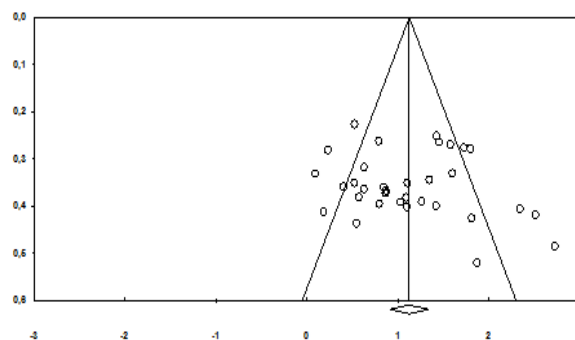


Figure 2. Effect size distribution graph of studies included in the meta-analysis

In the funnel plot, the distribution of effect sizes of individual studies within the funnel lines and in a symmetrical manner does not indicate publication bias. However, if the effect sizes are distributed outside the funnel lines and asymmetrically, publication bias may occur. In this regard, when examining Figure 2, it can be stated that the effect sizes of the studies related to the academic achievement variable show a distribution close to symmetry in the graph. The funnel graph's Begg and Mazumdar Kendall tau:0.16, $p=0.18$ and Egger bias value for publication bias is $-1.84586/4.72881$, which is the value range that should be within the 95% confidence interval. In this study, it was found to be 1.44148, $p=0.37$. While p values <0.05 are required as an indicator of bias, they were found to be larger in this study. These values indicate that there is no publication bias.

The Safe N (fail-safe N) value was proposed by Rosenthal (1979) to assess publication bias. The method developed by Rosenthal offers a simple approach to evaluate the effect of missing studies on the overall experimental effect estimate. Safe N determines the number of unpublished studies required to render the effect size of a statistically significant data set insignificant (Şen & Yıldırım, 2020).

Table 9. Rosenthal's Table of Safe N Values

Z value for observed values	18.65123
p value for observed studies	0.000
Alpha	0.050
Tails	2.000
Z for alpha	1.95996
Number of observed studies	33
fail-safe N	2956

When examining the analysis results given in Table 9, the number of studies obtained from the meta-analysis according to Rosenthal's Safe N method is 2956. In order to achieve a $p>0.05$ value, in other words, to render the effect size insignificant, 2956 more studies need to be conducted.

Similar safe N values to Rosenthal's have been proposed by other researchers (Orwin, 1983; Rosenberg, 2005). Orwin's method is also similar to Rosenthal's. It provides the number of studies required to reduce the effect size value of the data to a desired value.

Table 10. Orwin's Safe N Value Table

Hedges' g in observed studies	1.10110
Criterion for a trivial Hedges' g	0.0500
Mean Hedges' g in missing studies	0.00000
Number missing studies needed to bring Hedges' g under 0.10	694

When examining the analysis results presented in Table 10, it is necessary to conduct 694 more experimental studies to reduce the effect size of the studies to a low level and render the overall effect size meaningless.

Conclusion, Discussion and Suggestions

This meta-analysis study examines the effect of materials used in teaching Turkish as a foreign language on academic achievement. Thirty-three studies focusing on academic achievement were included in this meta-analysis, and the effect size was calculated using the CMA program. Referencing Cohen's effect size value ranges, it was concluded that the use of materials in teaching Turkish to foreigners to develop the four basic language skills has a positive effect size of 1.126, which is considered "very large." This result shows that the use of materials in teaching Turkish to foreigners can increase academic success. Yalın (2010) states that students have different learning styles, with some learning better by listening, some by reading, and some by speaking. The use of materials ensures that multiple senses are engaged and that learning is more permanent (Dale, 1969; Duman, 2013; Kuşçu, 2017). Gardner (1983) states that humans have different types of intelligence and that these should be taken into account in learning. Meta-analysis studies on the effect of material use on academic achievement indicate that material use positively affects academic achievement (Cho et al., 2018; Kablan et al., 2013; Kärchner et al., 2022; Kul et al., 2018;). Koçak et al. (2021) reviewed meta-analysis studies on factors affecting academic achievement and found that material use positively affects academic achievement.

In the study, effect sizes were calculated for various variables, and moderator analyses were conducted to examine whether there were any differences between subgroups. As a result of the analyses conducted in the publication type subgroup, it was concluded that there were 3 articles and 30 thesis studies; the effect size of the articles was 0.773 and at a large effect level, while that of the theses was 1.158 and at a very large effect level. No significant difference was found between the two groups. These results indicate that studies on material usage in both articles and theses positively affect academic achievement at a noteworthy level.

According to the analyses conducted in the school type subgroup, four studies were conducted in elementary school, one in middle school, one in high school, and twenty-seven in higher education; The effect size of the studies conducted in primary schools was 1.641, indicating an excellent effect level; the effect size of the study conducted in middle schools was 1.265, indicating a very large effect level; the effect size of the study conducted in high schools was 0.189, indicating a small effect level; and the effect size of the studies conducted in higher education was 1.057, indicating a large effect level. The teaching of Turkish as a foreign language at the elementary, middle school, and high school levels began in 2016 with the PİKTES project. In this regard, it can be stated that the studies to be carried out at these levels will increase as long as the project continues. It is also stated that it is important to carry out studies at every level in order to view the teaching of Turkish to foreigners as a whole (Ergül et al., 2019). The impact of the studies conducted in primary schools is seen to be excellent. This shows that the use of materials in teaching Turkish as a foreign language in primary schools increases academic achievement to an excellent level. Among refugees living in Turkey, the number of children in the 5-9 age group is stated to be approximately 530,000 (Refugees Association, 2024). Primary school students are in the concrete operations stage based on their age (Yapıcı & Yapıcı, 2005). Considering that materials both facilitate language teaching and make teaching more concrete, their use in this age group can be expected to further increase academic achievement. The absence of a significant difference between the groups shows that the use of materials is effective at every level.

Analyses of the years in which the studies were published show that 12 studies were conducted between 2015 and 2019, and 21 studies were conducted between 2020 and 2024. The highest impact size was observed in studies conducted in 2024. This result shows that material usage has diversified with technology in recent years and that developments have made materials more effective in teaching Turkish as a foreign language. Furthermore, the increase in studies conducted in recent years indicates a growing interest in the field of teaching Turkish to foreigners (Can, 2023).

As a result of the analyses conducted within the subgroup of the four basic language skills, it was found that six studies focused on listening skills, six on speaking skills, eight on reading skills, and thirteen on writing skills. The effect size for listening skills was 1.395, indicating a *very large* effect size; for speaking skills, it was 0.670, indicating a *moderate* effect size; for reading skills, it was 1.345, indicating a *very large* effect size; and for writing skills, it was 1.080, indicating a *large* effect size. It was observed that the effect sizes for listening and reading skills were higher than those for speaking and writing skills. Listening and reading skills are defined as *receptive skills* in the CEFR (Council of Europe, 2020). In language learning, receptive skills represent learning, while productive skills reflect the ability to reproduce what has been learned. The type of material used influences the language skill to be developed (Duman, 2013). Accordingly, selecting materials appropriate for the specific language skill targeted for development will enhance the retention of learning. The absence of a significant difference among the groups indicates that the use of materials is effective for each skill.

The analysis conducted on the subgroups of material types used to enhance language proficiency determined that seven studies were carried out using digital applications, six studies were based on games and activities, and twenty studies utilized visual and auditory materials. When examining the effect levels of these materials, it was observed that digital materials had an effect size of 1.212, indicating a very large effect; visual and auditory materials had an effect size of 1.114, also showing a very large effect; and game and activity-based materials had an effect size of 1.052, which corresponds to a large effect. Today, with rapidly advancing technological developments, language teaching with digital applications is gaining increasing importance. Digital applications are effective in the development of each of the four basic language skills (Babacan, 2023). Furthermore, access to digital applications is not limited to the classroom but also provides ease of accessibility to students outside the classroom. Language learners can communicate with any native speaker of the target language via digital applications, regardless of distance. This demonstrates the critical importance of digital applications in the cultural transmission process, both verbally and non-verbally. Moreover, virtual worlds are being created in language teaching through developing web tools, which removes

boundaries in reaching the target language (Ata et al., 2010). İnal and Arslanbaş (2021) stated that different applications such as Padlet, Voki, and Quizlett can be used for the development of each skill. Considering the influential role of mobile devices on language learning (Cho et al., 2018), it can be said that digital applications provide great convenience to language learners and teachers. The positive effect of digital applications on academic achievement has also been demonstrated in different meta-analysis studies conducted in Türkiye (Ayaz et al., 2016; Kalkanoglu, 2024; Öztop, 2022). Similarly, there are meta-analysis studies proving the success of using digital materials in foreign language teaching. Batdı (2021) concluded in his meta-analysis study that the use of technology in foreign language teaching has an effect size of 1.196, representing a very large effect. Yu and Trainin (2022) concluded in their meta-analysis study that technological applications have a moderately positive effect on academic achievement in second language teaching. Game and activity-based applications put the student directly in a central position. Especially in younger age groups, teaching with games is effective and attracts children's attention (Akdoğan, 2004). Games that elevate learning by doing and experiencing are of great importance in language teaching (Engin et al., 2010). Additionally, skills such as communication and collaborative learning develop with games. Karakoç et al. (2022), in their meta-analysis study investigating the effect of learning with games on academic achievement, concluded that game-based learning has an effect size of 1.695, indicating an excellent effect on students. Visual and auditory materials make the learning process more concrete. The education process becomes more efficient with visual and auditory materials prepared by considering the age, interests, and language levels of the students. Furthermore, considering the age groups of students in primary and secondary education, visual and auditory materials such as posters, audio recordings, and cartoons offer more enjoyable and fun learning environments for students (Kuşçu, 2017). Kansızoglu (2017), in their meta-analysis study on the effect of graphic organizers as a visual and auditory material on academic achievement in language learning, concluded that it has an effect size of 0.897, indicating a high-level effect. The absence of any significant difference between the groups suggests that every type of material is effective, and the choice of material type to be used, considering the learners' ages, is important in terms of facilitating learning.

This meta-analysis study revealed the effects of materials used in teaching Turkish as a foreign language on academic achievement, and showed that material use generally created a large, positive effect. Specifically, the use of digital applications, game and activity-based materials, and visual and auditory tools demonstrated a great impact on the development of language skills. The studies indicate that the use of materials is effective at every age and education level, and moreover, that this effect is at an excellent level at the primary school level. In terms of language skills, the effect sizes for listening and reading skills were observed to be higher. These findings reveal that material use makes students' language learning more effective and permanent, and that technology is playing an increasingly important role in this process. Consequently, it can be stated that the use of materials in Turkish language teaching is a significant tool for increasing academic achievement, and future studies in this field could further enhance the diversity and effectiveness of the materials used.

Considering the rapid advancement of technology, future studies may recommend increasing the use of digital tools. Specifically, mobile applications and online platforms could be utilized more extensively in language learning. It can be suggested that studies comparing the effects of different age groups, while considering the language learners' ages, could facilitate the development of effective teaching strategies. It can also be stated that increasing the number of studies utilizing applications that provide learning opportunities beyond the classroom (so that students' learning is not confined to school) would both ease the process for remote language learners and enhance cultural transfer.

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Inclusion in Türkiye and Hungary from the Salamanca Statement to today: policies and statistics

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Abstract

In June 2024, the Salamanca Statement and Framework for Action on Special Needs Education (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1994) have seen its 30th anniversary. The Salamanca Statement has been the mainstay of the spread of inclusion and influenced the educational systems of many countries. Although the countries that signed the Statement have made various regulations in their policies and practices to create more inclusive educational environments, these regulations have not been at the same pace and intensity in every country. In this study, we discussed what happened in the education systems of Türkiye and Hungary, the two countries that signed the Salamanca Statement, from 1994 to the present day. This comparison of the education systems of these two countries with different cultural, historical, and political backgrounds can contribute to the evaluations regarding the current situation of the practices of inclusion.

Keywords

Inclusion
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Introduction

The Salamanca Statement is considered the primary starting point in research, practice, and policies related to inclusion (Magnússon, 2019), and the most important international document in the field of special education (Ainscow et al., 2019). Having a rights-based anti-discriminatory stance, the Statement challenged the idea that some students don't belong to regular schools and contributed to the spread of the idea of inclusion in policies and practices (Flecha & Soler, 2013; Florian, 2019). Its call to governments to adopt the principle of inclusion, enrolling all children in regular schools unless there are compelling reasons for doing otherwise (UNESCO, 1994) had a great impact all over the world. The Statement has been accepted as a guide for national education policies (Majoko, 2013; Migliarini et al., 2019) and has given a lead for many countries to develop policies regarding inclusion (Meijer & Watkins, 2019). As well as changes in education policy, the Statement brought about a linguistic shift

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from the term integration to the term inclusion (Vislie, 2003). The term inclusion was used for the first time in the global sense with the Statement (Francisco et al., 2020), and soon after that, it began to be used in nearly all international documents and reports (D'Alessio & Watkins, 2009). Before the Statement, in the 1970s and 1980s, the term integration had been used generally and served as a mainstay for many policies and practices (Vislie, 2003). Integration accepts special and general education as different systems and means that members of the lesser system (special education) join the majority (mainstream) system (Idol, 1997). So, integration implies that the educative goal is to integrate a student back into the mainstream school, because at some point he/she has been excluded from it (Watkins, 2007). But the term inclusion being a human rights issue (Killoran et al., 2014) expresses a different political orientation and aims to ensure that no child is excluded from mainstream schools. As illustrated in Figure 1, integration differs from inclusion in that it involves physical placement but does not necessarily ensure meaningful participation or equal belonging, whereas inclusion emphasizes full participation of all learners within the same educational community. The main purpose of inclusion is to create supportive learning environments for all children regardless of their physical, cognitive, and social backgrounds (Qvortrup & Qvortrup, 2018). Inclusion is a rights-based approach to education and aims to not exclude or marginalize from education systems those in vulnerable situations, persons with disabilities, indigenous people, those in remote rural areas, ethnic minorities, the poor, women and girls, migrants, refugees, and displaced persons, whether as a result of conflict or natural disaster (UNESCO, 2018). So, inclusion contributes to reducing social barriers, eliminating discrimination, and providing a qualitative education available and accessible to all students (Kauliņa et al., 2016).

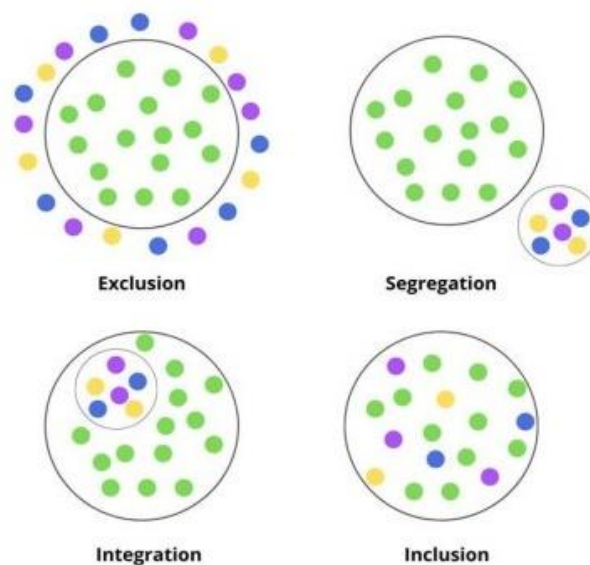


Figure 1. The four models of education in OECD Education Working Papers No. 260 (Cerna et al., 2021)

Florian (2019) states that there is a wide variety of differences between countries in the interpretation and implementation of inclusion. The fact that the decision-making authority on how to implement the inclusion is left to each nation and the decision-makers in these nations has led to the emergence of different meanings and, accordingly, different practices (Hunt, 2011). Therefore, the policies related to inclusion may differ according to the countries (Magnússon, 2019). In addition, if the Salamanca Statement is considered a tool for eliminating discrimination and creating the ideal society, it can be said that there may be changes in these policies according to the ideal society understanding of each country (Magnússon, 2019). However, considering that there will be progress towards inclusion in the countries that are party to the Salamanca Statement (Prince & Hadwin, 2013), it will be important to examine whether the ideals related to inclusion are included in the national policies of these countries, how they are included, and how they are comparatively examined (Magnússon, 2019). There are three

main reasons for this comparative study of Türkiye and Hungary. First, although both countries have committed to inclusion by signing the Salamanca Statement (UNESCO, 1994), they have different historical, political, and cultural structures (Deregözü, 2020). These differences provide an important opportunity for comparison in terms of understanding how the same international statement is interpreted and implemented in two different contexts. Second, while Hungary has become a full member of the European Union (EU) as of 2004 (Avar, 2024; Csehi, 2020), Türkiye is still a candidate country (Çetinkaya, 2019). Therefore, it can be said that both countries have different levels of obligations towards the principles and goals of the EU while developing their inclusive education policies. This situation shows that the EU influence on the shaping of practices and policies differs, and makes it possible to evaluate the paths followed by the two countries comparatively in this context. Thirdly, the minority/migrant social groups that the two countries focus on within the scope of inclusion also differ. While the focus regarding inclusion in Türkiye has been on the education of Syrian migrant children in recent years (Bayraklı, 2024; Güner et al., 2024; Kocaoğlu & Güner, 2024), the participation of Roma/Gypsy children in education is the main area of discussion in Hungary (Fehérvári & Varga, 2023). This situation provides a comparative perspective in terms of understanding how practices are developed for groups with different disadvantages and what problems are encountered. Based on these, this study aims to examine the reflections of the Salamanca Statement on the policies and statistics of inclusion in Türkiye and Hungary, two of the countries that are party to the Salamanca Statement, and to compare the national developments in these two countries.

Reflections of the Salamanca Statement in Türkiye

Following the Salamanca Conference, the ‘Decree Law No. 573 on Special Education’ was published in 1997. Compared with the first comprehensive law for individuals with special needs in Türkiye, which is the ‘Law on Children in Need of Special Education’, numbered 2916, and was published in 1983, it is the first legislation in which the concepts of special education support, integration, and individualized education plan are defined (Sucuoğlu & Kargın, 2008). According to this, in the 12th article of the decree, integration is defined as ‘*The education of individuals who require special education is carried out together with their peers in accordance with the individual education plans prepared by using appropriate methods and techniques in schools and institutions of all types and levels.*’ (Özel Eğitim Hakkında Kanun Hükmünde Kararname, 1997, p. 859). In addition, essential points related to the family, such as conducting special education services in early childhood through families, ensuring the family's participation in every stage of special education, and taking their opinions, are included in this legislation. However, although these concepts are included, the details regarding where, by whom, and how they will be applied are not clearly defined (Sucuoğlu & Kargın, 2008). Therefore, it can be argued that the effects of this ambiguity are reflected in the implementation of integration practices. A review of the post-Salamanca period reveals that various stakeholders in integration—such as children with special needs, their typically developing peers, families, and teachers—have required substantial support regarding the scope and application of integration (Batu, 2000; Kargın & Baydık, 2002; Sucuoğlu, 2004). These details regarding integration and implementation were presented in the ‘Special Education Services Regulation’ published in 2000 based on this decree (Yazıcıoğlu, 2018).

In the following years, a change began to be seen from the term “integration” to the term “inclusion”. For example, Article 15 of ‘Law on Disabled People’ numbered 5378, which came into effect in 2005, said that: ‘*Disabled people cannot be prevented from receiving education for any reason. Children, youth and adults with disabilities are provided with equal education opportunities in inclusive settings and with non-disabled individuals, taking into account their special circumstances and differences.*’ (Engelliler Hakkında Kanun, 2005). After that, in the ‘Special Education Services Regulation’ that came into force a year later, in 2006, the expression ‘*ensuring inclusion in society*’ was used (Özel Eğitim Hizmetleri Yönetmeliği, 2006, p. 2).

In 2008, the ‘*Circular on Educational Practices Through Integration*’ was issued, and the term integration continued to be used. But in 2017, the ‘*Circular on Educational Practices Through Integration/Inclusion*’ came into force instead of this circular, and the term integration had left its place to the term ‘*integration/inclusion*’ (Ministry of National Education [MoNE], 2017). Similarly, in the ‘*Special Education Services Regulation*’, the most recent version of which was published in 2018, when compared with the previous regulations, the term ‘*integration/inclusion*’ was used instead of integration. The term “*integration/inclusion*” has been increasingly used in recent literature (Ahmetoğlu et al., 2019; Çakıcı, 2020; Çulhaoğlu & Söğüt, 2021; Kocaoğlu et al., 2023; Yıldırım & Kılıç, 2024), particularly following changes in these educational regulations. An examination of current practices reveals that the number of courses related to inclusion within teacher education programs has grown, alongside the development of interdisciplinary master’s and doctoral programs aimed at training experts to enhance the quality of inclusion.

Lastly, another legislative development about inclusion is the regulations about migrants, which came into force with the start of a large migration wave from various countries to Türkiye since 2011, mostly from Syria (Kocaoğlu & Güner, 2024). These are the ‘*Law No. 6458 on Foreigners and International Protection*’ (Yabancılar ve Uluslararası Koruma Kanunu, 2013) and the ‘*Temporary Protection Regulation*’ issued in 2014 based on Article 91 of the Law on Foreigners and International Protection (Geçici Koruma Yönetmeliği, 2014). When the full texts of these regulations for migrants are examined, it is emphasized that these individuals will be provided with education by the state and that they cannot be deprived of education and basic/emergency health services, even if necessary restrictions are imposed. In the 90th article of the ‘*Law on Foreigners and International Protection*’, this situation is expressed as ‘*Those who do not comply with the written obligations and those whose applications and international protection status are negatively decided; except for education and basic health rights, restrictions may be imposed in terms of benefiting from other rights*’ (Yabancılar ve Uluslararası Koruma Kanunu, 2013). Similarly, in the 35th article of the ‘*Temporary Protection Regulation*’, it is stated that ‘*Those who do not comply with their obligations despite being warned, may be completely or partially restricted from benefiting from other rights, excluding education and emergency health services*’ (Geçici Koruma Yönetmeliği, 2014). These articles in the laws about migrants show us no matter the situation any migrant will access to education services, and it can be said that this is within the scope of inclusion.

Inclusion is a complicated pedagogical and psychological process and requires a specific attitude and preparedness of the education professionals, and society as a whole (Kauliņa et al., 2016). As can be seen, in Türkiye, the term ‘*integration*’ was revised as ‘*integration/inclusion*’, but it is not possible to say that the practices in education settings are fulfilling the requirements of inclusion. Although the post-Salamanca legislations are adequate, when practices are evaluated holistically, it can be said that they are far from the definition of the international inclusion term and are limited to only a certain group or category (Güner Yıldız et al., 2022; Keser & Düzkantar, 2019). For example, in the Educational Practices Teacher's Guidebook in the Scope of Inclusion, which was published in 2013, it is stated that “*In Türkiye’s system, the educational diagnostic results of students are classified as “severe, moderate, and mildly disabled”. Students with mild disabilities can be enrolled in mainstream schools, as their ability to attend school requires only minor changes in educational practices at school.*” (MoNE, 2013, p. 27). As it can be understood, students with moderate and severe special needs are not accepted into classrooms that include typical students. So, in this article, the practices made in Türkiye are mentioned as integration, not inclusion. Moreover, while there is still a long way to inclusion, it is seen that even applications that can be defined as integration are carried out with many problems.

The problems experienced in the general education settings regarding integration in Türkiye are reported in various studies. Among these problems can be listed as inadequacies of educational environments, lack of knowledge of teachers about integration, negative attitudes of teachers towards educating students with special needs, and inadequacy of support services. For example, there are many

studies reporting teachers' lack of knowledge about integration (Akdemir et al., 2022; Akkaya & Güçlü, 2018; Aktan, 2021; Bakkaloğlu et al., 2018; Batu et al., 2018; Buldu et al., 2021; Çalışoğlu & Tanışır, 2018; Değirmenci-Kurt & Tomul, 2020; Gezer & Aksoy, 2019; Gök & Dokumacı, 2021; Güner Yıldız et al., 2022; Gürgür & Hasanoğlu Yazçayır, 2019; Kilinc, 2019; Koç & Gürgür, 2021). Also, teachers need more knowledge and support about cooperating with other teachers, school administrators, experts, and families (Akdemir et al., 2022; Aktan, 2021; Bakkaloğlu et al., 2018; Batu et al., 2018; Değirmenci-Kurt & Tomul, 2020; Gök & Dokumacı, 2021; Gürgür & Hasanoğlu Yazçayır, 2019). Crowded classrooms are cited as another problem. In some studies, it is emphasized that the number of students in the classes should be reduced in order to carry out integration practices (Batu et al., 2018; Gök & Dokumacı, 2021; Gürgür & Hasanoğlu Yazçayır, 2019; Koç & Gürgür, 2021). It is also emphasized in the studies that there is a need for more materials and assessment tools to be used for the evaluation and education of students with special needs (Akdemir et al., 2022; Batu et al., 2018; Kilinc, 2019). These findings from various research show that there should be more firm steps taken action to implement the articles on the regulations on integration.

Changes in Special Education Statistics in Türkiye after the Salamanca Statement

Statistical data on integration can be considered as a reliable data source that can reveal the change and development of integration rates in Türkiye since Salamanca. According to official statistics, the earliest data after Salamanca belong to 2006. In Table 1, the numbers and rates of students with special needs who have been educated in integration settings since 2006 are given. It is noteworthy that although the earliest data belong to 2006, the data about the number of students with special needs studying in integration settings are accessible after 2010. Considering the rates over the years, the rate of students who received education in mainstream schools among all students with special needs increased from 65.38% to 75.59% in the period from 2010-2011 to the 2021-2022 academic year. In other words, the proportion of students who received education in mainstream schools has increased gradually.

These statistics show that the number of students with special needs studying in general education classrooms in Türkiye is increasing every year. Even though a quarter of children with special needs are integrating into general educational classrooms today, there is still a lot of work to be done regarding integration in Türkiye. The National Action Plan for Educational Practices Through Integration/Inclusion (MoNE, 2022), which outlines what must be done in the five years between 2022 and 2026 in order to make the education system more inclusive, can be considered an indicator of this situation. Within the action plan, there are targets for the work to be done within a five-year period in areas such as support services to be provided, materials to be prepared, physical arrangements to be made in educational environments, and the number of students, teachers, school administrators, and parents to be given education. These targets are comprehensively discussed within four policy areas titled Access to Education, Improving Quality in Education, Raising Awareness and Attitudes, and Legal Regulations. When these four policy areas and their associated targets are examined, it becomes clear that the journey towards inclusion, as outlined in legislative texts, is intended to be continued through educational practices in Türkiye.

Table 1. Distribution of Students Receiving Education in Integration Settings in Türkiye

Year	Total number of students with special needs	Number of students with special needs studying in integration settings	Percentage (%)
2006-2007	32.027	Unavailable	-
2007-2008	24.613	Unavailable	-
2008-2009	25.386	Unavailable	-
2009-2010	28.195	Unavailable	-
2010-2011	141.248	92.355	65,38
2011-2012	199.513	148.753	74,55
2012-2013	220.649	161.295	73,10
2013-2014	242.716	173.117	71,32
2014-2015	259.282	183.221	70,66
2015-2016	288.489	202.541	70,20
2016-2017	333.598	242.486	72.68
2017-2018	353.610	257.770	72.89
2018-2019	398.815	295.697	74.14
2019-2020	425.774	318.300	74.75
2020-2021	425.816	319.881	75.12
2021-2022	472.686	357.319	75.59

MoNE (2025)

Reflections of the Salamanca Statement in Hungary

In order to better understand the education of children with special educational needs (SEN) in Hungary, it would be appropriate to look at the past years. The 1886 Public School Education Act, which mandated compulsory education for children, explicitly excluded children with SEN from compulsory education. Segregated education in Hungary began in 1902, and integration was not possible until 1993 (Németh & Pukánszky, 2004). By the middle of the 20th century, especially in the Rákosi era between 1945 and 1956, the Hungarian educational policy showed unique and specific features, and this uniqueness unfolded in the fact that the Rákosi era suppressed all initiatives that were unacceptable in terms of Stalinist policy (Donáth, 2008). Still, experts were consulted on possible educational orientations despite the intimidation, and the education system adapted to the educational paradigm of socialist countries (Donáth, 2008). Dissatisfaction with the high level of repression induced the 1956 revolution in Hungary and led to the Kádár era (1956-1989) (Barkó, 2021). But indeed, there was no substantial change in the regime.

A major and dramatic change in the history of the Hungarian education system came with an attempt to renew it in the early 1980s. This was the last major modernization effort of the Kádár regime, in which education policy was a prominent part. This time, real experts were involved in the reforms (Kozma, 2016), and the political system accepted some, but not all, of the experts' recommendations. For example, it did not ban further integration, but it also did not allow it. Parents were not seen as education partners, as all decisions were subject to significant restrictions on rights and freedom, which included education (Sáska, 2016). There was already a sense of regime change behind the reforms, and this political situation lasted until 1989. The 1985 Education Act, which strongly emphasized the rejection of the past and a move towards a new, freer system, was a part of these reforms. Thanks to the Education Act, integration was also valorized (Kozma, 2016), but unfortunately, it did not necessarily affect children with disabilities, as defined at the time, who were still only allowed to receive segregated education.

The other specific characteristic of the 1985 Education Act is that the State shall make special provisions for the education and training of the physically, sensorially, mentally, and speech-impaired. The 1985 Education Act used the term 'disability', which was considered appropriate at that time.

Despite this, disability was mentioned only 15 times in the text of nearly 80,000 characters. The word 'integration' was not mentioned once in the Act, even though it is already a known concept.

The biggest change in the Hungarian education system occurred one year before the Salamanca Statement; the Act LXXIX of 1993 on Public Education was enacted. Thus, the legal environment governing Hungarian education changed drastically, replacing the education law that had been in place since 1985. The law created in 1993 was part of Hungary's democratic establishment. In fact, it was created by Hungary a year before the Salamanca Statement, but thanks in part to the democratic transition of 1989/90, it is a decentralized law that gives greater autonomy to education. Hungary followed the international discourse connected to integration, but similar to the previous law, the word 'integration' does not appear in this law. The most crucial differences between the 1985 and 1993 laws, according to the 1993 Law, were giving rights to families to educate children on their religious and philosophical beliefs and sharing the responsibility for education between the local government and parents. Even though the 1985 Law was modern, parental rights were not included in the focus because the right to decide was left to the state according to the socialist regime. In 1993, this changed, and it allowed parents the right to choose their school and specifically mentioned the responsibilities of children in segregated education (Fejes & Szűcs, 2018).

Following the Salamanca Statement, changes in the Hungarian education system have been slow (Réthy, 2002). In fact, there are a few verified cases in which the Salamanca Statement led to changes in Hungarian education. For example, we know of one case where an institution for special educational needs and segregated education of the disabled was closed down by the local government, specifically referring to the Salamanca Statement (Kerülő, 2008). In another court case concerning inequality of opportunity was brought in, in which the court ordered the municipality to eliminate Roma/Gypsy segregation, and in its reasoning referred to the Salamanca Statement as a binding and accepted regulation (Kerülő, 2008). The problem of the Roma/Gypsy groups was hidden in the pre-democratic period (Forray & Kozma, 2022). However, with the children with SEN, Roma/Gypsy children were also brought to the fore and included in the laws regulating education. The Office of the Ministerial Commissioner for the Integration of Disadvantaged and Roma Children was established in 2003 by the Hungarian Ministry of Education; however, under Act XLII of 2010, it was abolished. However, the situation of disadvantaged Roma/Gypsy children in Hungary is still not solved (Fehérvári & Varga, 2023).

If we look at the current situation of education in Hungary, even though integration is relatively widespread in Hungary, we cannot speak of inclusion. The terms 'integration' and 'inclusion' are used in the Hungarian special education system (Papp, 2011; Papp & Perlusz, 2012), but the Hungarian legislators use the two concepts interchangeably and with the same meaning. In fact, only integration is used in the law, which is also meant 'inclusion'. Similarly, a high percentage of both teachers and parents do not necessarily understand the differences between integration and inclusion (Varga, 2015) and reject inclusion (Erdei, 2020; Vida, 2019). The most significant problem is that the introduction of inclusion has not yet been followed by methodological innovation (Réthy, 2002; Vida, 2019). Inclusion requires different methods of classroom work, which can be interpreted in relation to special educational needs (Ainscow, 2014; Florian, 2008). But the structure, curricula, and governance of institutions have not been supportive of inclusion (Csepeli et. al., 2020). Also, it is difficult to see examples of inclusion, while the practices that can be named integration are widely implemented. There are only a few Hungarian institutions that meet the criteria for inclusion. Examples include the 'House of Children' Alternative Foundation Programme (Kókayné, 1999) and the Istvánffy Primary School in Szigetvár (Falus & Szűcs, 2023; Pirisi & Pesti, 1996), but these institutions no longer operate in this form.

As a result, the law still maintains segregated institutions in Hungary, even though it is formally committed to the education of children with SEN and other disadvantaged children in general education environments. It can be observed that the Hungarian government accepted various declarations and proposals on the surface (Erdei, 2020), but in reality, these had very little impact on

everyday practice. For instance, while so-called 'elite' schools only rarely admit students with SEN, and that's only if they are gifted, some schools have become collection points for students with SEN and disadvantaged. Teachers working in these schools feel that it is almost impossible to meet the challenges (Falus & Szűcs, 2023). Children with special educational needs sit in classrooms with high class sizes, and most teachers who teach them have no competence in special education needs. In many cases, they do not even know which child has a problem. Education is the same for all children, and most of the development takes place in separate sessions outside the classroom, not embedded in the curricular content (Trembulayák & Szabóné Pongrácz, 2023). Also, research studies have revealed several problems. For example, research conducted by Kende (2004) showed a general perception that children with SEN could be better educated in separate, segregated institutions. In 2019, the attitude toward acceptance did not show a significant shift; only half of the interviewed teachers supported it, and that support was only partial (Vida, 2019). In many cases, parents opposed the participation of a child with SEN in their children's classroom, because they fear that the quality of education will be compromised (Radó, 2018). Csepeli's work (2003) summarized the current situation in Hungary: educating children with SEN and disadvantaged in general education classrooms is a failure, and the heads of institutions themselves are not committed to this kind of educational practices.

Examining education statistics in Hungary is very complicated due to the difficulty of accessing data from all years and the possibility of data manipulation in the past. However, when we look at the available data, it is seen that the most important point is the decrease in the number of students. In 1994, 1.053.000 children were enrolled in full-time primary education in Hungary compared to 724,000 in 2019 (KSH- Hungarian Central Statistical Office, 2023). The Salamanca Statement targeted inclusion from a human rights perspective. However, the Hungarian education system has faced the most serious challenges in the last 30 years, such as the drastic decrease in the total number of children (Mrázik, 2017, 2021), exacerbated by temporary or permanent emigration to neighboring countries (Langerné, 2021). In addition, the decreasing number of teachers (Lukács, 2023) made it more difficult an overall shift towards inclusion.

Conclusion and Recommendations

In this study, we compared the educational systems of two very different countries in terms of the Salamanca Statement and its effects. The results of our comparison revealed that the developments related to inclusion in both countries are progressing very slowly and with several problems. Of course, the sources of problems and what is done in policies and practices differ according to the cultural, historical, and political structure of the two countries. For example, although the practices in Türkiye cannot be called 'inclusion' yet, it is clear that there is progress in the direction of inclusive education. However, when looking at the practices, physical inadequacies in educational environments, inadequacies in teacher training and skills, lack of support services, overcrowded classes, and lack of materials are noticeable. The fact that Türkiye has prepared National Action Plan for Educational Practices Through Integration/Inclusion (MoNE, 2022) in which they aim to carry out various actions within five years for a more inclusive education shows that they are aware of these shortcomings and are making efforts to overcome them. Looking at Hungary, it is possible to see that there is no clear point of view in terms of the concepts of integration and inclusion, and that problems arising from the country's political past made inclusive education difficult. It is understood from the research results from Hungary that there are similar problems in the education of children with special needs in Hungary as in Türkiye.

In line with these results, we believe that the following recommendations can be made:

- Although legal regulations regarding inclusion have developed to a certain extent in both countries, there are significant gaps in the implementation of these regulations. In this context, in order to strengthen the transition between policy and practice, collaborations should be established between universities and ministries of education, and inclusive practices should be implemented.
- Both in Türkiye and Hungary, it has been observed that teachers have little knowledge, have inadequate classroom competencies, and are inadequately prepared for different student profiles. This situation prevents the effective implementation of inclusive practices in schools. Therefore, inclusion should be systematically included in pre-service and in-service teacher training.

In summary, the comparison of the education systems of Türkiye and Hungary and the approaches to inclusive education, once again reveals that the effects of the Salamanca Statement and its effects on the implementation can be at different speeds and intensity in different countries (Hunt, 2011). Of course, the political, cultural, and historical characteristics of the countries strongly influence the size and type of the effects of the Salamanca Statement (Magnússon, 2019). However, after 30 years have passed since declared of the principles of inclusion in Salamanca, we conclude that it is important to work for the creation of a common language and common practice globally in terms of inclusion

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