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Examination of interactive peer play behaviors of children aged 48-72 months with father involvement

Duygu Çetingöz ¹, Endam Düz yol Türk ², Neriman Aral ³

Abstract

The aim of this study was to examine the impact of fathers' involvement levels and certain demographic characteristics on the interactive peer play behaviors of children aged 48-72 months. The study included 328 children from Türkiye and their fathers. The Father Involvement Scale and the Penn Interactive Peer Play Scale - Parent Form were used as data collection tools. According to the findings, fathers' involvement levels did not differ based on the gender of the child. However, when the children's interactive peer play behaviors were examined, girls had significantly higher scores in the play interaction dimension, whereas boys scored higher in the play disruption and play disconnection dimensions. Regarding the leisure activity scores of the fathers, it was found that children with one sibling experienced more father involvement compared to those with three or more siblings. Similarly, children with two siblings experienced more father involvement than those with three or more siblings. Despite these differences, however, interactive peer play behaviors did not significantly vary according to the number of siblings. It was also found that children whose mothers had higher levels of education had higher scores in both the leisure and primary caregiving dimensions of father involvement, as well as in the play interaction dimension of peer play behavior. Furthermore, children whose fathers had higher education levels also had higher father involvement in leisure activities. Fathers who spent more time daily playing with their children had higher scores for leisure involvement, primary caregiving, interest, and closeness. However, no significant difference was found between the duration of daily father-child play and the child's interactive peer play behaviors. A moderate positive correlation was found between the dimensions of father involvement (leisure engagement, attention and closeness, primary caregiving) and the play interaction dimension. A low-level negative correlation was identified between attention and closeness and the play disconnection dimension.

Keywords

Father involvement
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Peer interaction
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Introduction

The preschool period, which is the most critical period for development, is influenced by various environmental factors, primarily parents, leading to positive or negative effects on children's personalities. Particularly in terms of social and emotional development, parents play a crucial role in helping children develop a healthy personality and establish positive interactions with their surroundings (Carneiro et al., 2019; Kandır & Alpan, 2008). The quality of time spent with parents during this influential period is vital for development, and this responsibility should not be assigned to a single parent. In the preschool period, fathers hold significant responsibilities for the child's development and education, comparable to those of mothers (Lin et al., 2019; McBride & Rane, 1997). However, in many societies, including Turkish society, mothers are primarily seen as the person responsible for the care and education of the child (Tezel Şahin & Özbeş, 2007). However, recent studies have shown that the active involvement of both mothers and fathers in the care and education processes of the child not only provides interactive and joint contributions to the child's development but also has a positive impact on the relationship between the parents (Cabrera et al., 2018). If both mothers and fathers actively participate in the care and education of their children, complementing each other and providing support, they can achieve significant gains in both their relationships with their children and with each other (Sullivan et al., 2020; Tezel Şahin & Özbeş, 2007).

Until about 20 years ago, in most studies on family involvement data were collected mainly from mothers. There has been limited research on father involvement by collecting data directly from them (Slaughter & Nagoshi, 2020; Wilson & Prior, 2011; Zanoni et al., 2013). However, fathers' participation in education is equally as important as mothers' involvement (Bronte Tinkew et al., 2008; Cabrera et al., 2011; Jones, 2004). Preschool-aged children enjoy spending time with their fathers, exchanging ideas, and learning new things from them (Uzun & Baran, 2019). Moreover, it has been observed that children who are supported by father involvement during this period effectively receive the necessary knowledge, skills, and emotional support for their development and education (Uzun & Baran, 2019; Zhang et al., 2021). These findings indicate that the roles of both mothers and fathers in children's development should be addressed through a holistic approach, and that supporting fathers' more active involvement in educational processes could make a particularly significant contribution to children's well-rounded development.

Positive relationships between fathers and children from early ages can positively impact various aspects of children's well-being, their problem-solving abilities, and their academic, social, and emotional skills (Coyl Shepherd & Newland, 2013). Research indicates that involved fathers positively influence a child's cognitive skills, social-emotional competence, and peer relationships (Veríssimo et al., 2011; Xu et al., 2020). Furthermore, actions that positively affect children's peer relationships, such as interactive play, highlight the significance of parental involvement, with both mothers and fathers participating in their children's activities. As a result of parental participation, play becomes an integral part of family life, contributing to its nourishment and formation (Schneider et al., 2022; Tamis LeMonda et al., 2002). The study conducted by Robinson et al. (2021) confirmed that play interactions between fathers and children have positive effects on children's emotional regulation and social skills. That study found that fathers typically engaged in more physical and stimulating types of play, and such interactions positively influenced the children's emotional regulation and social competencies. These play-based interactions not only strengthen father-child bonds but also provide a foundation for children to practice and develop the skills necessary for forming positive peer relationships. Moreover, the quality of these play experiences has been associated with more favorable outcomes in children's social development, emphasizing the importance of conducting play in a supportive and responsive manner. In this context, the active involvement of fathers in their children's lives supports the development of children's social and emotional skills, allowing these skills to be reinforced particularly through peer interactions in play settings (Robinson et al., 2021).

Interactive peer play, a universal characteristic, is engaged in by all preschool-aged children. Children from different lifestyles and cultures naturally engage in various games with each other (Edwards, 2021; Zigler et al., 2002). Interaction within the play environment is a determinant of a child's social behaviors (Sevinç, 2004). A child's personality becomes more pronounced during play (Seyrek & Sun, 1991). Additionally, play serves as a crucial tool in determining a child's interaction patterns with adults and peers (Pellegrini & Smith, 1998; Shorer & Leibovich, 2020), positioning it among the most favorable environments for the development of positive peer relationships. The relationships children develop with their parents also play a significant role in shaping their behavior in play environments (Stearns, 2019; Tamis LeMonda et al., 2002). In particular, the playtime fathers spend with their children not only supports all areas of children's development but also imparts diverse knowledge to children, contributing to the positive development of peer relationships (İşikoğlu & Bora İvrendi, 2008; Menashe Grinberg & Atzaba Poria, 2017).

Although the number of studies conducted in Türkiye on father involvement during the preschool period is small (Kuzucu, 2011; Yoleri, 2022), there has been a noticeable increase in international research on this topic in recent years (Alabay, 2021; Arslan & Demircioğlu, 2023; d'Orsi et al., 2023; Lamb & Lewis, 2010; Pekel Uludağlı, 2017; Varol et al., 2023; Zhang et al., 2021). Thus, studies conducted in Türkiye have remained limited compared to international efforts. However, several national and international studies have examined interactive play behaviors (Can Yaşar et al., 2019; Dunn, 2002; Karaca et al., 2020; Moustafa, 2021; Ross & Howe, 2008; Torres et al., 2013; Uygun & Kozikoğlu, 2019; Yokuş & Konokman, 2019). The research conducted in this field in Türkiye has predominantly focused on the effects of father involvement on various domains of child development (Arslan & Demircioğlu, 2023; Gürşimşek et al., 2007; Kuzucu, 2011). Although some in-depth examinations of father involvement are available in the literature (Kuzucu, 2011; Yoleri, 2022), studies that specifically explore the impact of the father-child relationship on children's interactive peer play behaviors are extremely scarce (Attili et al., 2015; Karaca et al., 2019). A review of the international literature reveals a limited number of studies that simultaneously address both father involvement and interactive peer play behaviors (Downer & Mendez, 2005; MacDonald & Parke, 1984; Pettit et al., 1998; Suh, 2017; Torres et al., 2013). However, to date, no study conducted in Türkiye has been identified that concurrently examines father involvement and interactive peer play behaviors.

In a previous study, it was determined that a positive father-child relationship positively influences the peer play behaviors of children (MacDonald & Parke, 1984). Another study conducted by the same researchers two years later found that the physical play fathers engage in with their children in daily life plays a significant role in the gender development of children (MacDonald & Parke, 1986). Children supported by fathers from an early age, having positive interactions with their fathers, were found to exhibit increased cognitive, linguistic, social, and emotional skills; independence; and positive interpersonal relationships and academic achievements (Gürşimşek et al., 2007).

In another study, children who frequently engaged in interactive peer play at home were observed to exhibit less disruptive behavior, less detachment from the game, high motivation, independence, positive attitudes towards learning, and the ability to concentrate (Fantuzzo & McWayne, 2002). Additionally, when the frequency and quality of fathers playing with children were examined in their early years, it was determined that play positively influenced children's social, emotional, and cognitive development (Amodia Bidakowska et al., 2020). McLean et al. (2023) found that adults' lack of understanding of the meaning of play hindered young children's effective engagement in the play process and maximization of learning opportunities through play.

Although previous studies have shown that positive father-child relationships influence children's social and emotional development (Gürşimşek et al., 2007; MacDonald & Parke, 1984, 1986) and that interactive peer play supports various aspects of early childhood development (Amodia-Bidakowska et al., 2020; Fantuzzo & McWayne, 2002; McLean et al., 2023), there remains a significant gap in the literature regarding the simultaneous and direct examination of the relationship between the father's involvement and the child's interactive peer play behaviors. The vast majority of existing

research focuses either solely on father involvement or solely on peer play; no previous study has been identified that addresses the relationship between these two variables, particularly within the context of Türkiye. Therefore, in the present study, the aim was to examine the relationship between the levels of father involvement and interactive peer play behaviors of children aged 48-72 months. The research problem is defined as "What are the relationships between the levels of father involvement and interactive peer play behaviors, as well as some demographic characteristics of children aged 48-72 months? Is there a relationship between the levels of father involvement and interactive peer play behaviors of preschool children?". In line with this, the following questions will be addressed:

- What are the levels of father involvement and interactive peer play behavior of children aged 48-72 months?
- Do the levels of father involvement and interactive peer play behaviors of children aged 48-72 months show significant differences according to some variables (gender, number of siblings, parental education level, and father's daily playtime with the child)?
- Is there a significant relationship between children's father involvement levels and interactive peer play behaviors?

Method

Research Model

In the present study, in which the aim was to determine the relationship between the levels of father involvement and interactive peer play behaviors, the relational survey model, a quantitative research method, was used. Quantitative research provides results based on deductive measurements and analysis (Watson, 2015). The aim of the relational survey model is to determine the degree of relationships between two or more variables and the causes and consequences of these variables (Büyüköztürk et al., 2014).

Population/Sample

The population of the study consisted of children aged 48-72 months (and their fathers) attending independent kindergartens in the city center of Izmir. The sample group of this study was determined using a random sampling method and consisted of 328 children (and their fathers) enrolled in 9 independent preschools affiliated with the Ministry of National Education, located in the central districts of Buca, Konak, and Karşıyaka in the province of Izmir.

Of the children, 172 (52.4%) were 48-60 months old and 156 (47.6%) were 61-72 months old. There were 169 female children (51.5%) and 159 male children (48.5%). Among them, 120 children (36.6%) had one sibling, 167 children (50.9%) had two, and 41 children (12.5%) have three or more. Regarding the duration of preschool education, 137 children (41.8%) had attended for 0-1 year, 142 children (43.3%) for 1-2 years, and 49 children (14.9%) for 2-3 years.

Regarding the educational level of the mothers, 38 children (11.6%) had mothers with an elementary school education, 89 (27.1%) had mothers with a high school education, and 201 (61.3%) had mothers with a university education. The educational level of the fathers was as follows: 40 children (12.2%) had fathers with an elementary school education, 110 (33.5%) had fathers with a high school education, and 178 (54.3%) had fathers with a university education. Among the fathers, 220 (67.1%) were in the 20-40 age range and 108 (32.9%) were 41 or older. In terms of daily playtime with their children, 89 fathers (27.1%) played for 0-30 minutes, 138 (42.1%) played for 31-60 minutes, and 101 (30.8%) played for 61 minutes or more.

Data Collection Tools

To determine father involvement, the Father Involvement Scale, developed by Simsiki and Sendil (2014), was used. To measure the quality of children's interactive peer play behaviors, the Penn Interactive Peer Play Scale-Parent Form, developed by Fantuzzo et al. (1998) and adapted into Turkish by Ahmetoğlu et al. (2016), was utilized. Demographic information about the children was collected using a personal information form developed by the researchers.

The Father Involvement Scale is a five-point Likert-type scale that assesses how often fathers with children aged 36-72 months participate in activities in the dimensions. The scale consists of three dimensions: arbitrary occupation (AO) (17 items), attention and closeness (AC) (12 items), and primary care (PC) (8 items). The scale, comprising a total of 37 items, can yield a minimum score of 37 and a maximum score of 185. The Cronbach's alpha reliability coefficients for the scale were determined as 0.89 for AO, .83 for PC, .85 for AC, and .92 for the total score (Simsiki & Şendil, 2014).

The Penn Interactive Peer Play Scale-Parent Form is a four-point Likert-type scale that evaluates contextual behaviors exhibited by children with their peers through assessments made by parents regarding the play interactions of children aged 40-82 months. The scale consists of three dimensions: play interaction (PI) (9 items), play disruption (PDR) (10 items), and play disconnection (PDC) (10 items), totaling 29 items. The Cronbach's alpha reliability coefficients for the scale were determined as 0.72 for PI, 0.75 for PDR, and 0.68 for PDC (Ahmetoğlu et al., 2016).

The personal information form developed by the researchers includes variables such as the gender of the child, the number of siblings, the educational level of the mother and father, and the daily playtime of the father with the child.

Data Collection Process

Permission was obtained from the developers and adaptors of the Father Involvement Scale and the Penn Interactive Peer Play Scale-Parent Form, which were used in the study. Prior to implementation, ethical approval was obtained. Randomly selected classes were determined through discussions with school administrators of schools in Buca, Karşıyaka, and Konak. Preschool teachers were informed about the research. Since participation in the study was voluntary, a parental consent form and volunteer participation form were sent to the parents of children in the participating schools. The children of fathers who agreed to participate in the research were included in the implementation. The Father Involvement Scale, Penn Interactive Peer Play Scale-Parent Form, and personal information form were distributed to parents who agreed to fill out the scales and forms, and they were collected on the specified date. Ethics committee approval was obtained with decision number 22 dated 13/06/2023.

Data Analysis

IBM SPSS was used for the examination and statistical analysis of the data obtained in the research. Prior to analysis, an examination of missing values and outliers was conducted, and no missing values or outliers were found. According to Tabachnick and Fidell (2013), skewness and kurtosis values between ± 1.50 can be considered normal distribution in social science research. Büyüköztürk (2012) stated that distribution can be considered normal between ± 2.00 . When the skewness and kurtosis values were examined, it was determined that all dimensions of the Father Involvement Scale and the Penn Interactive Peer Play Scale-Parent Form showed a normal distribution. In this context, parametric tests were applied. The independent samples t-test, one-way analysis of variance (ANOVA), LSD test, and Pearson's correlation analysis were applied.

Assumptions and Limitations

In this study, it was assumed that fathers responded sincerely and honestly to the data collection tools and that their evaluations regarding their children reflected actual behaviors. The sample was limited to children and fathers from independent preschools located in three central districts of İzmir; this limits the generalizability of the findings.

Results

The levels of father involvement and interactive peer play behavior of children aged 48-72 months are presented in Table 1.

Table 1. Levels of Father Involvement and Interactive Peer Play Behavior

	n	Min	Max	Mean	sd
FI AO	328	24.00	85.00	61.24	13.11
FI AC	328	12.00	60.00	54.41	8.098
FI PC	328	8.00	40.00	28.67	8.10
PENN PI	328	9.00	36.00	26.03	4.90
PENN PDR	328	10.00	28.00	14.42	3.26
PENN PDC	328	10.00	35.00	15.58	4.12

The Father Involvement Scale-Arbitrary Occupation (FI AO), The Father Involvement Scale-Attention and Closeness (FI AC), The Father Involvement Scale-Primary Care (FI PC), The Penn Interactive Peer Play Scale-Play Interaction (PENN PI), The Penn Interactive Peer Play Scale-Play Disruption (PENN PDR), The Penn Interactive Peer Play Scale-Play Disconnection (PENN PDC)

Upon examining Table 1, it is observed that the averages obtained from the dimensions of the Father Involvement Scale for children aged 48-72 months were 61.24 for arbitrary occupation, 54.41 for attention and closeness, and 28.67 for primary care. The averages obtained from the dimensions of the Penn Interactive Peer Play Scale-Parent Form were 26.03 for play interaction, 14.42 for play disruption, and 15.58 for play disconnection.

Table 2 presents the results of independent group t-tests for the levels of father involvement and dimension scores of interactive peer play behaviors based on gender.

Table 2. Independent Group t-test Results for Gender Differences in Father Involvement and Interactive Peer Play Behaviors

Score	Gender	n	Mean	sd	t	df	p
FI AO	Female	169	61.38	13.12	.20	326	.84
	Male	159	61.09	13.15			
FI AC	Female	169	54.28	8.29	-.31	326	.75
	Male	159	54.56	7.92			
FI PC	Female	169	27.89	8.54	-1.80	326	.07
	Male	159	29.50	7.55			
PENN PI	Female	169	26.54	4.62	1.98	326	.04
	Male	159	25.48	5.14			
PENN PDR	Female	169	14.05	3.03	-2.11	326	.04
	Male	159	14.81	3.46			
PENN PDC	Female	169	15.12	3.94	-2.10	326	.04
	Male	159	16.07	4.25			

As seen in Table 2, the levels of father involvement do not differ based on the gender of the children ($t=.84; .75; .07$). However, significant differences were found in play interaction in favor of girls, while the dimensions play disruption and play disconnection showed significant differences in favor of boys ($t=.04; .04; .04; p<.05$).

The one-way ANOVA results for the levels of father involvement and dimension scores of interactive peer play behaviors based on the number of siblings are presented in Table 3.

Table 3. One-Way Analysis of Variance Results for Father Involvement and Interactive Peer Play Behaviors based on the Number of Siblings

ANOVA												
<i>f</i> , \bar{x} , <i>sd</i>	Number of Siblings	<i>n</i>	\bar{x}	<i>sd</i>	CoV	ST	<i>df</i>	SO	<i>F</i>	<i>p</i>	Dif.*	
FI AO	One	120	61.58	13.41	Between groups	1996.03	2	998.01	5.98	.00	1-3	
	Two	67	62.57	12.81	Within-group	54237.94	325	166.89			2-3	
	Three or more	41	54.83	11.85	Total	56233.97	327				3-1	
FI AC	One	120	54.22	8.36	Between groups	167.90	2	83.95	1.28	.28		
	Two	67	54.96	8.14	Within-group	21273.71	325	65.46				
	Three or more	41	52.76	7.00	Total	21441.61	327				3-2	
FI PC	One	120	28.38	8.41	Between groups	267.42	2	133.71	2.05	.13		
	Two	67	29.38	7.92	Within-group	21203.36	325	65.24				
	Three or more	41	26.61	7.69	Total	21470.78	327					
PENN PI	One	120	25.98	4.76	Between groups	55.04	2	27.52	1.15	.32		
	Two	67	26.31	5.03	Within-group	7791.71	325	23.97				
	Three or more	41	25.02	4.75	Total	7846.75	327					
PENN	One	120	14.69	3.87	Between groups	13.93	2	6.97	.65	.52		
	Two	67	14.26	2.91	Within-group	3468.01	325	10.67				
	Three or more	41	14.29	2.67	Total	3481.94	327					
PDC	One	120	16.13	4.37	Between groups	91.80	2	45.90	2.74	.07		
	Two	67	15.06	4.00	Within-group	5454.14	325	16.78				
	Three or more	41	16.10	3.62	Total	5545.94	327					

*LSD Results

In Table 3, a significant difference was found in the arbitrary occupation scores of children aged 48-72 months between the groups in terms of the arithmetic means ($F=5.98$; $p<.05$). Post-hoc analyses revealed homogeneity of variances and the LSD test was applied ($LF=.73$; $p>.05$). The difference in children occurred at the sibling level, favoring one sibling over three or more siblings at the $p<.05$ level. Between two siblings and three or more siblings, the group with two siblings had an advantage at the $p<.05$ level. However, no significant differences were found between the arithmetic means of the other groups ($p>.05$). The one-way ANOVA results for the levels of father involvement and dimension scores of interactive peer play behaviors based on the mother's educational level are presented in Table 4.

Table 4. One-Way Analysis of Variance Results for Father Involvement Levels and Interactive Peer Play Behaviors based on the Mother's Educational Level

ANOVA												
<i>f</i> , \bar{x} , <i>sd</i>	Mother's Score	educ. level	<i>n</i>	\bar{x}	<i>sd</i>	CoV	<i>ST</i>	<i>df</i>	SO	<i>F</i>	<i>p</i>	Dif.*
FI AO		Elementary	38	55.45	15.04	Between groups	2439.62	2	1219.81	7.37	.00	1-3
		High School	89	59.21	12.28	Within-group	53794.35	325	165.52			2-3
		University	201	63.23	12.68	Total	56233.97	327				3-1 3-2
FI AC		Elementary	38	52.05	11.94	Between groups	241.55	2	120.78	1.85	.16	
		High School	89	54.61	7.64	Within-group	21200.06	325	65.23			
		University	201	54.78	7.34	Total	21441.61	327				
FI PC		Elementary	38	25.05	8.79	Between groups	821.43	2	410.72	6.46	.00	1-3
		High School	89	27.72	7.89	Within-group	20649.34	325	63.54			2-3
		University	201	29.77	7.84	Total	21470.78	327				3-1 3-2
PENN PI		Elementary	38	23.26	5.42	Between groups	331.91	2	165.95	7.18	.00	1-2
		High School	89	26.22	4.62	Within-group	7514.84	325	23.12			1-3
		University	201	26.46	4.77	Total	7846.75	327				2-1 3-1
PENN PDR		Elementary	38	16.11	3.46	Between groups	121.96	2	60.98	5.90	.00	1-2
		High School	89	14.20	3.35	Within-group	3359.98	325	10.34			1-3
		University	201	14.20	3.11	Total	3481.94	327				2-1 3-1
PENN	Elementary	38	16.39	4.22	Between groups	28.99	2	14.50	.85	.43		
PDC	High School	89	15.42	4.41	Within-group	5516.95	325	16.98				
	University	201	15.50	3.97	Total	5545.94	327					

* LSD Results

Examination of Table 4 reveals a significant difference in father involvement in the dimensions arbitrary occupation and primary care, as well as in interactive peer play behaviors in the dimensions play interaction and play disruption ($F=7.37$; 6.46 ; 7.18 ; 5.90 ; $p<.05$). Post-hoc analyses revealed homogeneity of variances and the LSD test was applied ($LF=.15$; $.81$; $.62$; $.21$; $p>.05$). Significant differences were found in the dimensions of arbitrary occupation and primary care of father involvement between elementary school and university and between high school and university, in favor of those with a university education. In the dimension play interaction in interactive peer play behaviors, significant differences were found between elementary school and high school and between elementary school and university, in favor of those with a high school and university education ($p<.05$). In the dimension play disruption, significant differences were found between elementary school and high school and between elementary school and university, in favor of those with an elementary school education ($p<.05$). However, no significant differences were found between the arithmetic means of the other groups ($p>.05$).

Table 5 presents the one-way ANOVA results for the levels of father involvement and dimension scores of interactive peer play behaviors based on the father's educational level.

Table 5. One-Way Analysis of Variance Results for Father Involvement Levels and Interactive Peer Play Behaviors based on the Father's Educational Level

ANOVA											
<i>f</i> , <i>̄x</i> , <i>sd</i> Score	Father's educ. level	<i>n</i>	<i>̄x</i>	<i>sd</i>	CoV	<i>ST</i>	<i>df</i>	<i>SO</i>	<i>F</i>	<i>p</i>	Dif.*
FI AO	Elementary	40	57.28	13.98	Between groups	2299.74	2	1149.87	6.93	.00	1-3
	High School	110	58.81	12.92	Within-group	53934.23	325	165.95			2-3
	University	178	63.63	12.61	Total	56233.97	327				3-1
FI AC	Elementary	40	54.43	9.49	Between groups	34.53	2	17.27	.26	.77	
	High School	110	53.97	8.09	Within-group	21407.08	325	65.87			
	University	178	54.69	7.80	Total	21441.61	327				3-2
FI PC	Elementary	40	27.65	8.66	Between groups	103.71	2	51.85	.79	.46	
	High School	110	28.25	8.35	Within-group	21367.07	325	65.74			
	University	178	29.16	7.83	Total	21470.78	327				
PENN PI	Elementary	40	24.93	5.29	Between groups	72.23	2	36.12	1.51	.22	
	High School	110	25.87	4.89	Within-group	7774.52	325	23.92			
	University	178	26.37	4.80	Total	7846.75	327				
PENN	Elementary	40	15.13	3.24	Between groups	22.60	2	11.30	1.06	.35	
PDR	High School	110	14.33	3.27	Within-group	3459.34	325	10.64			
	University	178	14.32	3.26	Total	3481.94	327				
PENN	Elementary	40	16.45	4.58	Between groups	35.38	2	17.69	1.04	.35	
PDC	High School	110	15.53	4.11	Within-group	5510.55	325	16.96			
	University	178	15.42	4.01	Total	5545.94	327				

*LSD Results

According to Table 5, the father's educational level creates a significant difference in the dimension arbitrary occupation of father involvement for children aged 48-72 months ($F=6.93$; $p<.05$). Due to the homogeneity of variances, the LSD test was applied ($LF=.57$; $p>.05$). Significant differences were found in the dimension arbitrary occupation of father involvement between university and elementary school and between university and high school, in favor of those with a university education ($p<.05$). However, no significant differences were found between the arithmetic means of the other groups ($p>.05$).

Table 6 presents the one-way ANOVA results for the levels of father involvement and dimension scores of interactive peer play behaviors based on the daily playtime between the father and the child.

Table 6. One-Way Analysis of Variance Results for Father Involvement Levels and Interactive Peer Play Behaviors based on the Father's Daily Playtime with the Child

ANOVA												
<i>f</i> , \bar{x} , <i>sd</i>	Playtime with the father	<i>n</i>	\bar{x}	<i>sd</i>	CoV	ST	<i>df</i>	SO	<i>F</i>	<i>p</i>	Dif. *	
FI AO	0-30 min.	89	53.53	12.83	Between groups	8412.47	2	4206.23	28.59	.00	1-2	
	31-60 min.	138	62.24	12.07	Within-group	47821.51	325	147.14			1-3	
	61 min. and above	101	66.67	11.57	Total	56233.97	327				2-1	
FI AC	0-30 min.	89	52.20	9.06	Between groups	655.35	2	327.68	5.12	.01	1-2	
	31-60 min.	138	54.82	7.34	Within-group	20786.26	325	63.96			1-3	
	61 min. and above	101	55.81	7.86	Total	21441.61	327				2-1	
FI PC	0-30 min.	89	26.40	9.06	Between groups	736.58	2	368.29	5.77	.00	1-2	
	31-60 min.	138	28.93	7.75	Within-group	20734.20	325	63.80			1-3	
	61 min. and above	101	30.31	7.27	Total	21470.78	327				2-1	
PENN PI	0-30 min.	89	25.69	4.57	Between groups	85.93	2	42.96	1.80	.17		
	31-60 min.	138	26.62	4.66	Within-group	7760.82	325	23.88				
	61 min. and above	101	25.51	5.43	Total	7846.75	327					
PENN PDR	0-30 min.	89	14.34	3.36	Between groups	1.22	2	.61	.06	.94		
	31-60 min.	138	14.49	2.99	Within-group	3480.72	325	10.71				
	61 min. and above	101	14.41	3.55	Total	3481.94	327					
PENN PDC	0-30 min.	89	15.42	3.74	Between groups	8.61	2	4.31	.25	.78		
	31-60 min.	138	15.77	3.92	Within-group	5537.33	325	17.04				
	61 min. and above	101	15.47	4.70	Total	5545.94	327					

*LSD Testi Sonuçları

Table 6 reveals that the father's daily playtime with the child shows a significant difference in all dimensions of father involvement ($F=28.59$; 5.12 ; 5.77 ; $p<.05$). Due to the homogeneity of variances, the LSD test was applied ($LF=.53$; $.09$; $.07$; $p>.05$). In the dimension arbitrary occupation, significant differences were found in favor of the group spending more than 61 minutes playing games, compared to the groups with 0-30 minutes and 31-60 minutes. Between 31-60 minutes and 0-30 minutes, a significant difference was also found in favor of the group playing games for 31-60 minutes. In the dimensions primary care and attention and closeness, significant differences were found between 31-60 minutes and 0-30 minutes, favoring the group playing games for 31-60 minutes. Similarly, between 61 minutes and above and 0-30 minutes, a significant difference was found in favor of the group playing games for more than 61 minutes ($p<.05$). However, no significant differences were found between the arithmetic means of the other groups ($p>.05$).

Table 7 presents the results of Pearson's correlation analysis conducted to determine the relationship between children's levels of father involvement and interactive peer play behaviors.

Table 7. Pearson Correlation Analysis Results between Father Involvement Levels and Interactive Peer Play Behaviors

		PENN PI	PENN PDR	PENN PDC
FI AO	r	.38	-.04	-.09
	p	.00	.47	.12
	N	328	328	328
FI AC	r	.39	-.02	-.15
	p	.00	.68	.01
	N	328	328	328
FI PC	r	.31	.01	-.04
	p	.00	.92	.49
	N	328	328	328

As seen in Table 7, a positive and moderate correlation was identified between the dimensions of father involvement, namely arbitrary occupation, attention and closeness, primary care, and play interaction ($r=.38; .39; .31; p<.05$). Additionally, a low-level negative correlation was found between the dimension attention and closeness of father involvement and play disconnection ($r=-.15; p<.05$).

Discussion, Conclusion and Suggestions

In the present study, the aim was to examine the interactive peer play behaviors of children aged 48-72 months in terms of father involvement levels and certain demographic characteristics. It was found that father involvement levels did not differ based on the children's genders. Parallel to our study, the literature indicates that there are studies showing that the gender variable does not affect father involvement (Deleş & Kaytez, 2020; Paulson et al., 2010; Uzun & Baran, 2019). Recent research also suggests that fathers contribute to the development of their children regardless of their genders.

Regarding interactive peer play behaviors of children, it was determined that the play interaction dimension showed a significant difference in favor of girls, whereas the dimensions play disruption and play disconnection favored boys. Similar findings have been reported in both national and international studies, indicating that girls tend to have higher levels of play interaction than boys (Can Yaşar et al., 2019; Torres et al., 2013). Similarly, levels of play disruption have been found to be higher in boys compared to girls, in line with our study (Karaca et al., 2020; Torres et al., 2013). Moreover, Polenski (2001) mentioned that boys tend to display more externalizing behavior problems than girls. Play interaction reflects the strong aspects of children in the game, including creative behavior and encouragement for other children to join the game. Play disruption represents antisocial behaviors that hinder ongoing peer interaction in the game. Children may exhibit aggressive and angry behaviors. Play disconnection reflects a lack of participation in peer games and children may show introverted behaviors (Fantuzzo et al., 1998). These characteristics are associated with social skills. In the preschool period, girls tend to exhibit more positive traits than boys in terms of social skill levels (Mercurio, 2003; Park & Cheah, 2005), suggesting that they experience fewer difficulties and manage peer interaction-rich play processes more effectively. In their study examining father involvement and peer play competence in preschool-aged children, Torres et al. (2013) used multiple regression models and found that boys were more likely to exhibit disruptive play behaviors and showed less peer interaction. In this context, the results of the study suggest that, similar to the literature, it is expected to find more positive behaviors in the interactive peer play of girls compared to in boys.

In terms of the arbitrary occupation scores of fathers, a preference was identified for children with one sibling over those with three or more siblings. Additionally, a preference was determined for the group with two siblings over those with three or more siblings. In this context, it appears that as the number of children decreases, fathers' engagement in free-time activities and various games with their children increases. In the literature, there are studies in which a decrease in father involvement rates was found as the number of children increased (Mehall et al., 2009; Paquette et al., 2022; Simsik &

Şendil, 2014). Arbitrary occupation includes fathers playing games and engaging in free-time activities with their children (Simsıkı & Şendil, 2014). Playing games within the context of arbitrary occupation is a social behavior. With an increase in the number of children, it is thought that the increase in the number of individuals with whom children can play games at home may lead to children playing games with their siblings. However, it can be emphasized that the number of siblings is not a factor causing a change in fathers' behaviors regarding showing attention, closeness, and providing primary care to their children. In this context, the fact that father involvement as reflected by showing interest, establishing closeness, and providing basic care does not vary based on the number of siblings may be explained by fathers prioritizing those duties and responsibilities over leisure engagement.

The research results indicated that interactive peer play behaviors did not differ based on the number of siblings for children. These findings are in line with studies in the literature suggesting that the number of siblings does not create a difference in interactive peer play behaviors (Moustafa, 2021; Uygun & Kozikoğlu, 2019). However, there are also studies suggesting that the number of siblings may lead to differences in children's peer play behaviors (Dunn, 2002; Ross & Howe, 2008; Yokuş & Konokman, 2019). Ross and Howe (2008) emphasized that the relationships developed between siblings are likely to be reflected in children's relationships and play with peers, and they highlighted not only sibling relationships but also parent-child relationships in this regard. Furthermore, they noted that parents, like siblings, play an important role in children's social interactions with peers. The inconsistencies in the literature may be attributed to differences in parental attitudes at home, levels of parental involvement, the nature of communication and interaction between siblings, and cultural factors. In the present study, the finding that children with one or two siblings differed in terms of the father's leisure engagement can be interpreted as an indication that the potential lack of social interaction behaviors in the play processes of children with fewer siblings might be compensated through father involvement. Therefore, the children's interactive peer play behaviors did not vary significantly according to the number of siblings. It is also thought that the characteristics of the interactive play behaviors established between siblings may influence whether a significant difference emerges.

It was found in the present study that children whose mothers had higher levels of education had higher scores in father participation's arbitrary occupation and primary care, as well as interactive peer play behaviors' game interaction. It was also concluded that children whose fathers had higher levels of education had higher scores in father participation's arbitrary occupation. Similarly, higher education levels were positively associated with primary care, participation in play, and father involvement, consistent with previous research (Craig, 2006; Ihmeideh, 2014; Mwoma, 2009; Sasaki et al., 2010). In our study, a difference in favor of children with lower mother's education levels was found in the play disruption dimension. Shafiq (2010) also consistently stated that higher mother's education positively influences children's social behaviors. Nkwake (2009) found that parents with higher education levels had higher levels of knowledge and stronger parent-child relationships. In this context, it appears that as the educational levels of caregivers increase, their knowledge about child development and how to support it also increases. This situation positively affects father involvement and children's peer play behaviors. Additionally, it can be argued that parents with higher education levels mutually influence each other and show increased interest in their children.

In groups in which fathers spend more time playing daily games with their children, it was determined that father involvement's arbitrary occupation, primary care, and attention and closeness scores were higher. Levin and Currie (2010) mentioned that communication between fathers and children is influential in small children feeling happy and satisfied with their lives. Culp et al. (2000) found that high levels of father involvement were associated with an increased sense of acceptance perceived by children from their fathers, and they emphasized the significance of fathers taking on the role of playmate. Another study revealed that higher levels of father involvement were linked to increased prosocial play with peers (Torres et al., 2013). Based on the finding of our study that the act of fathers spending more time playing with their children enhanced father involvement, it can be

suggested that children may feel valued and happy in the presence of father involvement, which could contribute to the development of positive characteristics in their interactive play behaviors. However, no significant difference was found between the amount of time fathers spent playing with their children on a daily basis and the children's interactive play behaviors. Examination of the literature indicates that fathers generally play educational games with preschool children and engage less in interesting games, stories, or experiments (Kutluana & Şahan, 2021). In another study, it was found that fathers go to parks/picnics and theaters/cinemas and engage in sports and shopping (buying toys, books) with their children during the day (McWayne et al., 2013; Şahin et al., 2017). McWayne et al. (2013) explained in their meta-analysis that the time fathers spend with their children can play a role just as important as other factors, provided that this time is devoted to interactive father-child activities that are expected to support the child's development. Indeed, as seen in various research, the activities fathers engage in while playing with their children are limited and often remain at the level of father involvement. In this study, the duration of fathers' involvement was not reflected in the children's interactive peer play behaviors. This outcome may be attributed to various factors including the attitudes and roles that fathers exhibit during play, the quality of the father-child relationship, the nature of the time spent together, the number of children in the family, and the developmental characteristics of the children.

In the present study, a positive moderate correlation was found between father involvement's dimensions of arbitrary occupation, attention and closeness, primary care, and play interaction. A negative low-level correlation was determined between the attention and closeness dimensions of father involvement and play disconnection. It is apparent that children who receive attention from their fathers are inclined to play with their peers in an outgoing manner. A review of the relevant literature shows that Downer and Mendez (2005), in their study on African American fathers' involvement and the school readiness of preschool children, identified a positive association between the father's involvement, particularly in school-based educational activities, and the relationship between school readiness and interactive play behaviors. In a study by Suh (2017) titled "The Effect of Marital Satisfaction on Children's Peer Play Behavior and Problem Behaviors: The Mediating Role of Father's and Mother's Parenting Behaviors," children's peer play behaviors were explained by the father's warm parenting behaviors. Accordingly, it may be assumed that the father's interest and the positive play experiences shared with the father are reflected in the child's interactive peer play behaviors. Pettit et al. (1998) associated fathers' involvement in child-peer play with higher levels of social competence in children. Another study found that fathers' engagement in physical play was positively associated with children's peer relationships, particularly among boys (MacDonald & Parke, 1984). In light of the findings from this study and the relevant literature, it can be suggested that the father's involvement contributes to the child's sense of well-being and supports development with the father serving as a positive role model for interactive behaviors during play processes.

In the present study, the interactive peer play behaviors of children were examined using quantitative research methods. These methods, such as observation and interviews, can be employed for in-depth analysis. Different variables can be considered in order to investigate the relationship between father involvement and interactive peer play behaviors. The interactive play behaviors of fathers with their children during the play process can be observed and compared across different cultures. Although the number of quantitative studies addressing father involvement in relation to assorted variables is increasing, there remains a limited number of studies examining the relationship between the father's involvement and the child's interactive peer play behaviors. In future research, such investigations could be designed using qualitative or mixed-methods approaches. In our study, education level was identified as a significant variable for both the father's involvement and the child's play behaviors. Therefore, educational programs could be developed to raise awareness among both fathers and mothers about the benefits of positive father involvement for child development. Furthermore, intervention programs targeting parents can be implemented, and play-based activity programs that include father involvement can be designed and tested through experimental studies.

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Executive function skills as predictors of social skills in socially disadvantaged children

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Abstract

The aim of this study is to examine the effect of executive function skills on social skills in 4-5-year-old children. The study group consists of 151 children aged 4-5 years and their teachers. The data of the research were collected through the "Childhood Executive Functioning Inventory" and "Social-Emotional Assets and Resiliency Scale". The assumptions of the multiple regression analysis were tested and applied to the obtained data. There is a positive relationship between executive functions and social skills. Social competence and emotion recognition are only predicted by working memory. On the other hand, empathy, self-regulation and total social skills are predicted by working memory and inhibitory control together. Two executive function skills can explain approximately 41% of social skills. Tracking the executive function skills of the children in the preschool period can give an idea of their current and future social-emotional developments.

Keywords

Executive function
Social skills
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Introduction

Social skills including emotion recognition and regulation, empathy, establishing positive relationships, maintaining relationships and responsible decision-making allow children to gain skills in social, academic and behavioral areas (Bierman et al., 2017). Social skills gained in early childhood enable the individual to exhibit skills such as establishing and maintaining healthy relationships, problem-solving, displaying positive social behaviors and responsible decision-making in the upcoming years (Weisberg, 2019). As these skills are developed, the sense of social belonging increases and the individuals have higher ethical values and demonstrate positive behaviors (Zins & Elias, 2007). This helps the conflicts and negative behaviors decrease by affecting society's mental health.

Social skills develop in line with cognitive skills (Bierman & Motemadi, 2015). Especially, the development of executive function skills plays a significant role in the social skills of children. Children with higher executive function skill levels adapt themselves to new conditions easily, cope with problems better, feel safe in new environments and interact with people around them more easily (Diamond, 2013). Children who plan their behaviors according to their goals, interact with their

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environment more easily, develop coping strategies and solve conflicts can exhibit behavior regulation, empathy and responsible behavior skills by reading the emotions of others (Benavides-Nieto et al., 2017). The research conducted in neuroscience indicates that similar areas of the brain are activated during the processes related to social skills and executive functions, and that the developments in certain areas of the brain affect executive functions and social skills (Cheng et al., 2010; Hinnant et al., 2013; Just et al., 2012). The mutual effect of development in the prefrontal region and environmental stimuli plays an important role in changes in executive functions and social skills (Eslinger et al., 2004). Damage or developmental problems in this region cause impairments in executive functions and social skills. Especially social and environmental deprivation in childhood negatively affects the development of prefrontal cortex and executive functions (Blair & Raver, 2012; Curtis & Cicchetti, 2007). Children living in socially disadvantaged areas can experience developmental problems due to the lack of environmental stimuli and exposure to negative events. Social and financial problems, negligence, poor nutrition and the lack of parent-child interaction affect the development of children in different areas (Black et al., 2017). As a whole, the lack of a stimulating environment during early childhood affects brain development and causes risks in executive function skills and social-emotional development (Barrasso-Catanzaro & Eslinger, 2016). In the study by Wolf and McCoy (2019), it is explicitly demonstrated that social skills and executive functions are important for early academic skills and success.

Social skills are essential for establishing successful relationships in social life (Hansen et al., 1995). Socially competent individuals can communicate effectively in various social settings and employ appropriate coping strategies. The development of social competence and social skills depends on the maturation of the skills of establishing effective communication, maintaining communication, and controlling emotions and behaviors (Fabes et al., 2006; Rubin et al., 2006). Benavides-Nieto et al. (2017) revealed that executive functions are related to the quality of social skills and peer relationships. The research concluded that children with high executive function scores also scored high in social interaction, social cooperation, following instructions, and developing friendship behaviors. According to the research findings of Veraksa et al. (2020), it was revealed that children with a high level of interaction in the classroom scored higher in cognitive flexibility tasks. Amani et al. (2019) examined the effects of an executive function skill strengthening program based on group games developed for preschool children on children's social skills. The research findings revealed that inhibitory control skills supported through group games produced improvements in children's social skills. Inhibitory control helps create appropriate responses reactions by regulating thoughts, behaviors, attention and emotions (Diamond, 2013). The ability to control and regulate emotions, thoughts and behaviors depends on children's ability to perceive social cues. In a study, preschool children's ability to understand emotions was found to be a predictor of their negative behaviors (Choe et al., 2013). The ability to understand emotions and correctly interpret social references also helps children regulate their behaviors and emotions. Skills such as inhibitory control and working memory are in a strong relationship with self-regulation skills (Slot et al., 2017). These executive function skills which help to choose appropriate responses and eliminate inappropriate options help the children to regulate their emotions and behaviors. A study shows that children with low working memory score conflict with their teachers, and the relationship between the teacher and children is negatively affected as a result. The findings of a study which revealed that this also influenced peer relationships showed that the conflict between the teacher and child decreased based on working memory which develops within the process (de Wilde et al., 2016).

The researchers investigating the effect of executive function skills on social skills conducted experimental studies to analyze the relationship between these two variables. These experimental studies show that the change occurring in the executive function skills affects cooperation, social interaction skills as well as adaptive skills (Romero-López et al., 2020) and that the children whose executive function skills develop exhibit behaviors such as helping peers in case of need, encouraging each other and helping other peers to find playmates (Diamond et al., 2019). The results obtained indicate that executive function skills have an effect on the social competencies of the children, and they mutually affect each other. Depending on the developments in their executive function skills, children demonstrate skills such as understanding and interpreting emotions, regulating behaviors, realizing the perspectives of others and acting accordingly. Conducted research shows that the developments in executive function skills have an effect on self-regulation (Slot et al., 2017), emotion recognition (Leung et al., 2016; Mohtasham et al., 2019), empathy (Cascia & Barr, 2017; Zeng et al., 2021) and social competence skills (Diamond et al., 2019; Dias & Seabra, 2017; Romero-López et al., 2020) of the children.

In this study, it is aimed to investigate the effect of executive function skills on social-emotions development in children aged 4-5 years. The findings of the research which was conducted in a socioeconomically disadvantaged area provide information on social skills, social competence and interpersonal communication skills which are of critical importance in social life. It is thought that deficiencies in social skills, poor social adaptive skills and lack of social competence will affect the children in social life, academy and other fields. The ability to adapt oneself according to different circumstances, to regulate emotions and behaviors and the social competence skill in a world that is dynamic and constantly changing are of critical importance for functionality. Therefore, the findings to be obtained from this research will contribute to the expansion of literature knowledge of the children on factors affecting their academic, social life and interpersonal communication skills. Therefore, the findings of this research will contribute to the expansion of the literature on the factors affecting the academic, social life and interpersonal communication skills of children living in socio-economically disadvantaged areas.

As the aim of this study, which was conducted through predictive correlational design, the effect of executive function skills on social-emotions development in children aged 4-5 years was analyzed. In line with this aim, answers to the following questions will be sought:

- Do inhibitory control and working memory skills of children predict their recognition of emotions?
- Do inhibitory control and working memory skills of children predict their empathy skills?
- Do inhibitory control and working memory skills of children predict their regulation skills?
- Do inhibitory control and working memory skills of children predict their social competencies?

answers to these questions are sought.

Method

Participants

The participants of this research consist of 151 children ($n_{girl}=77$, 51.0% - $n_{boy}=74$, 49.0%) at the ages of 4-5 (Means=54.6 months) in the educational institutions of socially disadvantaged neighborhoods at the center of the capital city, Ankara. In the selection of the disadvantaged region, the rate of slums, the number of needy people to be assisted and the high rate of migration were taken into consideration.

Data Collection Tools

The data of the research were collected through the "Childhood Executive Functioning Inventory" and "Social-Emotional Assets and Resiliency Scale".

Childhood Executive Functioning Inventory

Turkish validity and reliability study of the measurement tool developed by Thorell and Nyberg (2008) was conducted by Çiftçi et al. (2020). The scale which was applied to 754 children 48-72-month-old has a two-factor, 24-item structure. When the fit indices were examined, it was stated that the RMSEA value was .06, the SRMR value was .04 and the CFI value was .93. Regarding the reliability values of the factors, Cronbach's Alpha coefficients were found to be .95 for Working Memory sub-scale and .91 for Inhibitory Control sub-scale. When Table 1 was analyzed in this study, as a result of a confirmatory factor analysis conducted to test the suitability of the study for the sample group, it was observed that item load values were between .30 and .92, χ^2/df value was 2.44, CFI value was .88, TLI value was .86, RMSEA value was .08 and SRMR value was .06. This shows that the current structure is suitable for the sample of the research. Reliability values were found to be .96 for Working Memory sub-scale and .88 for Inhibitory Control sub-scale.

Social-Emotional Assets and Resiliency Scale

Turkish validity and reliability study of the scale developed by Ravitch (2013) was conducted by Gülay Ogelman et al. (2021). The measurement tool which was applied to 403 children at the age of 5 has four sub-dimensions and 22 items. When the fit indices were examined, it was stated that the CFI value was .92, the SRMR value was .05 and the RMSEA value was .08. Cronbach's Alpha values were calculated as .92 for the Emotion Recognition sub-dimension, .92 for the Empathy sub-dimension, .85 for the Self-Regulation sub-dimension and .86 for the Social Competence sub-dimension. The total reliability coefficient was found to be .96. When Table 2 was analyzed in this study, as a result of a confirmatory factor analysis conducted to test the suitability of the study for the sample group, it was observed that item load values were between .36 and .81, χ^2/df value was 2.19, CFI value was .91, TLI value was .90, RMSEA value was .08 and SRMR value was .06. This shows that the current structure is suitable for the sample of the research. Cronbach's Alpha value was calculated as .92, .91, .86 and .88, respectively. The total reliability coefficient was found to be .96 in this study.

Data Collection Process

Required approvals regarding the use of scale and applications were obtained before data collection. Ethical approval was obtained from the Ethics Committee of Ankara University on 10/02/2022 with the decision number 56786525-050.04.04/410978. Since the instruments are not suitable for self-assessment by children, they should be completed by an adult who knows the child. The data were collected from 40 teachers at 15 preschool education institutions of 16 schools in the determined areas. When the teachers were determined, it was considered that they knew the children for at least 6 months and had information on their developments. The teachers chose the 4 children completely randomly without knowing the purpose. Each teacher was randomly asked to make an evaluation about no more than 4 children, as 2 girls and 2 boys. The participants of the research consisted of 151 children after deducting the number of children whose data was incomplete from 160 children who provided feedback.

Data Analysis

Before the data was ready for analysis, all values were standardized and converted into z-scores. Assumptions of multiple regression analysis were tested for the obtained data. Firstly, extreme values and assumption of normality were tested. After this process, whether there was a linear relationship between the dependent and independent variables was investigated with a scatter diagram. No multicollinearity problem was observed between the independent variables in the examination regarding the multicollinearity problem.

Table 1. Assumptions of Multiple Regression Analysis

Dimensions	Skewness	Kurtosis	Cook's	Durbin-Watson	Tolerance	VIF
Working Memory	-.553	.147	-	-	.393	2.542
Inhibitory Control	-.220	-.107	-	-	.393	2.542
Emotion Recognition	-.549	-.762	.00-.06	1.320	-	-
Empathy	-.221	-.460	.00-.11	1.231	-	-
Self-Regulation	-.276	-.364	.00-.07	1.253	-	-
Social Competence	-.333	-.739	.00-.07	1.385	-	-
Total SES	-.460	-.389	.00-.11	1.153	-	-

According to Table 1, when the coefficients of skewness and kurtosis for the assumption of normality are analyzed, it is observed that it is between ± 1 for all scores. This is one of the indicators that the data demonstrate a normal distribution (Tabachnick & Fidell, 2013). It can be said that there are no multiple extreme values since it was observed that Cook's values checked in the examination of extreme values ranged from 0 to .11 and were less than 1. In the examination regarding autocorrelation, Durbin-Watson values are expected to be between 1-3 and closer to 2. It is observed in the data examination that there is no autocorrelation (Field, 2018). Correlation, tolerance and VIF values were analyzed to test the assumption of multicollinearity. It was determined that there was no multicollinearity problem since correlation values were not above .90, the tolerance value was not less than .10 and the VIF value was not above 10 (Pallant, 2016).

In addition, statistical analysis was made to reveal the power of the research. When the effect size ($f^2=.41$), sample size ($n=151$) and the number of predictors ($n=2$) were analyzed, the power of the study was found to be .99.

Results

Findings related to the results of the research are examined in this section.

Table 2. Correlation Matrix of the Variables

Dimensions	1.	2.	3.	4.	5.	6.	7.
1. Working Memory	1.00	.779**	.541**	.540**	.572**	.543**	.617**
2. Inhibitory Control		1.00	.455**	.522**	.616**	.484**	.585**
3. Emotion Recognition			1.00	.777**	.668**	.690**	.893**
4. Empathy				1.00	.702**	.772**	.916**
5. Self-Regulation					1.00	.717**	.869**
6. Social Competence						1.00	.876**
7. Total SES							1.00

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

In Table 2, because the scale scores supported the assumption of normality, the relationship between social skills and executive functions was analyzed through Pearson's correlation coefficient. There is a positive relationship between working memory and emotion recognition ($r=.54$, $p<.01$), empathy ($r=.54$, $p<.01$), self-regulation ($r=.57$, $p<.01$), social competence ($r=.54$, $p<.01$) and total social skills ($r=.62$, $p<.01$). Similarly, there is a positive relationship between inhibitory control and emotion recognition ($r=.46$, $p<.01$), empathy ($r=.52$, $p<.01$), self-regulation ($r=.62$, $p<.01$), social competence ($r=.48$, $p<.01$) and total social skills ($r=.59$, $p<.01$).

Table 3. Regression Analysis for the Prediction of Emotion Recognition by Working Memory

Model	B	sh	β	t	p
Stable	.021	.067	-	0.311	.756
Working Memory	.524	.067	.541	7.842	.000
R=.541	R ² =.292				
F(1, 149)=41.231	p<.001		Emotion Recognition= (.541) x Working Memory		

When Table 3 was analyzed, it was found that Inhibitory Control was not a significant predictor of Emotion Recognition ($p>.05$). Therefore, it was excluded from the analysis and regression analysis was re-conducted. According to the results, it was observed that working memory is a significant predictor of emotion recognition scores ($F(1, 149)=41.231$, $R^2=.292$, $p<.001$). This indicates that 29% of the total variance regarding the emotion recognition score can be explained by working memory.

Table 4. Regression Analysis for the Prediction of Empathy by Working Memory and Inhibitory Control

Model	B	sh	β	t	p
Stable	.004	.068	-	0.055	.956
Working Memory	.340	.109	.339	3.135	.002
Inhibitory Control	.258	.109	.257	2.375	.019

R=.563 R²=.317
 F(2, 148)=34.404 p<.001 Empathy= (.339) x Working Memory + (.257) x Inhibitory Control

According to Table 4, it is observed that working memory and inhibitory control together are significant predictors of empathy ($F(2, 148)=34.404$, $R^2=.317$, $p<.001$). Working memory and inhibitory control together explain 32% of the total variance of empathy scores. The order of importance of the variables predicting empathy significantly is as follows: working memory ($\beta=.34$), inhibitory control ($\beta=.26$).

Table 5. Regression Analysis for the Prediction of Self-Regulation by Working Memory and Inhibitory Control

Model	B	sh	β	t	p
Stable	.014	.063	-	0.224	.823
Working Memory	.232	.100	.235	2.316	.022
Inhibitory Control	.428	.100	.433	4.269	.000

R=.633 R²=.401
 F(2, 148)=49.565 p<.001 Self-Regulation= (.235) x Working Memory + (.433) x Inhibitory Control

When Table 5 was analyzed, it was found that working memory and inhibitory control were significant predictors for self-regulation scores ($F(2, 148)=49.565$, $R^2=.401$, $p<.001$). Together they explain 40% of the total variance of self-regulation. The order of importance for predicting self-regulation is as follows: inhibitory control ($\beta=.43$) and working memory ($\beta=.23$).

Table 6. Regression Analysis for the Prediction of Social Competence by Working Memory and Inhibitory Control

Model	B	sh	β	t	p
Stable	.025	.065	-	0.390	.698
Working Memory	.517	.066	.543	7.893	.000

R=.543 R²=.295
 F(1, 149)=62.299 p<.001 Social Competence= (.543) x Working Memory

When Table 6 was analyzed, it was found that inhibitory control was not a significant predictor of social competence ($p>.05$). Therefore, it was excluded from the analysis and regression analysis was re-conducted. According to the results, it was observed that working memory is a significant predictor of social competence scores ($F(1, 149)=62.299$, $R^2=.295$, $p<.001$). This indicates that 30% of the total variance regarding the social competence score can be explained by working memory.

Table 7. Regression Analysis for the Prediction of Social Skills by Working Memory and Inhibitory Control

Model	B	sh	β	t	p
Stable	.018	.062	-	0.284	.777
Working Memory	.403	.099	.412	4.084	.000
Inhibitory Control	.258	.099	.264	2.618	.010
R=.639	R ² =.408				
F(2, 148)=51.075	p<.001		Total SES= (.412) x Working Memory + (.264) x Inhibitory Control		

According to Table 7, working memory and inhibitory control together are significant predictors for the total score of social skills ($F(2, 148)=51.075$, $R^2=.408$, $p<.001$). Working memory and inhibitory control explain 41% of the total variance of social skills scores. The order of importance for predicting social skills significantly is as follows: working memory ($\beta=.41$), inhibitory control ($\beta=.26$).

Discussion, Conclusion, Suggestions

Executive functions which present the skill to plan, control and update the interactions and behaviors in social environments are important for the healthy development of children. These environments provide children with the opportunity to experience different social situations and establish new relationships. In addition, children encounter social problem situations and have the opportunity to experience the processes of producing solutions to these situations. Controlling their behaviors in social environments, creating appropriate response reactions, and developing problem solving skills by establishing effective communication enable children to gain social competence. Executive function skills come into play in children's ability to communicate effectively, review their behaviors in social situations and produce new options and alternatives, manage their behaviors, and use effective problem-solving strategies. Executive functions, which are involved in the processes of making plans, controlling behaviors and impulses, and changing behaviors when necessary, are important for the healthy development of children. The development of children living in socio-economically disadvantaged areas can be negatively affected by factors such as poverty, neglect, and lack of a stimulating environment. Poor executive function and social emotional skills of children who face limited learning opportunities due to environmental factors can be observed (Black et al., 2017; Korzeniowski, 2022). Poor executive function skills impair behavior regulation abilities, which in turn lead to problem behaviors and hinder the development of social competence (Holmes et al., 2016). Studies have revealed that similar regions in the brain are activated in behaviors that involve social skills and in processes where executive functions must be used (Cheng et al., 2010; Hinnant et al., 2013; Just et al., 2012). Development in the prefrontal region of the brain affects executive functions and social skills. Developmental problems due to damage to this region or lack of environmental stimulation lead to deterioration in executive functions and social skills (Blair & Raver, 2012; Curtis & Cicchetti, 2007). The study conducted by Wolf and McCoy (2019) also reveals the effect of the development of executive functions and social skills on children's early learning processes. Based on the relationship between social skills and executive functions, this study aimed to examine whether executive function skills are predictors of social-emotional development in socially disadvantaged children.

The findings obtained from the study show that working memory is a predictor of children's emotion recognition skills. However, when working memory and inhibitory control were included in the model together, it was determined that there was no significant effect. The results of the study conducted by Morra et al. (2011) also support these findings. In the study conducted with children between the ages of 5-11, it was revealed that working memory predicted emotion understanding skills. Perceiving and recognizing emotions is an important skill that allows predicting what the other person feels, their purpose and subsequent behaviors during the interaction process with others (Thingujam et al., 2012). Working memory ensures that the information received after stimulus inputs is integrated with previous experiences, the inputs are processed sequentially, they are interpreted and this information is manipulated for a purpose (Spencer, 2020). Therefore, a strong working memory will

help children read and interpret social references as a result of experiences correctly and make correct analyses by combining them with their past experiences. Swanson and Beebe-Frankenberger (2004) also show that children with weak working memory have difficulty integrating new learning experiences with their past experiences. In both social life and in the cognitive processes in which learning experiences take place, the results obtained from past experiences help to structure new information. Social references such as emotions, facial expressions and tone of voice are also structured according to past experiences and reactions are formed accordingly. Therefore, having a strong working memory is important for recognizing emotions, associating them with past experiences and creating responses. The emotional socialization behaviors of adults such as mothers, fathers or teachers in the child's close environment and the learning opportunities they offer to children enable children to understand emotions and become aware of others' thoughts (Castro et al., 2015).

Growing up in environments that deprive children of a stimulating environment and cause a lack of social experience leads to deficiencies in the ability to recognize emotions and interpret social cues. Parents who interact less with their children and are unaware of their developmental needs interact less with children and cause children to be socially isolated (Rokita et al., 2018). The study conducted by Li et al. (2023) reveals the effect of learning opportunities in the home environment on social competence. The stimuli provided by parents depending on their beliefs and attitudes towards the development of children's social skills affect children's social skills. The risk of children living in socially disadvantaged areas being deprived of a stimulating environment, and parents' beliefs and attitudes towards children's developmental needs can affect developmental processes. According to Soucie et al. (2023), mothers who were more aware of their children's emotions used more emotional expressions than mothers who were less aware. This reveals the importance of parental awareness and the learning opportunities that parents offer to the child.

The findings obtained regarding the second research question show that working memory and inhibitory control skills predict empathy when included in the model. These two skills together explain empathic skills in children. The results of the meta-analysis study conducted by Yan et al. (2020) based on studies on children's empathy skills and executive functions revealed that cognitive empathy skills are related to inhibitory control, working memory and cognitive flexibility skills, and emotional empathy skills are related to inhibitory control. The results of another research reveal that inhibitory control skill is the predictor of cognitive empathy (Zeng et al., 2021). In the research by Gao et al. (2016), it is shown that there is a relationship between working memory and cognitive and emotional empathy skills. The results obtained in the research support the findings of this research which shows that working memory and inhibitory control skills are predictors of empathy. In the process of social interaction, it seems reasonable that empathy which includes emotional sharing and regulation processes and enables making deductions about the cognitive and emotional states of people (Decety & Holvoet, 2021) can be affected by inhibitory control and working memory skills which ensures that the behaviors are displayed in a consistent and regulated way. An individual who makes inferences by considering the emotional states, facial expressions and tones of voice of people will perceive these social references and go into a process of regulation based on previous experiences. It is thought that working memory and inhibitory control skills will become more prominent in these processes. Executive function skills are influenced by life experiences and learning opportunities. Adverse experiences during childhood can impact children's developmental processes. Research indicates that experiences in childhood affect social-cognitive skills, such as the ability to understand others' perspectives and develop empathy (Crawford et al., 2020; Lim et al., 2024).

The findings regarding the third question of the research show that working memory and inhibitory control explain self-regulation skills in children. Working memory and inhibitory control predict self-regulation skills when included together in the model. Slot et al. (2017) examined the relationship between the emotional and cognitive self-regulation skills of children and executive functions. In the study, it was concluded that there is a strong relationship between inhibitory control and working memory which are executive function skills and self-regulation skills of children. In another study, it was determined that there is a significant relationship between inhibitory control skills and emotional regulation skills of preschool children (Carlson & Wang, 2007). Inhibitory control skill which helps the creation of appropriate response reactions by enabling the control of thoughts, behaviors, attention and emotions (Diamond, 2013) will help the children to regulate their emotions and behaviors. The findings of a study on children with attention deficit hyperactivity disorder show that inhibitory control plays an important role in the regulation of externalization behaviors of children (Cristofani et al., 2020). Another research reveals that children with low working memory scores have a higher rate of conflict with their teachers and they have more problems with their peers accordingly. It has been revealed that there is a decrease in conflicts between the teacher and children whose working memory skills are developed through the intervention practices made during the research process and that the teacher-child relationships are improved (de Wilde et al., 2016). The results of the research in the literature indicate that working memory and inhibitory control skills help children with the regulation of behaviors and emotions. The promotion and enhancement of these skills will help the children to display behaviors by putting them into the process of evaluation, interpretation and re-regulation. Families with low socioeconomic status face numerous stressors that affect their lives, such as financial concerns, access to quality nutrition, and adequate housing. Children raised in these environments, where access to resources is limited, are more exposed to risk factors such as parental stress, restricted access to resources, and a lack of stimulating environments (Duncan et al., 2015). Compared to children in socially advantaged positions, those growing up in disadvantaged regions experience life circumstances that influence their social and cognitive development. Neurodevelopmentally intertwined executive functions, and social skills are also shaped by children's life experiences (Cuartas et al., 2022). Children raised in socioeconomically challenging conditions are more likely to face social and emotional difficulties later in life compared to their peers (van Poortvliet, 2021). The research findings by Hosokawa and Katsura (2017) also revealed that low family income is a predictor of an increase in emotional and behavioral problems. It is thought that the stress factors experienced affect the coping processes of families and children and the processes of using effective problem-solving skills. The lack of environments that support effective problem-solving skills and the modeling of parents' problem-solving styles suggest that children's problem-solving and self-regulation skills will be affected.

The findings for the fourth research question show that working memory is a significant predictor of social competence scores. According to Tang et al. (2021), it was concluded that verbal ability in children, that is, the ability of children to express their feelings and thoughts effectively, predicts social competence together with working memory. In short, it was observed that children with good verbal abilities and working memories also have better social skills. Children with stronger executive function skills also have better abilities to adapt to changing situations, overcome problems, feel safe in new environments, and communicate more easily with their environment. Experimental research results focusing on developing executive function skills show that children have increased cooperation, social interaction skills, and adaptation behaviors due to the development seen in their executive function skills (Romero-López et al., 2020) and that they exhibit behaviors such as helping their peers in case of need, encouraging each other, and mediating other peers to find playmates (Diamond et al., 2019). The results of a study also show that working memory affects children's ability to display social competence behavior in peer conflict situations. It has been found that working memory shows a higher correlation than these two skills in the task of coping with conflict situations, in which other components of executive functions, such as cognitive flexibility and inhibitory control skills, are also involved (Caporaso et al., 2019). Children who are good at working memory and other

executive function skills can become more socially competent individuals by exhibiting skills such as thinking, reviewing and regulating their behavior in conflict situations or situations that require competence. Therefore, it is estimated that executive function skills may have an impact on social-emotional development.

Another finding from this study is that executive function skills are predictors of social skills. When working memory and inhibitory control are included in the model together, it is concluded that they explain the total social skill scores of children. According to the research of Amani et al. (2019), there are improvements in the social skills of children whose inhibitory control skills are supported. Benavides-Nieto et al. (2017) revealed that children with high executive function scores had high scores in social interaction, social cooperation, following instructions, developing friendship behaviors, and accepting others.

In early childhood, the importance of social competence and social-emotional well-being is emphasized (Oberle et al., 2016). It is stated that children who are socially competent are more likely to be successful in education, find a job in the future, and establish safe and stable social relationships (Jones et al., 2015). Deficiencies in social skills affect the children's adaptation to school. Disruptive behaviors lead to aggression and adaptation problems (Domitrovich et al., 2007). Additionally, the sense of belonging is higher in children who have good social-emotional well-being and feel self-sufficient. The sense of belonging that is developed with social competence and well-being helps children to have high academic self-efficacy and success (Goodenow, 1993). Children who are socially strong and successful are more likely to be strong in other areas. The positive effect of feeling socially competent and good in other stages of development shows that these skills should be supported (Taylor et al., 2013).

Similar to the other studies in the literature, this research indicates the effect of executive function skills on social skills. The predictors of social skills were analyzed in this research which specifically focuses on two specific executive function skills such as working memory and inhibitory control. In addition to the studies in the literature, analysis was made by modeling both skills together and the prediction level of these two skills for social skills jointly and separately was determined. The obtained findings indicate that inhibitory control and working memory skills of the children living in socio-economically disadvantaged areas predict their empathy and self-regulation skills. It demonstrates that particularly the education programs of children living in disadvantaged areas should be diversified, especially through objectives for executive function skills. It is thought that children whose skills such as planning, avoiding sudden behaviors, ability to switch between emotions, and behavior-shaping according to life experiences are more socially competent and behave responsibly by minding the emotions and thoughts of others. The acquisition of these skills which will facilitate the resolution of conflicts and problems in social life will help individuals within society to establish healthy relationships, produce alternatives, care about others and respect their rights.

The research reveals the effect of executive function skills of children within the study group on social skills and includes various limitations. The limitations of the research include conducting the research in a specific area and collecting the data through teachers who know the children well. It is thought to be effective to conduct the research with the data obtained directly from children with a broader sample and include different executive function skills in the research can be effective. Tracking the executive function skills of the children in the preschool period can give an idea of their current and future social-emotional developments. Besides, the promotion of executive functions at the points that they are deemed inadequate can prevent the weaknesses which may occur during their social-emotional development.

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The transactive interaction patterns in middle school students' collaborative-based critical thinking processes aligned with social studies *

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Abstract

Collaborative-based learning (CBL) has established itself as a respected pedagogical approach in nearly every education system. The success or full potential of such small-group practices largely depends on transactive interactions, which are characterized by both social and cognitive dimensions. This study, grounded in a qualitative methodology and designed as a case study, aims to examine the social and cognitive interaction processes and related experiences of 28 fifth-grade middle school students. These students were assigned to seven collaborative groups and guided to work together on critical thinking tasks aligned with the social studies course. These students were guided to work cooperatively on cognitive tasks related to critical thinking within the context of the social studies curriculum. According to the research procedure, cognitive tasks were developed through a three-phase preliminary process. An implementation model was designed for these tasks, and the activities were conducted in accordance with this model. Data were collected through participants' self-reports (self-assessments, peer assessments, interviews) and the researcher's observation reports during the preparation, orientation, pilot, and primary study phases. The collected data were analyzed in seven stages using MAXQDA Analytics Pro 2024 (version 24.0.0). The findings reflect that socially characterized transactive interactions may be related to students' understanding of collaboration, their socio-emotional awareness and expressiveness, as well as their perceived group well-being. On the other hand, transactive interactions characterized by cognitive features were found to be related to goal orientation, the regulation of idea-generation processes (group metacognition), and the pursuit of high-quality argumentation within the scope of knowledge processing and decision-making. The results are discussed in relation to the classroom reflections of social and cognitive transactive interactions within critical thinking processes based on collaboration. Several recommendations are provided to strengthen both the theoretical and practical frameworks of future research in this field.

Keywords

Transactive interactions
Shared cognition
Complex cognitive processes
Critical thinking
Collaborative-based learning
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Introduction

The mechanisms underlying human interactions have long been a topic of fascination (Isaacs, 1933; Smaldino, 2023). From a reductionist perspective, the unique features and nuances of these interactions have drawn attention to learning processes that involve complex thinking (National Research Council, 2000; Tomasello, 2014). Contemporary educational practices position these forms of learning at the heart of classroom interactions, emphasizing the need to enhance the level, quality, and diversity of such interactions as a prerequisite for improving learning processes (Aguilera-Jiménez & Gallardo, 2020). From a pedagogical standpoint, formal interactions in classroom environments are predominantly embedded within CBL frameworks (Davidson, 2022). The impact of CBL on various learning variables has been extensively documented (Ginsburg-Block et al., 2006; Hu et al., 2021). Furthermore, it has been repeatedly demonstrated that CBL enables students to structure and critically analyze each other's thoughts, thereby fostering, facilitating, and enhancing critical thinking (Hajhosseini et al., 2016; Xu et al., 2023). The nature of critical thinking is inherently interactive (Halpern, 2014); students often require input or responses from others in order to question their own thinking or ground it in logical reasoning. In CBL groups, this partnership—or social contract—between students is tightly integrated into patterns of social and cognitive processes, which form the core of transactive interactions.

Background

Transactive Interactions Through CBL

CBL is an instructional approach that not only allows students to reflect upon and deepen their own knowledge but also enables them to engage meaningfully with others (van Boxtel & Roelofs, 2001). Within this approach, assumptions regarding how learning groups attain different performance levels tend to synthesize the social and cognitive dimensions of knowledge processing (Tindale et al., 2008). The core of this synthesis lies in transactive interactions (Jurkowski & Hänze, 2010; Nemeth et al., 2023). The term transactive is defined as “reasoning that operates on the reasoning of another” (Berkowitz & Gibbs, 1983, p.402). The foundation of transactive interactions involves learning partners (or group members) referencing the knowledge and meaning provided by others, expanding upon it, transforming it into detailed thinking, and integrating it with their own thoughts (Jurkowski ve Hänze, 2010; Jurkowski et al., 2022). In this context, the concept of “transactive interaction” denotes that knowledge and meaning are constructed through interpersonal exchanges.

The conceptual and theoretical structure of transactive interactions is frequently associated with the approaches of Dewey (1933), Piaget (1952, 1971), and Vygotsky (1962, 1978). According to these perspectives, knowledge and meaning are constructed through reciprocal interactions among individuals, particularly in contexts conducive to logical thinking and reasoning. A number of studies that focus on interaction processes in CBL settings have largely supported this view (Bales, 1950; Liu & Tsai, 2008). On this basis, transactive interactions are inherently dynamic processes in which social and cognitive dimensions are deeply intertwined. Social interactions pertain to the perceived mutual response processes among students within the group context (Coie et al., 1982). Prior research has shown that the balance of learners' approaches to collaboration, as well as the temporary relationships they establish, determine whether the group can engage in more complex and deeper thinking processes (De Laat & Lally, 2004). Cognitive interactions, on the other hand, involve the process through which students co-construct shared meanings related to the task (Hernández-Sellés et al., 2020). Transactive interactions primarily seek to explain this cognitive dimension.

According to conceptual classifications, the behaviors that constitute transactive interactions (transacts) can be divided into two dimensions: representational and operational (Berkowitz & Gibbs, 1983; Berkowitz et al., 2008). Representational transacts are limited in scope and quality, such as merely repeating or adhering to the reasoning processes of others, and do not significantly advance the group's reasoning. In contrast, operational transacts build the foundation of an idea, strongly contextualize it, transform it, and enhance the reasoning processes of other group members. Because transactive interactions involve discourse forms that lead to cognitive change, they are inherently intensive and

demanding (Hänze & Jurkowski, 2022; Nemeth et al., 2023). For an optimal transactive interaction process, it is emphasized that mental preparation must be made before engaging in dialogue by considering the social context and environment (Frith & Frith, 2006; Kuhlen et al., 2017). Additionally, sustaining such interactions requires continuous attention to the ongoing conversation, retention of ideas in memory, critical analysis of context, and the reorganization of mental representations accordingly (Mojzisch et al., 2014). This is particularly critical for CBL groups (Ouyang et al., 2023), because if these social and cognitive processes are not well-organized, the information-processing mechanisms required for critical thinking become vulnerable to various forms of faulty reasoning (Battersby, 2016; Dwyer, 2023).

CBL and Complex Cognitive Processes

CBL and other pedagogical practices within this context operate as an integration of both social processes (such as understanding others and perspective-taking, i.e., *mentalizing*) and complex cognitive processes (e.g., reasoning, problem solving, critical thinking, decision making) (Gross & Medina-DeVilliers, 2020). According to theory of mind (Frith & Frith, 2006) and social information processing theory (Crick & Dodge, 1994), this integration involves understanding others' intentions, interpreting their thoughts, and applying cognitive regulation (Nelson et al., 2005). Neuroscientific studies have identified connections between brain regions activated during collaborative (social) behavior and those involved in processing complex information (Mitchell et al., 2004; Stallen & Sanfey, 2015). As the social load on the brain increases, the activation of medial (MFP) and lateral frontoparietal (LFP) systems also increases (Meyer et al., 2012). Parallel to this, abstract reasoning tasks performed through social interaction, such as collaboration, are believed to enhance the efficiency of cognitive processing in the brain (Davidescu et al., 2019; Dikker et al., 2017; Pan et al., 2018; Prado et al., 2020).

This body of research suggests that collaborative learning may lead to better learning outcomes than individual learning in the context of complex cognitive tasks (Ginsburg-Block et al., 2006; Olivera & Straus, 2004). In complex cognitive tasks, CBL offers several affordances, such as the integration of prior knowledge (Zambrano et al., 2019), coordination of working memory resources (Du et al., 2022; Sankaranarayanan et al., 2021), and distribution of cognitive load (Kirschner et al., 2009). The role of CBL as a regulator between social and cognitive interactions highlights its critical importance for fostering critical thinking (Frith & Frith, 2012; Sawyer et al., 2017; Trouche et al., 2014; Trung & Truong, 2023).

Transactive Interactions and Critical Thinking in Groups and Dyads

Critical thinking involves consciously focusing on reasoning processes and formalizing thought (Facione, 1990; Paul & Elder, 2006). This formalization process entails making judgments and choices among alternatives based on specific criteria (Wang & Ruhe, 2007). A broad body of research literature links such factors that may influence critical thinking in groups or dyads to the transactive spread or dialogic network structures observed in CBL groups (Felton et al., 2015; Gätje & Jurkowski, 2021; Heyman, 2008). In this regard, Liu and Tsai (2008) identified five forms of transactive propagation: centralized and distributed information exchange, group development obstacles, ability obstacles, and partial information exchange. Their findings show that high academic achievement and heterogeneous abilities do not necessarily guarantee strong cognitive performance. Indeed, some high-achieving groups performed poorly due to passive interaction processes. Further analysis using probabilistic models such as first- and second-order Markov chains revealed that while students actively supported correct suggestions in groups and dyads, they were also inclined to accept and propagate incorrect ones. Moreover, although students were more adept at detecting errors or gaps in correct suggestions, their ability to question or correct incorrect suggestions remained limited (Nemeth et al., 2023). These findings imply that while transactive interactions may enhance information flow among students, they may also facilitate the unnoticed circulation of incorrect information within the group. Therefore, transactive interactions are highly functional phenomena that warrant further investigation, especially in learning groups engaged in complex cognitive tasks like critical thinking.

The Present Study

Many school-based implementations fall short of leveraging the potential of CBL (Christie et al., 2009). This shortcoming often stems from the assumption that placing students in groups will automatically yield meaningful interactions. However, a substantial body of research has highlighted that simply grouping students does not guarantee the emergence of expected meaningful interactions (Dillenbourg, 1999; Veldman et al., 2020). In this regard, Baines et al. (2003) emphasize that in many group learning applications, students tend to operate independently, often neglecting peer-to-peer interaction. The success and transformative potential of CBL lies precisely within these interaction processes. However, how students interact in CBL groups—what processes they use to generate ideas or how they develop understanding and insight—remains insufficiently understood. While prior research has frequently emphasized the relationship between transactive interactions and higher-order thinking skills such as academic achievement, cognitive performance, and critical thinking (Hunter & Anthony, 2014; Jurkowski & Hänze, 2010; Webb, 1984, 2008; Yager et al., 1985) there is still a lack of comprehensive studies that systematically reveal the characteristics of transactive interactions among students within group learning contexts. This study represents the first research effort in Türkiye focusing specifically on transactive interactions. Addressing this gap and gaining a deeper understanding of how CBL functions is a critical step in contributing to the existing literature. The aim of this study is to examine the interaction processes and associated experiences—both social and cognitive—of fifth-grade middle school students working collaboratively on cognitive tasks designed to promote critical thinking in a series of social studies lessons. While social and cognitive interactions cannot be strictly separated, this research focuses on the characteristic elements of both domains.

Research Question and Sub-Questions

This study seeks to answer the following main research question: "What are the patterns of transactive interactions in the critical thinking processes of middle school students during collaborative activities associated with social studies?" To address this overarching question, the following sub-questions are posed:

1. What group dynamics or student characteristics—socially oriented—guide the interaction processes of fifth-grade students while they collaboratively engage in cognitive tasks related to critical thinking, and how do these explain the structure of their transactive interactions?
2. What group dynamics or student characteristics—cognitively oriented—guide the interaction processes of fifth-grade students while they collaboratively engage in cognitive tasks related to critical thinking, and how do these explain the structure of their transactive interactions?

Method

Research Design and Participants

This study is grounded in a qualitative methodology that aligns with post-positivist, social constructivist, or other interpretive paradigms (Creswell, 2013). The interaction patterns that emerged during students' collaborative critical thinking processes were examined through a case study design. As a flexible methodological approach, case studies are particularly well-suited for in-depth investigations of specific instructional processes or pedagogical practices in educational research (Creswell, 2013; Merriam, 1998; Mills et al., 2010). This design is also effective for exploring the behaviors of individuals interacting within a shared context (Debout, 2016). The study was conducted with 28 fifth-grade students at a public middle school in northern Türkiye. The school was selected to represent typical urban educational settings in the region, ensuring both accessibility and a degree of academic and demographic diversity. Participants were selected using a purposive strategy (Palys, 2008; Patton, 2002) based on criteria such as developmental appropriateness, grade level, accessibility, and demonstrated active participation in collaborative processes. Participants had a mean age of 11 years.

Group Balance

Without intervening in the pedagogical context or the natural modes of student interaction, the groups were structured to ensure a context of interaction appropriate to the conditions in terms of both size and equality. Meta-analyses and empirical studies have shown that optimal transactive interactions frequently occur in dyads (Kim et al., 2020) and in groups of four (Corrége & Michinov, 2021). In this study, drawing on the group size approach of Johnson et al. (1994)—which posits that in a single logically sequenced round of interaction, dyads engage in two interactions and groups of four in twelve—seven collaborative groups (G1, G2, ... G7), each consisting of four students (S1, S2, ... S28), were formed to facilitate context-appropriate transactive exchanges. The final decision regarding the equality of the groups (Hooper & Clariana, 2012; Hwang et al., 2008; Johnson et al., 1994) was made based on pilot implementations data and the professional judgments of the school counselor, the classroom teacher, and the social studies teacher.

Procedure

Preliminary Steps

To identify patterns of transactive interactions, participants were guided through various critical thinking cognitive tasks. These cognitive tasks were developed in three stages aligned with the social studies curriculum. In the first stage, studies integrating CBL techniques with critical thinking skills (Criterion A) and studies defining at least one specific critical thinking skill (or subskill) (Criterion B) were systematically reviewed based on inclusion and exclusion criteria. According to Criterion A, 13 CBL techniques and 22 critical thinking skills were examined across 15 studies. According to Criterion B, 35 distinct critical thinking skills were analyzed in 14 studies. In the second stage, the cognitive tasks were determined, and in the third stage, expert reviews, pilot implementations, and subsequent revisions were conducted.

Critical Thinking Cognitive Tasks

The critical thinking cognitive tasks (P) were implemented over five periods (P1, P2, P3, P4, P5), requiring a total of 15 hours. These tasks were structured around techniques such as Think-Pair-Share (2x), Team-Pair-Solo (2x), and Jigsaw (1x), and were aligned with skills related to evidence-based reasoning and inquiry, inference through comparison, distinguishing the presence or absence of relationships among propositions, and causal explanation. Each task also incorporated various subskills relevant to critical thinking.

Implementation Model

The collaborative critical thinking cognitive task model is illustrated in Figure 1.

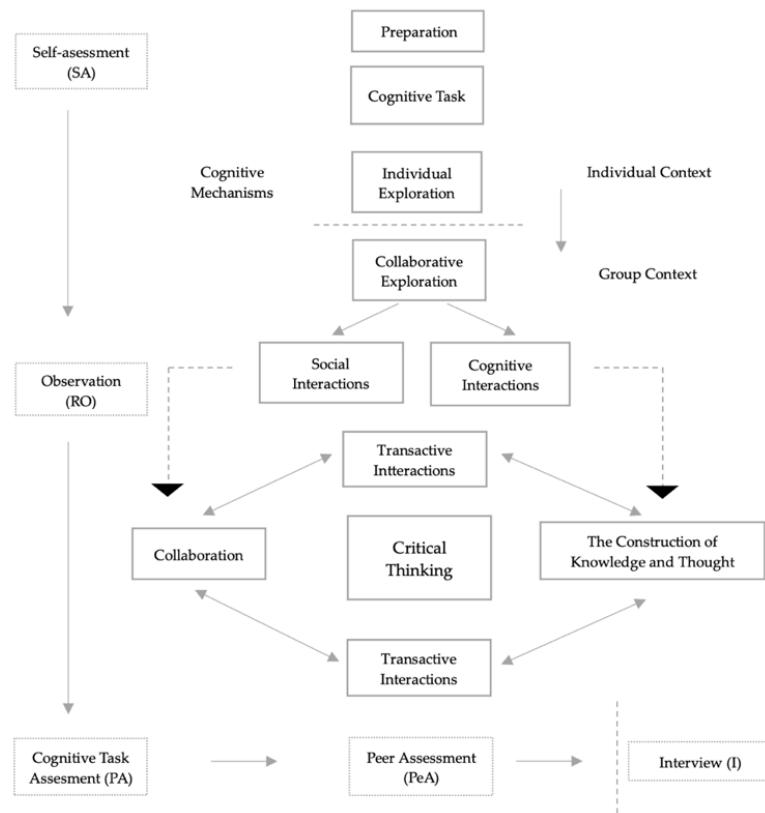


Figure 1. A step-by-step representation model of the functioning of collaborative critical thinking cognitive tasks and the data collection process

According to Figure 1, a critical thinking cognitive task consists of two stages. The "Individual exploration" stage includes processes such as preparing students for the activities, explaining social and cognitive interaction standards, etc. The "Transactive exploration" stage involves students' transactive interaction and active thinking processes. This stage includes the collaborative structuring of critical thinking cognitive tasks in groups and dyads (leveraging the power of social dynamics) and the deepening of knowledge and thought (transforming ideas into a new form). The cognitive tasks were designed to encourage transactive interactions. The questions included in the cognitive tasks were prepared in a way that supports the functionality of the model in Figure 1, ensuring that students participate in collaboration processes and stay within the critical thinking context. The cognitive tasks in critical thinking include questions such as "Prof. Filiz, after attending a meeting and discussing with Prof. Albert, thinks that Sahhen and Rado were wrong. What convinced Prof. Filiz? Was it the right decision for Prof. Filiz to change her mind?" (P1), "Who wrote the most suitable or helpful answer to Ozan_52's question?" (P3), "The two authors of the texts disagree on the role of plastics in human life. What is the key point of disagreement between the authors?" (P5).

Instruments

The data were collected through 2 categories and 5 different methods, based on participants' self-reports; sociometric and cognitive self-assessment (SA), cognitive task assessment (PA), peer assessment (PeA), interviews (I), and researcher observations (RO). Instruments were developed in 7 steps during the expert review and pilot implementations cycle (systematic literature review, creation of general question and expression matrices, determination of their structure and function, categorization, creation of specific question and expression matrices, expert opinion and pilot implementation cycle for each instrument, periodic language adjustments). The sociometric and cognitive self-assessment instrument ensured that students defined certain social and cognitive characteristics before the first application period. The cognitive task assessment instrument allowed participants to subjectively assess the personal cognitive experiences they had during the assigned

tasks. The peer assessment instrument enabled students to evaluate the contributions to cognitive tasks and the quality of interactions through their peers. The interview instrument facilitated in-depth understanding of interaction processes and helped uncover details that were difficult to capture with other instruments. The observation instrument provided standardized structures for systematically observing real-time interactions and behavioral patterns in their natural context. A subset of questions from the instruments, along with their conceptual descriptions, is presented in Appendix 1. Due to the nature of qualitative data, and in line with Maxwell's (2013) recommendations to reduce bias and reactivity, care was taken to avoid questions and expressions that indicated a particular theory or were based on any pre-determined preference. This process was conducted with great attention to ensure neutrality. Neutrally structured questions allowed participants to express their experiences (understandings, interpretations, feelings, etc.) in their own words.

Data Collection

Data were collected following several phases: the preparation phase (including the scheduling of the study, parent meetings, and other planning activities), the orientation phase, pilot implementations, and the main study phase. During orientation, students first engaged in the "determination of academic tasks," which involved theoretical instruction on collaborative learning and critical thinking skills. This was followed by the "example simulation" phase, in which students applied these theoretical concepts in real-life contexts. During the pilot implementation phase, the suitability of research questions, cognitive tasks, and instruments was tested according to specific criteria and revised accordingly. As a result of these phases, an implementation model explained in Figure 1 was developed for the primary study, and data were collected in accordance with this model. Prior to P1, SA data were collected once. During each cognitive task period, RO, PA, and PeA data were collected as standard. Interview data were collected during the 3rd and 5th weeks of the implementation process in a two-phase manner (with all participants and random selections). All data were processed into forms prepared on iPads, structured according to the groups, and then matched with the recordings, later being confirmed by the students.

Data Processing and Analysis

This study employed a content analysis approach based on established qualitative research principles (Drisko & Maschi, 2015; Kyngäs, 2020). Although content analysis strategies vary, the analytical framework recommended by Creswell (2012) and Creswell and Poth (2018) was adopted due to its systematic structure and applicability to the data. Data were analyzed using the MAXQDA Analytics Pro 2024 (version 24.0.0) software, which allowed for the exploration of complex relationships and patterns (Kuckartz & Rädiker, 2019). A data analysis matrix is shown in Figure 2.

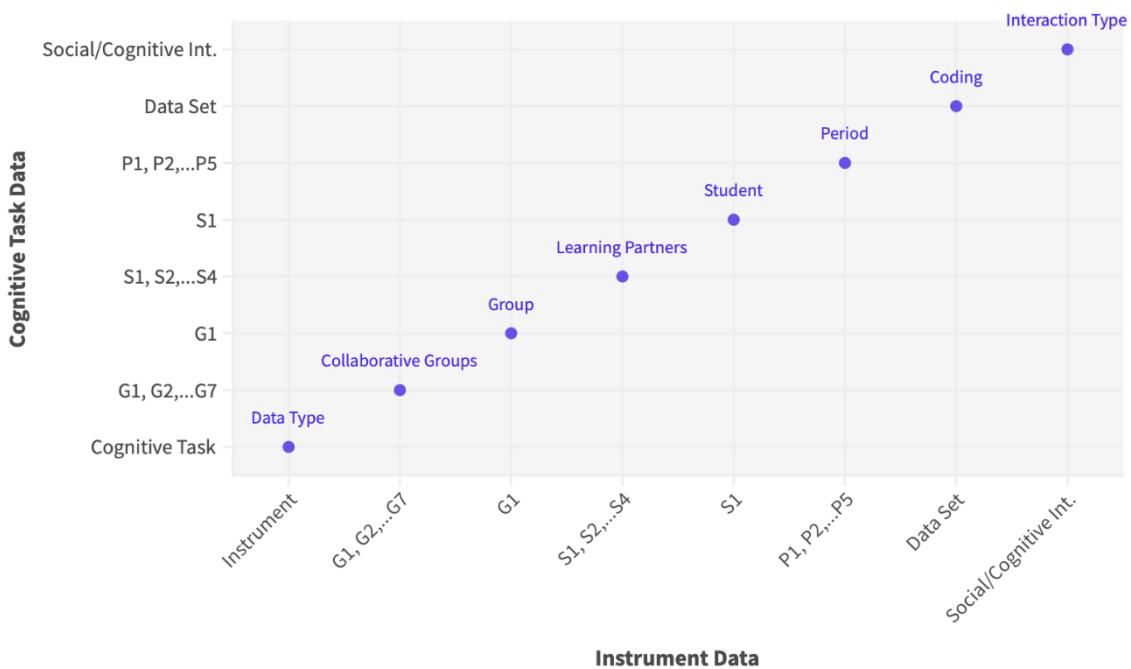


Figure 2. Example of Data Analysis Matrix

All student data were transcribed verbatim into sentences, each containing a single proposition, and then transferred into MAXQDA Analytics Pro 2024. The data sets were divided into two document systems: cognitive task data and instruments data, and sub-document groups were created accordingly. Document groups were categorized based on data type, CBL groups, individual groups, learning partners, individual students, and cognitive task periods. The data types were defined, and the data were classified according to collaborative groups. An analysis group was identified, and the data of the four learning partners in this group were consolidated, after which the data of the student to be analyzed were placed into the analysis matrix according to the cognitive task period and the type of data collection instrument. Based on this matrix, the data were processed in MAXQDA Analytics Pro 2024, and this process was repeated cyclically for the 7 groups, 28 students, and 5 cognitive tasks. In this way, cognitive task and instruments data were analyzed comparatively. Information regarding the functioning of transactive interactions was embedded in various codes — the code system representing these information sets is shown in Appendix 2. Independent and related code matrices, along with information pieces, were transformed into upper and lower codes, and initial patterns were identified. Poor quality codings were eliminated, and low-frequency sub-codes (usually 5 or fewer) were synthesized at the upper code level according to context. Categorical classifications were made to re-identify the patterns. The categorized and reviewed data files were sent to multiple coders for inter-coder agreement, and requests for review and coding were made to ensure the stability of the analyses. The inter-coder agreement was determined to be 93.57%. It is recommended that this agreement be above 80% (Saldana, 2021). Codes with sufficient agreement percentages were organized into meaningful units, patterns were re-identified, and the analyses were completed.

Limitations

This study has four main limitations. First, it is limited to the students who comprised the study group at the middle school where the interventions were conducted during the 2023-2024 academic year. Second, due to its post-positivist design, inherent methodological constraints restrict the generalizability of the findings. Third, the results are confined by the scope of the data collection tools, which consisted of student self-reports and observation-based forms. Finally, excluding orientation and pilot phases, the study was conducted over a period of five weeks, which may be insufficient to capture

long-term trends in students' collaborative critical thinking interactions. Therefore, the research has limitations in providing a comprehensive understanding of how the observed phenomena evolve over time.

Ethical Issues

This study was conducted with the ethical approval of the Social and Humanities Research and Publication Ethics Committee of the Rectorship of Kastamonu University, dated 07.09.2022, and decision number 9/2, as well as the permission of the Governorate of Ordu, dated 11.09.2023, with reference number E-18802389-605.01-83541134.

Findings

Findings Regarding Sub-Problem 1

The analyses indicate that socially characterized transactive interactions in collaboration-based critical thinking tasks are associated with the understanding of collaboration, socio-emotional awareness and expressiveness, and the perception of social well-being within the group.

Understanding of Collaboration and Tendencies Toward Collaboration

The understanding of collaboration and students' disposition toward collaborative work constitute the primary and most influential dimension of socially characterized transactive interactions. A willingness to engage in collaboration or an effort to establish partnerships regardless of other conditions was categorized as positive collaboration, whereas avoidance of collaboration or expressing concerns about forming partnerships was classified as negative collaboration. Students' conceptualization of collaboration guided them to act jointly with the group (collective), independently from the group (individual), or with specific peers (dyadic). The most frequently coded data pertained to this theme. In total, 363 transactive interactions related to collaboration were identified, of which 185 were associated with positive collaboration and 178 with negative collaboration. Data from Groups 1, 2, 4, and 5 accounted for 87.57% (162 interactions) of the positive collaboration instances, while data from Groups 3, 6, and 7 represented 12.43% (23 interactions). In contrast, the negative collaboration category included 44 interactions (24.72%) from Groups 1, 2, 4, and 5, and 136 interactions (76.40%) from Groups 3, 6, and 7. This grouping, or dichotomization, of collaboration understanding was also broadly mirrored in the patterns of other transactive interaction processes. The findings from both research questions generally aligned with this categorization.

Social-Emotional Awareness and Expressive Capacity

Social-emotional awareness and expressive capacity constitute the second characteristic dimension of socially characterized transactive interactions. In this domain, students' abilities to make social inferences—particularly through body language, facial expressions, speaking style, tone of voice, and emotional cues such as frustration and sadness—played a significant role in shaping transactive interaction processes. When social inference skills were used effectively, students exhibited proactive behaviors such as attempting to resolve potential conflicts before they escalated, investing effort into understanding the intentions and feelings of others, and using motivating elements such as social rewards. The following student statements illustrate these dynamics:

“...Actually, if someone has difficulty expressing themselves, I try to help... I look at their face and try to understand how they feel. I try to find a solution together so they can express themselves better.” (G2, S7, PA)

“...Their ideas sound strange (and silly). If everyone criticizes them, they might feel really bad... When one of my friends noticed this, and told them they were part of our group, it reflected on them... This way, everyone can do better. I think we need to understand each other...” (G4, S11, PA)

“...When I realize they're struggling, I sometimes try to encourage them to join us... When I saw a groupmate constantly feeling bad, I said, 'Awesome! You're doing great, buddy!'” (G6, S27, I)

Groups that demonstrated effective use of social inference skills more frequently displayed behaviors such as respectful attitudes (avoiding condescending or superior behavior), active listening, building constructive relationships, and openness to feedback. A total of 111 transactive interactions were identified in relation to this theme. Of these, 99 interactions (89%) were observed in data from Groups 1, 2, 4, and 5, while only 12 interactions (11%) came from Groups 3, 6, and 7.

Groups Ineffective in Using Social Inference Skills

Groups that were less effective in utilizing social inference skills more frequently displayed behaviors such as withdrawal and difficulty in self-expression, poor emotional regulation, social disengagement, feelings of exclusion and worthlessness, and the exertion of knowledge dominance (bullying). A total of 111 transactive interactions were identified regarding this dimension. Of these, 89 interactions (66%) were recorded in data from Groups 3 and 7, while 45 interactions (33%) were observed in Groups 1, 2, 4, 5, and 6. Selected student reflections related to this theme are presented below:

“I think we were the group that failed at this. For example, when they kept finding what I said ridiculous, it made me angry. So this time, I didn’t say much until it was over... I didn’t get too involved. To be honest, nobody cared either. That made me even more upset.” (G3, S10, I)

“...Sometimes my opinions weren’t taken seriously. They acted like it didn’t matter whether I was there or not... I felt a bit insignificant in our group, to be honest. Maybe that’s why I stayed quiet. Even though I’m confident, I found it hard to talk to them at times.” (G7, S9, PA)

“...Since he’s normally a quiet, calm person, I don’t think it was a problem that he didn’t join us.” (G7, S6, PA)

These statements, when evaluated in terms of social inference skills, highlight that some group members failed to adequately perceive the emotional and social cues in their interactions with peers.

Perceived Social Well-Being Toward the Group

Perceived social well-being toward the group constitutes the third characteristic dimension of socially characterized transactive interactions. Students’ sense of harmony with their peers, their satisfaction in working together, and their friendships played a decisive role in shaping their social interaction processes. This dimension is closely related to self-esteem, group self-discipline, internal state experiences, and the quality of interpersonal connections.

Self-esteem was manifested in the form of confidence and the ability (or difficulty) to express oneself or withdraw from group interactions. In groups where members perceived a strong sense of harmony, higher levels of confident behavior were observed. Conversely, in groups lacking such a sense of cohesion, confidence-related behaviors were markedly less frequent. In high-confidence groups, students felt more mentally comfortable, which allowed them to express their thoughts more freely—contributing greatly to the depth of cognitive interaction. On the other hand, in groups with low confidence behaviors, students often felt mentally uneasy. This unease increased their anxiety about being criticized, humiliated, or not being able to assert themselves within the group, leading to difficulties in self-expression and withdrawal behaviors.

Group self-discipline and internal state experiences emerged through concepts such as group flow, suboptimal experiences, strong versus weak group discipline, internal versus external motivation, ability to cope with challenges, and lack of social motivation. Group flow and suboptimal group experiences were especially important. Group flow was defined as the enjoyment derived from spending time together and working as a team. Groups that demonstrated this tendency showed strong group self-discipline (e.g., collective will, organization, and focus) and operated with intrinsic motivation, making more effective use of their collective potential and human resources. In contrast, suboptimal experiences referred to dissatisfaction with group interactions. These groups tended to

display weak group self-discipline (e.g., poor sense of responsibility, disorganized structure, and fragmented task handling) and lacked social motivation. Below are selected student reflections illustrating these tendencies. The first reflects group flow and strong self-discipline, while the second exemplifies a suboptimal experience and weak group discipline:

“...Everyone was really motivated. Even the quietest and least successful student in our class was in our group—he read every single question out loud. He didn’t fall behind at all...” (G2, S5, PA)

“...Teacher, it felt like we were strangers to one another. There were a few people helping with the questions, but for the most part, everyone kept to themselves. For example, after working on things alone, I asked for help where I was struggling: ‘Can you help me with this?’ But overall, we kind of just handled things on our own. I don’t think we fully supported one another.” (G3, P8, I)

Extremes in social relationships—whether in the form of overly close friendships or difficulties in forming emotional or social bonds with the group—were both found to negatively impact transactive interaction processes. Overly close friendships hindered the objective exchange of ideas within the group. For instance, although Groups 4 and 5 generally exhibited relatively high levels of both social and cognitive interaction, excessively close friendships occasionally undermined their transactive interaction processes. Conversely, difficulties in establishing social or emotional connections with group members also disrupted the natural flow of these interactions. These challenges often resulted in fragmented communication and reduced cooperative behavior. Below are selected student reflections illustrating these issues. The first quote relates to overly close friendships, while the others exemplify challenges in forming social and emotional connections with the group:

“...I don’t criticize my best friend, even if I want to. Even if they make mistakes, I don’t say anything. For example, one of my friends contributed less, but I didn’t say a word to them...” (G5, S21, PeA)

“Some people were hiding information. I think they didn’t like us very much, so they kept their answers from us. I asked what was written in one section, and no one looked. But when someone else asked, they all answered...” (G3, S8, PeA)

“...They want to help their friends in the other group more than us. That’s why we got most of the warnings.” (G4, S22, PeA)

These reflections underscore how extreme social dynamics—whether stemming from excessive closeness or emotional detachment—can weaken collaborative structures and hinder the creation of an effective sharing environment within groups.

Findings Regarding Sub-Problem 2

The analyses indicate that cognitively characterized transactive interactions in collaboration-based critical thinking tasks are associated with goal orientation, the regulation of thought production processes (group metacognition), as well as knowledge processing and decision-making.

Goal Orientation and Regulation of Idea-Generation Processes

Goal orientation and the regulation of idea-generation processes constitute the first characteristic dimension of cognitively oriented transactive interactions. Goal-directed tendencies were categorized into goal-oriented behaviors (163 interactions), competence-oriented behaviors (70 interactions), and goal-detached behaviors (113 interactions), resulting in a total of 346 interactions. The regulation of idea-generation processes was observed through two primary categories: metacognitive awareness and monitoring (160 interactions) and limited metacognitive awareness (160 interactions), totaling 320 interactions.

More frequent goal-oriented, competence-oriented, and metacognitive monitoring behaviors were identified in Groups 1, 2, 4, and 5 compared to others. Conversely, goal-detached behaviors and limited metacognitive awareness were more prevalent in Groups 3 and 7. These differences were particularly striking. For example, 25.34% of all goal- and competence-oriented interactions occurred in G1 (92 interactions), while only 1.78% occurred in G7 (7 interactions), and 0.76% in G3 (3 interactions). In contrast, 60% of the goal-detached and limited metacognitive awareness interactions were observed in G3 (96 interactions), 43.12% in G7 (69 interactions), and only 7.5% in G5 (12 interactions).

Groups' orientations toward goals influenced their seriousness, persistence, and ability to adapt to changing conditions (e.g., confronting challenging questions). Groups demonstrating goal-oriented behaviors tended to avoid a purely performance-based approach (e.g., aiming solely for high scores). In contrast, goal-detached behaviors led to deviations toward irrelevant topics (e.g., off-topic comments), prioritization of personal traits over group goals (e.g., ad hominem remarks, efforts to prove oneself), and, most critically, a focus on merely providing a correct answer without depth or quality.

The regulation of idea-generation processes closely paralleled goal orientation. Groups with strong goal orientations displayed higher levels of metacognitive awareness by effectively monitoring the roles of other group members, detecting and correcting errors, and directing others' thinking processes—much like monitoring one's own. Students in these groups actively guided peers with comments such as, "Could you be missing something here?", "Does this solution really make sense?", or "There's something going wrong, don't you think?" Furthermore, they were more capable of identifying which cognitive strategies worked—or didn't work—within task contexts. On the other hand, groups with limited metacognitive awareness (typically those exhibiting goal-detached behaviors) struggled to monitor their peers' thinking processes, even if they made efforts to complete the critical thinking tasks. Analyses showed that these students often expressed ideas without fully understanding the task context, had difficulty recognizing and analyzing different perspectives, and failed to determine which viewpoints were most appropriate. They frequently relied on previously unsuccessful strategies (e.g., repeatedly rereading all text passages for each question), indicating a lack of adaptive regulation in problem-solving processes.

Knowledge Processing and Decision-Making Processes

Knowledge processing and decision-making processes constitute the second and most critical characteristic dimension of cognitively characterized transactive interactions. The interactions in this domain manifested as the exchange of knowledge, ideas, and arguments, emphasizing a shared pursuit of high-quality arguments. The relevant codes and the distribution of interactions are presented in Figure 3.

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Figure 3. Codes Related to the Theme of Knowledge, Ideas, and Arguments Exchange and the Frequency Distributions of Interactions Defined by These Codes

Hundreds of interactions centered on the exchange of knowledge, ideas, and arguments among groups were clustered under various distinct codes. Characteristics that promote strong cognitive interactions (e.g., evaluating diverse perspectives and reviewing alternatives, seeking quality arguments, providing detailed explanations and feedback) as well as those that lead to weak cognitive interactions (e.g., passive and non-contributory opinions, performance/result-oriented argumentation, intuitive thinking and decision-making) have been identified. According to the code relationship analysis, strong cognitive interactions were most closely associated with the code for seeking quality arguments. Therefore, it was determined that interactions related to knowledge, ideas, and arguments exchange primarily focused on seeking quality arguments.

Quality argument exchange is defined as the effort to make responses to cognitive tasks related to critical thinking more qualified while fulfilling these tasks. This involved understanding the perspectives of group members, identifying ideas that contribute to solutions, using or eliminating them, producing solid and persuasive evidence and alternatives, responding constructively to mistakes, and using basic strategies.

In Table 1, the distribution of interactions related to seeking quality arguments across the groups in the cognitive tasks P1 "Sumerians: A Journey in Search of the Mysterious History of Writing" and P2 Welcome to "Kids Are Talking" YouTube Channel! is presented, and in Table 2, the responses provided by the groups to some questions in these cognitive tasks under the common decision-making condition are shown.

Table 1. Distribution of Interactions Related to the Pursuit of Quality Arguments in P1 and P2 Cognitive Tasks Across Groups

Groups	Pursuit of Quality Arguments
G1	44
G2	30
G3	3
G4	28
G5	18
G6	6
G7	8
Total	131

Table 2. Common Responses Provided by Groups to Certain Questions in P1 and P2 Cognitive Tasks

P1		Sumerians: A Journey in Pursuit of the Mysterious History of Writing
CT Skill		Evidence-Based Reasoning and Inquiry
Question		"Prof. Filiz finds Sahhen's thoughts more convincing than Rado's. Why might this be? Write your answer using evidence from the text."
		Responses
G1	"He has more knowledge than Sahhen. Sahhen is more aware than Rado. Rado is a rug maker, while Sahhen is a guide. Sahhen is more knowledgeable."	
G5	"The fact that Sahhen is a local guide shows that he has to know the subject. He already demonstrated that he knows the subject better. He even gave an example: People living in big cities might have needed writing to prevent problems. This explains why Sahhen believes this."	
G3	"The large number of people might have been influential."	
G7	"They both said the right things, but Prof. Filiz may not have believed [Rado] enough."	
Correct Answers	Answers emphasizing Sahhen's knowledge will be considered correct.	
P2		Welcome to "Kids Are Talking" YouTube Channel!
CT Skill		Inference Through Comparisons
Question		One of the purposes of the text titled Welcome to "Kids Are Talking" YouTube Channel! is to compare the cultural and historical significance of Hagia Sophia with other churches. What is the other purpose of this text?
		Responses
G2	"The natural areas around Hagia Sophia are being destroyed, and it explains the changes over the past 40 years. It mentions how the natural areas around Hagia Sophia are being destroyed and how the structures' historical genetics can be damaged over time."	
G4	"To prevent damage to the surroundings of these buildings. Because an important change occurred recently in the picture. The surroundings of the Taşbaşı church in Ordu have become filled with houses. I live there too. I will tell my dad that we need to move, teacher."	
G6	"To introduce historical places to people."	
G7	"If we want them to last longer, we must protect the buildings."	
Correct Answers	Answers highlighting the protection of historical sites from human destruction will be considered correct.	

When Tables 1 and 2 are considered together, it is observed that groups that engaged in more intense cognitive interactions related to the search for quality arguments provided more accurate, consistent, detailed, and longer responses in terms of word count. In contrast, groups that experienced fewer interactions on this matter gave shorter, contextually disconnected answers with a more limited knowledge base.

This situation, though not frequent, was sometimes related to how groups behaved when they were unable to reach consensus during the decision-making process, particularly in situations where group members had to take initiative. When a positive dominance was adopted in the groups, the student who relied most on background knowledge made decisions by pressuring others. However, when group thinking was adopted, the ideas presented by the dominant group member were often accepted without question.

These findings show that collaboration-based critical thinking processes are highly sensitive to transactive interactions, and this process creates localized and complex behavioral patterns.

Discussion, Conclusion, and Recommendations

One of the principles of CBL is transactive interactions among learning partners. The momentum of transactive interactions is largely related to the understanding of collaboration, which itself is a learning outcome for collaborative-based pedagogical practices (Slavin, 2014). Schwarz et al. (2000) highlighted that students' success in group work depends on a series of conditions, which can be triggered by the optimal understanding of collaboration. Gillies (2014), who examined the research findings of Schwarz et al. (2000) and similar studies more deeply, argued that responding to a collaborative cue in collaborative learning groups forms the contextual foundation for group-specific behavioral patterns. This study concluded that the understanding of whether to sustain or avoid collaboration during cognitive tasks focused on critical thinking significantly alters the nature of transactive interactions. Groups with a dominant positive understanding of collaboration, defined as an effort to form partnerships while being open to collaboration and ignoring other conditions, generally had better experiences related to both social and cognitive transactive interactions throughout the entire research process. These results align with previous studies that emphasize the importance of the understanding of collaboration in group work (Hancock, 2004; Hunter & Anthony, 2014; Roseth et al., 2008). In one study, it was found that the mathematical thinking processes of students aged 8-12 developed through social collaboration dialogues in groups (Hunter & Anthony, 2014). Initially, 74% of the dialogues were related to cognitive tasks, but as social collaboration dialogues developed, this rate increased to 96%. However, it is well-known that simply placing students in groups and telling them to work together does not necessarily encourage collaboration in collaborative learning (Veldman et al., 2020). When students with different characteristics or tendencies are required to work together, many factors need to be managed in harmony, which complicates and makes the collaboration process more difficult (Fiedler et al., 2024). The dominant negative understanding of collaboration, defined as avoiding collaboration or having concerns about forming partnerships, was confirmed in groups with such assumptions. These groups had progressively worse experiences related to both social and cognitive transactive interactions throughout the entire research process. Järvelä et al. (2023) concluded that when sufficient resistance was not shown against triggering events that hinder collaboration, students did not socially, emotionally, and mentally adapt to the groups, and these groups became vulnerable to potential learning losses. From this perspective, collaborative understandings are a common behavioral pattern that affects both social and cognitive transactive interaction processes.

It was concluded that there were qualitative differences in the social and emotional awareness or expression abilities of group members while collaborating on cognitive tasks related to critical thinking, with social inference skills standing out in particular. Social inference skills refer to the process of predicting the possible and simple causes of observed social behaviors, usually quickly or automatically (Becker et al., 2021), and this skill begins to develop at a very early age (Poulin-Dubois & Brosseau-Liard, 2016). The reasons for the use of social inference skills at different levels and their effects on students have been repeatedly examined by research in neuroscience, memory studies, and behavioral sciences (Ferreira & Adleman, 2020; Hawkins et al., 2023; Molden et al., 2006; Nelson et al., 2005). Nelson et al. (2005), who examined the neuroscientific origins of this process based on social information processing theory, suggest that the social inference process occurs in three nodes in the brain. In the detection node, the characteristics of social stimuli, such as facial expressions or emotional cues, are analyzed; in the affective node, the emotional significance of the social stimuli is determined by activities in the amygdala, ventral striatum, and other parts of the limbic system, with emotional meanings assigned; and in the cognitive-regulatory node, social stimuli are subjected to higher levels of cognitive processing to interpret the mental states or intentions of others. Some memory studies have linked this process to emotional regulation habits and verbal memory (vocabulary) skills (Ferreira & Adleman, 2020). In other words, individuals who are better at re-evaluating the emotional state of a group member and performing verbal memory tasks tend to use their social inference skills more effectively. Some behavioral science studies also show that when individuals make appropriate social inferences, they make better decisions, which in turn improves group performance (Hawkins et al., 2023). Additionally, students' beliefs about their cognitive abilities also differentiate their social

inference skills and their power to interpret these cues (Molden et al., 2006). Students who believe cognitive traits are fixed or unchangeable tend to think behaviors are reflections of stable personality traits, while those who believe these traits can develop focus more on the variable and situational causes of behavior. For instance, in a situation where a group member seems withdrawn and stressed, those who adopt the first approach tend to assume that peers already possess such characteristics. However, those who adopt the second approach are more likely to consider the possibility that their peer might be feeling pressured due to the social context and situational factors. These findings provide some explanations for communication-focused differences in groups when collaborating on cognitive tasks related to critical thinking.

The conclusion that students' perception of social well-being (their harmony within the group, satisfaction derived from spending time or working together, and friendship relationships) is determinant for transactive interactions, which are socially characterized, has also been identified in various studies (Crick & Dodge, 1994; Gross & Medina-DeVilliers, 2020). Many studies in this area show that an increase in the perception of social well-being enhances students' collaborative and participatory behaviors, while a decline in this perception increases behaviors associated with instability, such as dominance, conflict, jealousy, explosive reactions, and impulsivity, as well as social isolation behaviors like loneliness and withdrawal (Coie et al., 1982; Garrison et al., 2010; Onrubia & Engel, 2012). Hackman and Morris (1975) examined students' collaboration understanding and their level of harmony with each other in productivity, discussion, and problem-solving tasks, and found positive significant relationships ranging from .59 to .68 across three different types of tasks. A series of studies conducted by Lai, Sung et al. and (2011) Lai, Jong et al. (2011) demonstrated that when the perception of social well-being is insufficient, the effect of collaborative learning is diminished. However, some studies focusing on why perceptions of social well-being differ for groups suggest that this may relate to students perceiving cognitive tasks as competitive and being more likely to view peers they do not define as friends as competitors (Johnson et al., 1994; Liao et al., 2018). When examining the dialogues or statements of certain groups (e.g., G3, G7) that often depict a negative picture in terms of social well-being, it seems possible that students in these groups might have seen each other as rivals rather than establishing friendships or developing intimate relationships. On the other hand, there are also counter-evidence findings that contradict these conclusions (Klang et al., 2020; Senior & Howard, 2014). For instance, in a study conducted by Klang et al. (2020) with 958 fifth-grade students over 15 weeks, it was concluded that students' perceptions of the classroom atmosphere and their friendship relationships were not sufficiently significant in determining their motivation during the collaborative learning process. These results generally support the dimensions of social well-being related to self-esteem, group self-discipline, and internal state experiences, but emphasize that the aspect of friendship relationships may not always make a difference in transactive interactions.

In goal-oriented groups, students exerted significant effort to adequately complete the cognitive tasks presented to them. However, students in groups that deviated from the goal orientation were unable to do so sufficiently and generally focused more on performance goals rather than learning goals. These differences in goal orientation directly influenced the perseverance and determination behaviors of the groups. Some findings in this regard are supported by various mindset theories. For example, the data obtained from Groups 1, 2, 4, and 5 are similar to Gollwitzer's model of action phases (Fujita et al., 2007; Gollwitzer, 1990). The goal orientations of these groups align with the deliberative and implemental mindsets in the model. Deliberative mindsets are superior in goal-setting, while implemental mindsets are superior in the effort demonstrated to achieve the goal (Brandstätter et al., 2015). These groups seemed to be a combination of both mindsets. On the other hand, the data from Groups 3, 6, and 7 were distinctly compatible with certain achievement motivation theories (Hokoda et al., 1989; Sorrenti et al., 2018). In relation to this, the regulation of thought production processes was also closely connected. This is often discussed in the literature on collaborative learning as group processing (Deutsch, 1949; Johnson et al., 2007) and organizational interactions (Hernández-Sellés et al., 2020). The ability of group members to monitor their progress toward their goals during collaboration—i.e., their group-based metacognitive abilities—had a significant impact on group performance (Haataja et al., 2022; Yager et al., 1985). When Yager et al. (1985) studied 84 third-grade students in terms of group

metacognition, they found that groups who monitored their work or thinking processes achieved better results in academic success, knowledge retention, and transfer. Similar results have also been identified in other studies (Lachowsky & Murray, 2021). In this study, groups that were more successful in monitoring their thought production processes were typically the groups that engaged in more metacognitive conversations (metatalk) (Newman, 2017), exchanged better ideas and arguments in cognitive tasks, and made efforts to produce higher-quality arguments.

The most significant outcomes of cognitive-characterized transactive interactions were related to the exchange of knowledge, ideas, and arguments. Children can begin using such cognitive features to provide justifications for their decisions from around the age of 3 to 5 (Köymen et al., 2020). In collaborative-based cognitive tasks, students should engage in the exchange of knowledge, ideas, and arguments to explore the underlying mechanisms of the cognitive tasks presented to them. This enables group members to engage critically but constructively with each other's ideas (Howe et al., 1990; Mercer et al., 1999). Piagetian and Vygotskian approaches, in particular, have repeatedly argued that higher-order mental processes emerge in learning environments through such interactions (Piaget, 1952; Vygotsky, 1962, 1978). The common feature of these approaches is that individuals' opposing views and different levels of understanding stimulate social and cognitive conflicts, which in turn pave the way for more efficient cognitive processes. In this study, groups that interacted more frequently on issues related to the exchange of knowledge, ideas, and arguments generally provided more accurate answers to questions involved in cognitive tasks by striving to develop higher-quality arguments. This is explored in a broad literature focusing on the structure of cognitive tasks and teacher or researcher support (Gätje & Jurkowski, 2021; Liu & Tsai, 2008; Nemeth et al., 2023; Ouyang et al., 2023). Ouyang et al. (2023) examined the guiding elements of the processes of knowledge, idea, and argument exchange in collaborative group work. After analyzing 6,104 statements based on idea exchanges, they identified 13 different types of discourse moves that guided this process. These strategies were related to groups starting their negotiation process from the right point, staying within the negotiation through transition statements that guided each other, asking appropriate questions, and providing clear summaries before the decision-making process. Felton et al. (2015) more clearly outlined many of these details. In a study with 70 middle school students in Spain, they examined the structure of dialogues in the process of exchanging knowledge, ideas, and arguments, their approaches to arguments, and most importantly, how they responded to opposing views. When the students assigned to two groups under the conditions of agreement and persuasion were examined, it was found that students in the agreement group engaged more frequently in dialogues aimed at understanding, elaborating, and relating different perspectives to their own thinking. Students in the persuasion condition, on the other hand, spoke less when confronted with opposing views and engaged in dialogues aimed at ending the discussion. Although this contradicts Piagetian and Vygotskian approaches in certain aspects, the results of this study largely align with these findings. However, there are various studies that do not support these results (Sperber & Mercier, 2012).

In light of these results and the comprehensive discussion framework, several recommendations are made to strengthen the theoretical and practical structure of similar future research. First, students' collaborative tendencies in collaboration-based critical thinking processes should be taken into account. These different tendencies among students determine the direction in which higher-order cognitive tasks, such as critical thinking, will progress. Second, the importance of interactions among group members should be emphasized, and external support mechanisms should be prepared for situations where transactive interactions are assumed to be unsustainable. During implementations, actions should be taken accordingly. Third, the importance of social harmony in this process should be considered, and more effective groups should be formed using sociometric techniques. Finally, although the success of cognitive tasks may vary depending on their purpose and content, to increase the success of cognitive tasks and achieve more meaningful results, the focus should be on students' reading and comprehension skills rather than their academic achievements or previous standardized test scores. In this regard, educational systems and practitioners should recognize the significance of transactive interactions in collaboration-based learning environments and should not overlook the development of strategies in this area.

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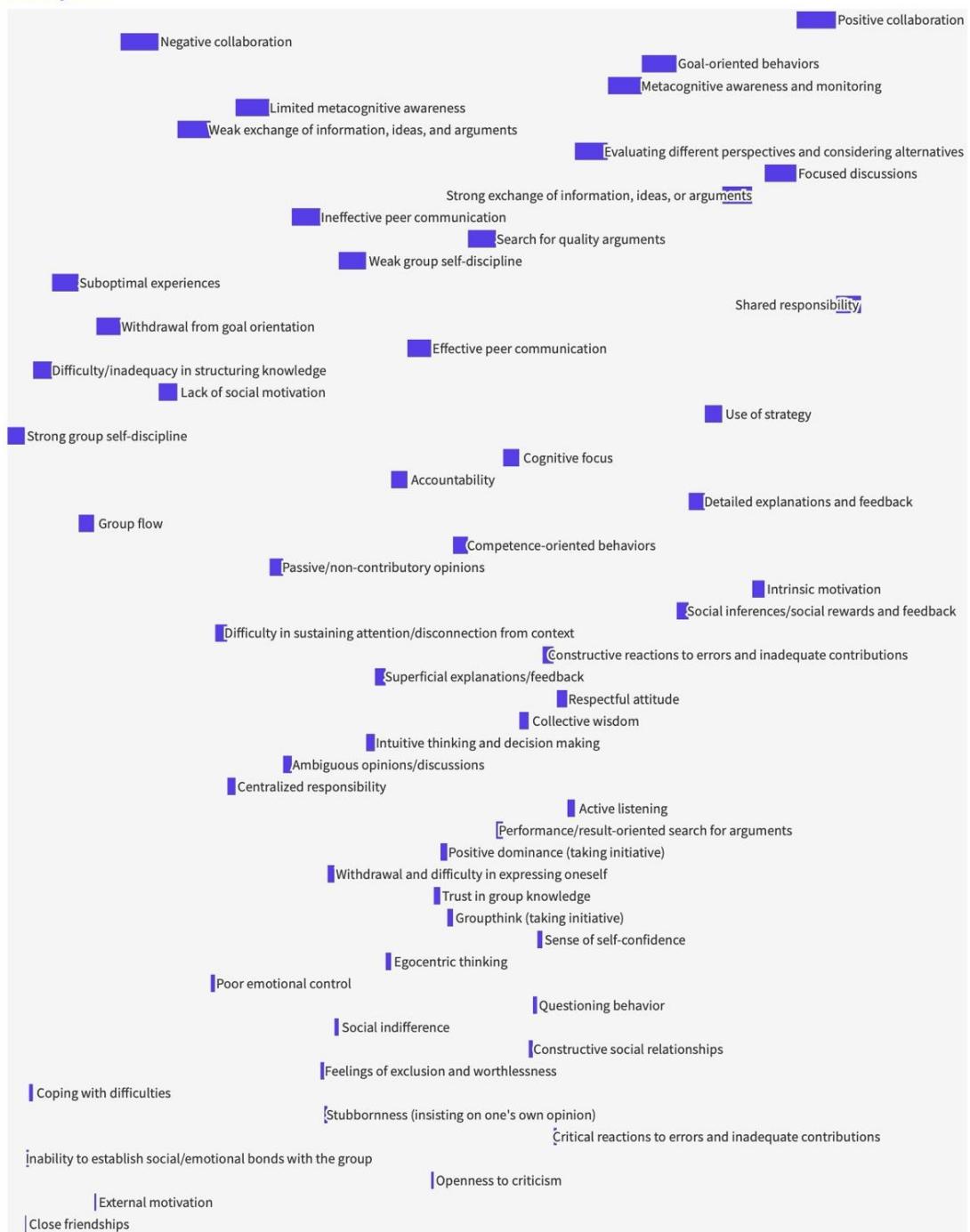
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Appendices

Appendix 1. A Subset of Questions from the Instruments Along with Their Conceptual Descriptions

Instruments	Questions	Descriptions
SA	“Which classmates would you prefer to study with? Please write the names of three classmates in order from the one you prefer the most to the one you prefer the least.”	This dimension focuses on group dynamics.
PA	“This activity went well for me in some ways because...”	This dimension relates to general individual experiences.
PeA	<p>“How did your group members approach collaboration with you (e.g., sharing knowledge, giving feedback, willingness to work together)? To help us better understand, could you describe a behavior or dialogue you remember related to this? What exactly happened?”</p> <p>“During the activities, group members presented various ideas and behaviors, and you interacted with them. Who do you think contributed the most to you or your group, and what were the most distinct features you noticed during your interactions with them?”</p> <p>“How did your group members approach collaboration with you (e.g., sharing knowledge, giving feedback, willingness to work together)? To help us better understand, could you describe a behavior or dialogue you remember related to this? What exactly happened?”</p> <p>“During the activities, group members presented various ideas and behaviors, and you interacted with them. Who do you think contributed the most to you or your group, and what were the most distinct features you noticed during your interactions with them?”</p>	This dimension involves students' evaluations of their group members.
I	“Some groups managed to establish a rich and effective network of interaction during the activities, while others could not. Can you explain the possible reasons for this based on examples from your own group?”	This dimension addresses the reasons behind differences in transactive interactions among groups.
RO	<p>“Do group members collaborate effectively?”</p> <p>“Which types of discussions are most encouraged or suppressed by group members?”</p> <p>“How are the knowledge, ideas, or arguments proposed by members accepted, rejected, or filtered by the group?”</p>	This dimension relates both to confirming students' statements and interpreting the meaning of those statements.

Code System

Total Codes 56

Appendix 2. Code System. Frequency distributions of the codes were taken into account. Colour intensities decrease from frequently encountered situations to less frequently encountered situations in interaction processes.



A bridge between home and school built through books: a journey into critical thinking, problem solving, and creativity *

Gülşah Gençer ¹, Bahar Doğan Kahtalı ²

Abstract

The aim of this study is to examine the development of critical thinking, problem-solving, and creativity skills among 7th-grade students from low socioeconomic backgrounds, and to analyze this developmental process using children's books within the framework of the flipped learning model. In this context, action research, one of the qualitative research methods, was employed. The study was conducted over a period of 12 weeks during the fall semester of the 2022–2023 academic year at a secondary school with a low socioeconomic profile, located in a central district of a major city in the western part of the Eastern Anatolia region. The participants consisted of twenty 7th-grade students who exhibited deficiencies in critical thinking, problem-solving, and creative thinking skills, selected through criterion sampling. Different data collection tools were utilized at various stages of the research. While the Cornell Critical Thinking Test and the Torrance Tests of Creative Thinking were used to gather quantitative data, qualitative data were collected through observation notes, the researcher's diary, audio and video recordings, and interviews with teachers, students, and families, as well as student projects created based on the activities related to the books. Quantitative data were analyzed using correlation analysis and the Kendall's W test to determine inter-rater agreement. Qualitative data were analyzed using the thematic analysis method. As a result of the analyses, it was concluded that the students showed improvement in their critical thinking and problem-solving skills. Although there was also an improvement in their creative thinking skills, it was not as pronounced as the other two skill areas.

Keywords

Critical thinking
Problem solving
Creativity
Flipped learning
Children's books
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Introduction

Today, the worlds of education and business operate in a rapidly evolving environment. Technological advancements, globalisation, and social changes continue to reshape individuals' expectations and needs. In this process of transformation, the traditional knowledge-based approach to education is increasingly being replaced by a model centered around 21st-century skills. These skills emphasize the development of flexibility, communication, critical thinking, problem-solving, creativity, collaboration, and digital literacy rather than the mere acquisition of basic academic knowledge (Demir & Yilmaz, 2019). They are considered key factors not only in academic achievement but also in success within the business world and everyday life.

Wagner (2008) observes that 21st-century skills are increasingly valued in the business world. He notes that traditional job roles and business models are evolving, and that technological advancements and global competition demand new skill sets. Employers now seek candidates who possess not only academic knowledge but also flexibility, critical thinking, creativity, teamwork, and problem-solving skills. In this context, it is critical for the education system to focus on developing 21st-century skills. Schools and universities should therefore not only provide students with academic knowledge but also foster environments that support the development of real-world application skills. Methods such as project-based learning, collaborative work, and technology integration can play an effective role in helping students acquire these skills (Anderson & Krathwohl, 2001).

In light of all this, it can be said that as 21st-century skills gain increasing importance in both education and business, their effective development is vital for enhancing individual success and societal competitiveness. Therefore, educational institutions and businesses have focused on 21st-century skills and have sought to classify them in order to adapt to changing dynamics and promote success. Accordingly, various institutions, organizations, and individual researchers have worked to classify these skills and conceptualize them within a coherent framework. Numerous classifications in the literature aim to support not only individuals' academic success but also their ability to function effectively in society (Fadel et al., 2015; Marzano & Heflebower, 2012; Partnership for 21st Century Learning [P21], 2015; OECD, 2013 Pedro, 2006; Wagner, 2008). Among these conceptual frameworks, the most widely accepted is the Partnership for 21st Century Learning Framework (P21, 2015), developed by Battelle for Kids (P21, 2015). The skills covered by this framework are shown in Figure 1.

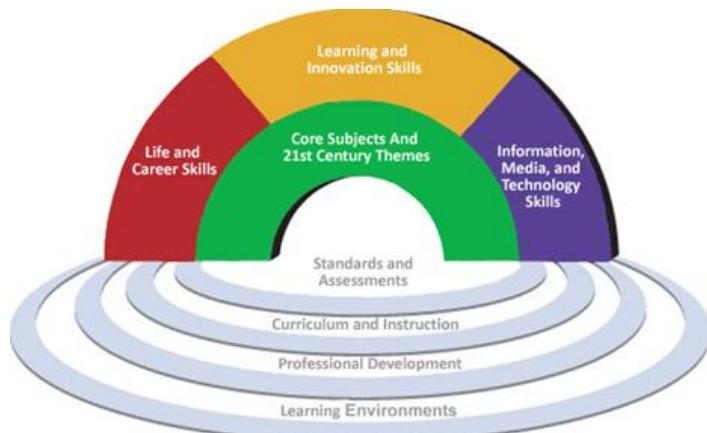


Figure 1 - P21 Framework for 21st Century Learning

Figure 1. 21st century Skills P21 Framework

The Partnership for 21st Century Learning Framework (P21) is an initiative designed to foster 21st-century skills through international collaboration. It was developed to strengthen education systems, equip students for success in a global context, and promote social and economic development. The framework encourages the adoption of innovative approaches to enhance students' knowledge and skills, with a strong emphasis on digital technologies and access to information. It supports international

collaboration aimed at improving educational quality and preparing students more effectively for the future. Therefore, integrating these skills into educational settings that prepare individuals for life is essential.

It is well known that curricula play a vital role in developing 21st-century skills and preparing students for the future. For this reason, it is considered essential that contemporary curricula adopt a student-centred and skills-based approach rather than relying on traditional lesson planning. These programmes are believed to encourage students' active participation in lessons, promote collaboration and teamwork, and offer opportunities to enhance problem-solving, creative thinking, and critical thinking skills—thus better preparing students for real-life challenges. Güler et al. (2017) emphasized that integrating technology into curricula can help students acquire 21st-century skills, as digital tools provide interactive learning experiences, foster creativity, and enable students to build global connections. Additionally, digital literacy skills are thought to enhance students' capacity to process and evaluate information effectively. However, Başaran et al. (2021) highlighted the importance of providing teachers with proper training and support to ensure the successful implementation of curricula that promote 21st-century skills. They also noted that it is crucial for teachers to employ innovative methods and strategies to help students develop these competencies. In this respect, it is believed that 21st-century skills should be at the core of curricula. To prepare students for the future and guide them effectively, curricula should adopt a flexible, innovative, and skills-based approach. This will enable students to adapt to changing global conditions and succeed in various fields.

Updates in curricula introduce new trends by influencing teaching methods and reshaping teacher roles. Digital learning models and technology-based instructional methods transcend traditional classroom settings, offering students flexibility, personalized learning experiences, and interactive content (Alsancak Sırakaya, 2015). These approaches allow students to progress at their own pace and support various learning styles. Moreover, digital platforms enable access to global resources and foster international connections. Integrating digital learning models with 21st-century skills can better prepare students for life, equipping them to succeed in the future workforce and society. These integration efforts not only enhance students' ability to use technology effectively but also strengthen critical thinking, creativity, and problem-solving skills (Dilekçi, 2020). The Covid-19 pandemic, which had a significant global impact in 2020, prompted the Turkish Ministry of National Education to initiate reforms in the education system due to the impossibility of face-to-face instruction. Efforts were made to prevent disruptions in the educational process through the rapid implementation of web-based teaching applications. This shift brought distance education to the forefront and enabled the continuation of instruction via various digital platforms. During this period, both students and teachers had to quickly adapt to these innovations, and instruction began to be delivered using web-based tools in virtual classroom settings. The effective use of information and communication technologies made it possible to implement student-centered teaching methods. As a result of the pandemic, the transition to distance education and the integration of digital teaching materials into the curriculum brought a renewed perspective to the education system.

Extraordinary circumstances, such as the Covid-19 pandemic, have made distance education both widespread and essential. Distance education is an educational model that allows students to access learning through the internet and digital technologies, typically when they are not physically present in a classroom or school (Yıldırım, 2020). This model offers students flexibility and accessibility, enabling them to continue their education regardless of geographic, physical, or temporal constraints. The rise of distance education has been largely driven by technological advancements, including the proliferation of the internet, the development of digital platforms, and improvements in information and communication technologies. In addition, crises such as epidemics and natural disasters have further highlighted the importance of this model. However, one key criticism of distance education is that it may hinder the classroom environment and interpersonal communication that are inherent in face-to-face education. This concern has led to the emergence of alternative approaches, such as blended

learning and the flipped classroom model, which aim to combine the advantages of both traditional and online education.

Blended learning is a model that combines traditional classroom instruction with digital technologies (Bonk & Graham, 2006). It provides students with face-to-face interactive learning experiences while also supporting learning through online platforms (Garrison & Vaughan, 2008). Flipped learning is an instructional approach that redefines the traditional classroom process. In this model, students engage with course content at home through pre-recorded videos or other online materials, while classroom time is dedicated to in-depth discussions, interactive activities, and hands-on practice. The goal of flipped learning is to increase student interaction in the classroom and enhance the overall learning experience (Picciano, 2017). In contrast to the traditional approach—where new topics are introduced in class and homework is completed at home—the flipped model reverses this sequence. Students learn new material at home and then work collaboratively in class to deepen their understanding and apply their knowledge. This approach enables personalized learning and allows students to progress at their own pace, while promoting more student-centered activities during classroom time. While flipped learning incorporates digital technologies and online resources to enhance student learning, it also highlights the teacher's role as a guide and facilitator within the classroom (Osguthorpe & Graham, 2003). As such, this model is considered to support the development of 21st-century skills such as critical thinking, problem-solving, and creativity.

A review of the literature reveals that numerous studies have examined 21st-century skills in various contexts, including listening instruction through web-based activities (Kır, 2024), curriculum design (Dolmacı, 2023), Generation Z's perceptions of 21st-century skill competencies (Karabaş, 2023), pre-service teachers' learning skills (Eken, 2023), teachers' motivation to teach these skills (Baba, 2022), and pre-service teachers' entrepreneurship (Kaya, 2020).

There are studies examining the effect of the flipped classroom model on the academic achievement of pre-service teachers (Eken, 2023); the effect of the flipped classroom model on students' course attitude, self-regulated learning and readiness (Erişmiş, 2023), its effectiveness on student achievement (Çelebi, 2023), its effect on students' high-level reading comprehension skills and attitudes towards reading (Kayan, 2023), the effect of the 5E model on the flipped learning model (Cumaoğlu, 2023), and its effect on writing skills (Harmankaya, 2023). However, as a result of the literature review, it was seen that the studies that carry 21st century skills into the learning environment using the flipped learning model and present teaching materials containing these skills are limited. Accordingly, in this study, students' critical thinking, problem solving and creativity skills are tried to be developed with lesson plans created by blending 21st century skills and basic language skills.

In this context, the main problem is 'How do the action plans implemented according to the Flipped Learning Model contribute to the development of critical thinking, problem solving and creativity skills of 7th grade students with low socioeconomic level?' From a methodological perspective, this study is designed as action research and is considered valuable for demonstrating, in a step-by-step and detailed manner, classroom practices that teachers can implement to help students improve their higher-order thinking skills, such as critical thinking, problem-solving, and creativity—especially for those who are perceived to be lacking in these areas.

Purpose

The main purpose of this study is to examine whether lesson plans developed using children's books within the framework of the Flipped Learning Model enhance students' critical thinking, problem-solving, and creativity skills. In line with this purpose, the following sub-questions were addressed:

- In what ways do the implemented teaching activities support the development of critical thinking skills among students from low socioeconomic backgrounds?
- How do these activities contribute to improving their problem-solving skills?
- How do the activities foster students' creativity?

Method

Research Model

In this study, action research, one of the qualitative research designs, was employed. The defining characteristic of the qualitative approach used here is its focus on collecting data through face-to-face interaction, observation, and interviews in a natural setting, rather than using standardized measurement tools (Creswell, 2014). Action research is a type of inquiry that can be planned, organized, and shared with others (Johnson, 2014).

Action research is a method commonly used by teachers to address the problems they encounter. However, it would be inaccurate to suggest that all teachers or students face the same problems. In this study, the researcher conducted action research to address a specific problem identified in their own classroom. Based on classroom observations and teaching experiences, the researcher noticed that while students were reading books, they often failed to grasp the intended messages, underlying themes, and were unable to apply what they read to real-life situations. The literature review revealed that reading comprehension is one of the most persistent problems in Turkish language education (Karacaoğlu & Karakuş, 2022; Karatay, 2014; Sayın & Takıl, 2023; Yiğit & Elkamış, 2021), and this issue also negatively affects performance in other subjects. However, the rapid advancement of technology has led to the rise of 21st century skills, making it essential for students to develop these skills in a digital context and apply them in their daily lives. Today, students' frequent use of digital platforms and technology in their daily activities has made it necessary to integrate technology into teaching processes. Therefore, to foster the development of critical thinking, problem-solving, and creativity—skills that are central to 21st century education—activities were designed around the books students read, aiming to enhance these skills. In this context, the action research method was employed to intervene and support their continuous improvement every week.

Participants of the Study

Criterion sampling, a type of purposive sampling, was used to determine the participants of this study. 'Criterion sampling is a selection based on the fulfilment of predetermined criteria' (Büyüköztürk, 2012, p.91).

The participants of the study were 20 seventh-grade students from a low socioeconomic secondary school in one of the central districts of a metropolitan city in the western part of the Eastern Anatolia region, during the autumn term of the 2022-2023 academic year. The students' willingness to participate in the study was considered. In this regard, the researcher provided both the 'Voluntary Participation Form' and the 'Parental Consent Form,' which contained information about the research, to the students and their parents. Students and parents signed these forms indicating that they voluntarily participated in the research.

The selection of the school where the research would be conducted was influenced by the fact that it was the researcher's workplace, located in a socioeconomically disadvantaged area, and easily accessible. After selecting the school, the researcher applied for the necessary legal permissions. In this regard, ethics committee approval was obtained from Malatya İnönü University. At the same time, permission to conduct the research was obtained from Malatya Provincial Directorate of National Education, the institution to which the school was affiliated.

Data Collection Tools

In this study, the researcher employed multiple data collection tools to strengthen and support the findings. The data collection tools, and their specific purposes are detailed in Table 1.

Table 1. Data Collection Tools Used in the Research

Researcher	Students
Observation notes (Qualitative)	Torrance Tests of Creative Thinking (Quantitative)
Researcher's Diary (Qualitative)	Cornell Critical Thinking Test (Quantitative)
Camera Recordings (Qualitative)	Student Diary (Qualitative)
Audio Recordings (Qualitative)	Video Recordings During Lesson (Qualitative)
Parent interview forms	Student Worksheets (Qualitative)
Subject Teacher Interview Forms	Student Project Activities (Qualitative)
	Student Interview Forms (Qualitative)

In this study, which aimed to develop students' critical thinking, problem-solving, and creativity skills, data triangulation was employed through the use of multiple data collection tools. Both quantitative and qualitative data collection instruments were utilized, with the intention of using quantitative data to support the qualitative findings and thus strengthen the overall results. For quantitative data, the Torrance Tests of Creative Thinking and the Cornell Critical Thinking Test were administered. For qualitative data, a variety of sources were used, including the researcher's journal, student journals, observation notes, video recordings of the lessons, audio recordings of lessons and interviews, student worksheets, student activity projects, parent interview forms, and interview forms conducted with subject-area teachers.

Quantitative Data Collection Tools

1. Torrance Creative Thinking Test

In 1967, Torrance developed the Torrance Test of Creative Thinking based on its application to 10,127 individuals from various age and occupational groups (Aslan, 2001). The test consists of two main forms: Verbal and Figural, each with Forms A and B. The Verbal Form includes seven activities, with five minutes allocated for each, totalling 35 minutes. The Figural Form comprises three activities, with ten minutes allotted per activity, for a total of 30 minutes. In the pre-tests of this study, Booklet B of both the Verbal and Figural Forms was used. To prevent students from recalling test items or producing unoriginal responses influenced by others before the post-test, Booklet A of both forms was administered in the post-tests.

2. Cornell Critical Thinking Test

The Cornell Critical Thinking Test was developed by Ennis and Millman in 1985 and consists of two separate levels: Level X and Level Z. Level X was designed for primary, secondary, and high school students, while Level Z was intended for gifted high school students, as well as undergraduate and graduate students. The test comprises four sub-dimensions: making inferences through inductive reasoning, evaluating the reliability of observations and sources, identifying assumptions in statements, and making inferences through deductive reasoning. The test includes a total of 71 questions. Each correct answer is awarded 1 point, while incorrect answers receive 0.

3. Personal Information Form

Through the personal information form, data were collected about the students participating in the study and their families. The form included questions about the family's monthly income level, parents' educational background, and whether the students had siblings currently attending school. Additionally, the researcher obtained further information from student identification forms she had prepared for the school guidance service, as she had been serving as a Turkish language teacher and class advisor for three years. Based on all of this information, it was determined that the students came from a low socioeconomic background.

Qualitative Data Collection Tools

1. Researcher and Student Diaries

The researcher kept a diary throughout the implementation process, dating each entry and recording her observations on both the process and student behavior. In addition to maintaining her own diary, the researcher also asked the study participants to keep diaries. According to Yıldırım and Şimşek (2016), diaries kept by both researchers and participants can be useful in clarifying the research process. For this reason, the researcher began keeping a diary one week prior to the implementation and continued until its conclusion. Her entries included not only reflections on the process itself but also information obtained from the thesis monitoring committee and the validity committee. The diary consisted of a total of 35 pages. An overview of the researcher's diary entries and their corresponding dates is presented in Table 2.

Table 2. Researcher Diary: Dates and Content

Diary History	Diary Content
01.11.2022	Distribution of parental consent forms and voluntary participation forms
02.12.2022	Introducing Web.2.0 tools
05.11.2022	Validity committee meeting-1
07.11.2022	Administration of the Torrance Creative Thinking Pre-test
08.11.2022	Administration of the Cornell Critical Thinking Pre-test
14.11.2022	Implementation – Week 1
16.11.2022	Validity committee meeting-2
17.11.2022	Supplementary session for absent students
21.11.2022	Implementation – Week 2
23.11.2022	Interview-1
25.11.2022	Validity committee meeting-3
28.11.2022	Implementation – Week 3
29.11.2022	Validity committee meeting-4
30.11.2022	Supplementary session for absent students
01.12.2022	Interview-2
05.12.2022	Implementation – Week 4
07.12.2022	Validity committee meeting-5
08.12.2022	Supplementary session for absent students
12.12.2022	Implementation – Week 5
14.12.2022	Validity committee meeting-6
15.12.2022	Supplementary session for absent students
16.12.2022	Interview-3
19.12.2022	Implementation – Week 6
21.12.2022	Validity committee meeting-7
22.12.2022	Supplementary session for absent students
26.12.2022	Implementation – Week 7
28.12.2022	Validity committee meeting-8
29.12.2022	Supplementary session for absent students
30.12.2022	Interview-4
02.01.2023	Implementation – Week 8
04.01.2023	Validity committee meeting-9
05.01.2023	Supplementary session for absent students
09.01.2023	Implementation – Week 9
10.01.2023	Validity committee meeting-10
11.01.2023	Interview-5
12.01.2023	Administration of post-tests

The researcher also asked the student participants to keep diaries; however, they did not maintain their diaries consistently. Therefore, the student diaries were excluded from the analysis.

2. Observation Notes

Observation notes refer to the researcher's records of classroom activities and student behavior throughout the implementation process. These notes were created by documenting what occurred during each lesson. The observation method employed in this study was participant observation. According to Güler et al. (2013, p. 105), "Participant observation refers to a method in which the purpose of the researcher's involvement in the lesson is known." In this study, the researcher also served as the Turkish language teacher for the participant students and had informed them that the study was being conducted as part of her doctoral dissertation, indicating that a participant observation approach was followed. The researcher's observations concluded with the end of the implementation process. During this period, special attention was paid to students' reactions to critical thinking, problem-solving, and creative thinking activities related to the book they were reading, as well as how their responses evolved from week to week. Additionally, instances where students built on each other's ideas and developed new perspectives were also noted.

3. Student Interview Forms

In this study, a semi-structured interview form was used to gather students' opinions about the books they read, and the activities designed based on those books. The form included questions about the students' views on the book, the activities, classroom practices, teaching materials, and the Web 2.0 tools that were used during the implementation. Detailed feedback was collected regarding the activities related to each chapter of the book, particularly those aimed at enhancing critical thinking, problem-solving, and creativity. Students were also asked to evaluate specific sections of the book, propose alternative solutions to the problems presented, introduce a new character, and critique the parts they disliked. Following the completion of the book, five interviews were conducted at two-week intervals. In doing so, the researcher aimed to ensure data variety. The questions used in the student interviews are presented below:

1. What are your thoughts about the book?
2. Is there anything in the book you would like to change? If so, how would you change it?
3. What was your favourite part of the book? Why?
4. What part of the book did you like the least? Why?
5. How did the main character solve the problems they faced?
6. If you were in the main character's place, how would you solve the problems?
7. How do you usually deal with problems in your daily life?
8. Did you find the activities related to the book useful? Which application or Web 2.0 tool did you enjoy the most?
9. Did the activities related to this book influence your reading habits, reading comprehension, or how you think about what you read? If so, can you describe any changes in your perspective?

The interview questions prepared for the students were asked at the end of each book, in relation to the activities conducted. Details of the student interviews are presented in Table 3.

Table 3. Student Interview Dates and Times

Student Interview	Student Interview Date	Student Interview Duration (mm:ss)
Interview 1	23.11.2022	35:52
Interview 2	29.11.2022	25:23
Interview 3	13.12.2022	27:28
Interview 4	27.12.2022	20:03
Interview 5	10.01.2023	28:41

According to Table 3, the total duration of the interviews was 137 minutes and 45 seconds. After the interviews, the researcher transcribed and analyzed the texts, using the results to inform updates to the action plans. These interviews were also utilized in the findings section of the study.

4. Parent Interview Form

Prior to the implementation, interviews were conducted with the families of the students to assess their current approaches and attitudes regarding critical thinking, problem-solving, and creativity skills. A single representative from each family was interviewed for approximately 5–10 minutes. The interview questions were shared with families beforehand, and input from other family members was encouraged. On the scheduled day, the designated family representative was interviewed, and all sessions were audio recorded. The total interview time with families amounted to 286 minutes.

The following questions were asked during the interviews:

- Do you have conversations with your child at home? What topics do you most frequently discuss?
- Can your child freely express their ideas and thoughts to you or other family members?
- Do you consider your child's opinions when making family decisions? If so, how are those opinions reflected in the final decisions?
- How open is your family environment to different ideas and perspectives?
- When faced with small problems, does your child attempt to solve them independently, or do they immediately seek help from you?
- Are there any activities you do at home to support your child's artistic or creative abilities?
- Do you include games, books, or activities at home that encourage your child's imagination?
- When your child encounters new information, do they accept it immediately, or do they consult you for clarification or discussion?

5. Interview Form with Subject Teachers

In this study, a semi-structured interview form was used to gather students' opinions about the books they read, and the activities designed based on those books. The form included questions about their thoughts on the book, the activities, in-class practices, instructional materials, and the Web 2.0 tools utilized. Students were asked detailed questions about the activities linked to specific chapters in the book, particularly those aiming to develop critical thinking, problem-solving, and creativity skills. They were also invited to evaluate specific parts of the book, suggest alternative solutions to the problems presented, introduce a new character, and reflect on the sections they disliked. After completing the book, a total of five interviews were conducted at two-week intervals to ensure data diversity. The interview questions posed to the students are presented below:

- Do students ask questions to you or to their peers during the lessons? What is the nature of these questions?
- Are students able to develop different perspectives on the topics discussed in class?
- When faced with a problem during the lesson, do students attempt to generate immediate solutions? Are they able to develop different problem-solving strategies?
- Are students able to generate creative ideas during your lessons?
- Are students able to use critical thinking skills in digital environments? Do they use digital tools solely as consumers?

6. Camera Recordings of the Lesson Process

The research implementation process was recorded using a video camera. Since the researcher also served as the teacher during the implementation, the camera was mounted on a tripod and positioned to capture the entire classroom. Video recordings were made for two hours each week, covering two class periods on Mondays. After each observation day, the recordings were regularly backed up by copying them to a computer and an external USB drive. Each recording was dated and archived in weekly folders. Throughout this process, the video recordings were reviewed regularly to identify emerging themes.

The primary data source in this study was the video recordings of the teaching process. These recordings were used to expand and support the researchers' observation notes. Since the researcher was also the practitioner, it was not possible to take detailed observation notes during the lessons. The recordings were made using a Panasonic camera mounted on a tripod. The recording period spanned from November 1, 2022, to January 9, 2023, starting in the first week of the implementation. On each recording day, the videos were transferred to a computer and backed up to an external drive. The total duration of the recordings was 636 minutes. During each lesson, the camera was positioned next to the teacher's desk to capture the classroom environment.

The dates and durations of the camera recordings conducted during the lesson periods are presented in Table 4.

Table 4. Dates and Recording Durations of Classroom Video Recordings

History	Duration (dd)
11.11.2022	75
21.11.2022	69
28.11.2022	71
05.12.2022	64
12.12.2022	71
19.12.2022	73
26.12.2022	71
02.01.2023	70
09.01.2023	60

Video recordings captured throughout the research process served as the primary data source. The researcher integrated the findings from these recordings with other data sources, including interviews, student assignments, projects, observation notes, researcher diaries, the Torrance Creative Thinking Test, and the Cornell Critical Thinking Test.

7. Audio Recordings

In this study, to prevent data loss, both video and audio recordings were made during the implementation process. The audio recordings were transferred to the computer immediately after each lesson and then backed up to an external drive for safekeeping. Following each lesson, the audio recordings were transcribed, and the transcripts were analyzed to support the reporting of the findings.

Audio recordings were also made during participant interviews conducted at two-week intervals. After each interview, the recordings were transferred to an external drive, transcribed, and incorporated into the research report. The dates and durations of the audio recordings are presented in Table 5.

Table 5. Dates and Durations of Audio Recordings

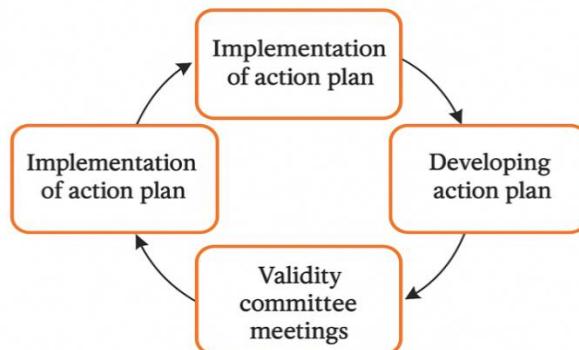
History	Duration (dd)
11.11.2022	75
21.11.2022	73
23.11.2022	35
28.11.2022	73
01.12.2022	25
05.12.2022	64
12.12.2022	71
16.12.2022	27
19.12.2022	75
26.12.2022	72
30.12.2022	20
02.01.2023	72
09.01.2023	62
11.01.2023	28

8. Student Activity Sheets and Projects

One of the data sources of this research consists of activities, worksheets, and projects created by students using Web 2.0 tools as part of the classroom tasks. Cawkaytar (2009) states that students' work can serve as a valuable data source, as it reflects their developmental progress. Student activities were collected through worksheets and were also monitored via the EBA virtual classroom and WhatsApp. These student works are considered important for ensuring the validity of the research. Student assignments and projects were also incorporated into the research report.

9. Preparation and Implementation Process of Action Plans

At this stage, the researcher developed action plans to foster critical thinking, problem-solving, and creativity skills based on the books that had been read. These action plans were then put into practice through various activities. Therefore, this phase represents the core component of action research (Papatğa, 2016). The data collected during this phase were reviewed with the validity committee, and action plans for the following week were developed accordingly. Following the implementation of each action plan, the current situation was re-evaluated. Based on the newly collected data, either a new action plan was formulated, or existing plans were revised during the validity committee meetings. The research process was structured around this continuous cycle. The cycle of action planning in this study is illustrated in Figure 2.

**Figure 2.** Cycle of the Implementation Process

This cycle was followed throughout the implementation process. The process began with identifying the participants. Next, the necessary approvals were obtained through voluntary participation and parental consent forms, ensuring that all student participation was based on informed consent. Subsequently, quantitative data collection tools were administered, and the first book to be read was distributed to the students. Once the students had read the assigned chapters, they completed the activities designed to enhance their critical thinking, problem-solving, and creative thinking skills.

During this phase, the researcher put the developed action plans into practice. Details of this process are presented in Table 6.

Table 6. Dates of Action Plans and Activities

Action	Action Week and Date	Action Events
1	Week 1/01 November-04 November 2022	Giving voluntary participation form and parental consent form
2	Week 2/07 November-11 November 2022	Introduction of Web 2.0 tools, pre-tests, Validity Committee Meeting-1
3	Week 3/14 November-18 November 2022	Practice 1, Additional Lesson Plan 1, Validity Committee Meeting 2
4	Week 4/21 November-25 November 2022	Practice 2, Interview 1, Validity Committee Meeting 3
5	Week 5/28 November-02 December 2022	Practice 3, Additional Lesson Plan 2, Validity Committee Meeting 4, Interview 2
6	Week 6/05 December-09 December 2022	Practice 4, Additional Lesson Plan 3, Validity Committee Meeting 5
7	Week 7/12 December-16 December 2022	Practice 5, Additional Lesson Plan 4, Validity Committee Meeting 6, Interview 3
8	Week 8/December 19-December 23, 2022	Practice 6, Additional Lesson Plan 5, Validity Committee Meeting 7
9	Week 9/December 26-December 30, 2022	Practice 7, Additional Lesson Plan 6, Validity Committee Meeting 8, Interview 4
10	Week 10/02 January-06 January 2023	Practice 8, Additional Lesson Plan 7, Validity Committee Meeting 9
11	Week 11/09 January-13 January 2023	Practice 9, Validity Committee Meeting 10, Interview 5
12	Week 12/16 January-20 January 2023	Application of post-tests

As shown in Table 6, the implementation process spanned a total of 12 weeks. A total of 12 action plans were prepared, with one plan implemented each week. In accordance with these action plans, the implementation was conducted, and data were collected and analyzed.

1st Action Plan (Week 1: November 1–5, 2022)

Since the implementation took place at the school where the researcher works, and the students were selected through purposive sampling, the researcher first distributed voluntary participation forms to the students. Once the students who volunteered were identified, parental consent forms were sent to their families, and the necessary permissions were obtained. An introductory lesson was then conducted with the participating students, during which the Web 2.0 tools to be used in the implementation process were introduced.

2nd Action Plan (Week 2: November 7–11, 2022)

Following the identification of participating students, the Torrance Creative Thinking Test (Form B) was administered as a pre-test to assess their level of creative thinking skills. The Cornell Critical Thinking Test was also administered as a pre-test to determine the students' critical thinking and problem-solving skills. In addition, the first meeting with the Validity Committee was held during this week (Validity Committee Meeting 1 – November 5, 2022).

3rd Action Plan (Week 3: November 14–18, 2022)

In this stage, the researcher initiated the implementation process, conducting the first classroom application. The students engaged in activities based on the book *Grandpa's Grocery Store*. For those who were unable to participate, the researcher organized and conducted an additional session. The activities incorporated components of critical thinking, problem-solving, and creativity, derived from the literature and developed by the researcher. A balanced number of activities were designed for each skill, encouraging students to engage in higher-order thinking and develop their digital competencies. These skills were targeted through various activities, including expressing thoughts on the book's title, visuals, and content; proposing solutions to the problems faced by the characters; writing a new ending or introducing a new character; and designing a book cover using Web 2.0 tools to be shared in virtual classrooms. The activities took the form of open-ended questions, visual design tasks, Web 2.0 tool usage, group work, and collaborative projects. A meeting was held with the Validity Committee to evaluate the week, and the action plan was revised and prepared for the following week (Validity Committee Meeting 2 – November 16, 2022).

4th Action Plan (Week 4: November 21–25, 2022)

In this phase, the researcher carried out the second activity session and facilitated student engagement in activities based on the second half of *Grandpa's Grocery Store*. Following this, the first round of student interviews was conducted to collect their reflections on the process. Afterwards, the third Validity Committee meeting was held, and the subsequent action plan was developed based on the decisions made (Validity Committee Meeting 3 – November 25, 2022).

5th Action Plan (Week 5: November 28 – December 2, 2022)

During this week, students participated in activities related to the second book, *Little Black Fish*. These activities were designed using a framework that incorporated critical thinking, problem-solving, and creativity components derived from the literature. The activities aimed to foster skills such as questioning, interpreting, evaluating, generating logical solutions, identifying problems, flexible thinking, and idea generation. Students engaged in a variety of tasks, including resolving the protagonist's challenges during the journey, imagining themselves in the protagonist's role, writing a continuation of the story, watching a thematically similar film, and comparing it with the book. Three students were unable to participate in the activities. Subsequently, based on the decision made during Validity Committee Meeting-4 (29.11.2022), an additional lesson plan was developed for the students who missed the session. In accordance with this plan, these students were given the opportunity to complete the activities (Additional Lesson Plan-2, 30.11.2022). During this week, semi-structured interviews were conducted during one class hour to gather students' feedback on the activities (Interview-2, 01.12.2022). Additionally, the third book, *The Diary of an Untitled Youtuber*, was distributed to the students, who were instructed to read the first half of the book over the course of one week.

6th Action Plan (Week 6: December 5–9, 2022)

During this week, students participated in activities based on *The Diary of an Untitled Youtuber*. The activities included empathizing with the characters, evaluating their behaviors, and organizing a kindness campaign as a group activity inspired by the actions of the characters in the book. The students' work was evaluated, and it was noted that two students were absent from the session. In line with the decision taken during Validity Committee Meeting-5 (07.12.2022), an additional lesson plan was prepared to support the participation of these students. The prepared supplementary lesson plan was carried out with two students (Supplementary lesson plan-3, 08.12.2022). Then, the students were asked to read the second half of the book for one week.

7th Action Plan (Week 7: 12–16 December 2022)

During this week of the research, the students carried out the activities prepared for the second half of the book *The Diary of an Untitled Youtuber*. Four participant students were absent from this session. Based on the decision made during Validity Committee Meeting-6 (14.12.2022), an additional lesson plan was prepared and implemented with these students (Additional Lesson Plan-4, 15.12.2022). To gather students' opinions on the activities conducted during the week, semi-structured interviews were held during one class hour (Interview-3, 16.12.2022). Additionally, the fourth book to be read, *The Ball Hanging in the Air*, was distributed to the students. They were instructed to read the first half of the book over the course of one week.

8th Action Plan (Week 8: 19–23 December 2022)

In this week of the research, the students completed activities prepared for the first half of the book *The Ball Hanging in the Air*. The story revolves around a mysterious knot that a group of friends attempts to unravel. Accordingly, students were presented with a variety of open-ended questions and group activities designed to foster problem-solving, creative thinking, and empathy. It was observed that three students were absent from this session. In line with the decision made during Validity Committee Meeting-7 (21.12.2022), an additional lesson plan was prepared for the three absent students. This plan was implemented with them on 22.12.2022 (Additional Lesson Plan-4). Afterwards, the students were instructed to read the second half of the book over the course of one week.

9th Action Plan (Week 9: 26–30 December 2022)

During this week of the research, the activities prepared for the second half of the book *The Ball Hanging in the Air* were implemented with the students. It was observed that four students were absent from the lesson. In line with the decision made during Validity Committee Meeting-8 (28.12.2022), an additional lesson plan was prepared for these students and implemented on 29.12.2022 (Additional Lesson Plan-6). To gather students' opinions on the activities conducted during this week, semi-structured interviews were held during one class hour (Interview-4, 30.12.2022). Subsequently, the final book to be read, *Yuan Huan's Cabin*, was distributed to the students, and they were instructed to read the first half of the book within one week.

10th Action Plan (Week 10: 2–6 January 2023)

During this week of the research, activities designed for the first half of the book *Yuan Huan's Cottage* were implemented with the students. These activities included open-ended questions, process-based writing exercises, and story creation using Web 2.0 tools, which were then shared in virtual classrooms. One student was absent during this lesson. In line with the decision made at Validity Committee Meeting-9 (04.01.2023), an additional lesson plan was prepared and implemented with the student (Additional Lesson Plan-6, 05.01.2023). Subsequently, the students were instructed to read and complete the second half of the book over the following week.

11th Action Plan (Week 11: 9–13 January 2023)

During this week, activities based on the second half of *Yuan Huan's Cottage* were carried out. It was observed that one student was absent. In line with the decision made at Validity Committee Meeting-10 (10.01.2023), an additional lesson plan was prepared and implemented with the student (Additional Lesson Plan-7, 11.01.2023). To gather students' opinions about the activities conducted during this week of the research, interviews were held with them during one class hour using a semi-structured interview form (Interview-5, 12.01.2023).

12th Action Plan (Week / 16 January–20 January 2023)

During this week of the research, the 'Torrance Creative Thinking Test, Figural Form A and Verbal Form A' was administered to the students as a post-test to assess their creative thinking levels after the implementation. Subsequently, the 'Cornell Critical Thinking Test' was administered to evaluate their levels of critical thinking and problem-solving skills.

In total, 30 lesson hours were allocated throughout the implementation process: 1 hour for teaching Web 2.0 tools, 3 hours for administering pre-tests, 18 hours for implementing the book-related activities, 8 hours for additional lesson plans, and 8 hours for administering post-tests.

10. Selection of Books

In the school where the researcher works, she regularly reads books to her students and organises interviews about books. However, during the process, she observed that students read the books, but they do not have a critical perspective to make sense of what the books want to give, and they lack creative problem-solving skills developed for the problems encountered in the books. For this reason, he was interested in this issue and believed that it should be investigated.

In this context, the researcher firstly conducted a field survey and asked colleagues and families with students at the secondary school level for the names of the books that students read the most. At the same time, he created a list by determining the books on the list of the most read books in the children's books category of various book sales sites. She read all the books in this list of 28 books and identified ten books that she thought would improve students' critical thinking, problem solving and creativity skills. While determining the books, the basic principles of children's literature were considered. Then, she prepared a form containing information about these books and summaries of the books and asked six experts who have studies on children's literature in the field of Turkish education for their opinions on the books and selected the five books with the highest scores. Information about these books is presented below:

- Yaşar, Ş. (2018). Grandpa's Grocery Store. Taze Kitap.
- Behrengi, S. (2020). The Little Black Fish. Karpa Yayınevi.
- Serbarut, M. (2022). Yuan Huan's Hut. Tudem Yayıncılık.
- Serbarut, M. (2019). The Diary of an Unknown YouTuber. Altın Kitaplar Yayınevi.
- Ak, B. (2022). The Ball Suspended in the Air. Günsiğgi Kitaplık.

Note: The English titles are unofficial translations provided for informative purposes only.

11. Preparation of Activities for Books

The starting point of the research is to try to develop students' critical thinking, problem solving and creativity skills through the books read. In this context, the selected books were read by the researcher and the sections that were thought to develop the 21st century skills of critical thinking, problem solving and creative thinking were noted in a word processor file with page numbers. It is also considered to develop students' 21st century skills through these books by including the use of technology in the digital world they were born into in educational environments. For this reason, the researcher took a seminar on the use of Web.2.0 tools in education in an online environment and made use of these Web.2.0 tools while planning the activities. In addition, the researcher planned activities that will develop students in this context by taking into account the gains that can be associated with critical thinking, problem solving and creativity among the reading gains in the Turkish Curriculum.

While planning the activities, various reading and learning strategies, methods, and techniques were taken into consideration, and the activities were diversified to address individual differences. During the preparation process, the researcher focused on developing students' higher-order thinking, questioning, problem-solving, and creativity skills, and on designing activities that promoted collaborative work. In this context, emphasis was placed on enabling students to access information, use accurate and reliable sources, synthesise research findings, and apply them to real-life situations.

Accordingly, the activities related to the books were designed by integrating them with 21st-century skills.

12. Validity and Reliability

Unlike quantitative research, the validity and reliability of qualitative research are explained using the concepts of credibility, transferability, consistency, and confirmability instead of validity and reliability (Johnson, 2014). In this section, these concepts and the actions taken by the researcher to ensure them are explained in detail.

Credibility means that the research is meaningful, coherent, and logically structured for the readers. In order to enhance the credibility of the study, several strategies were employed. Since the researcher worked at the school where the implementation was carried out, they had the opportunity to conduct detailed observations of both the environment and the participants before and during the implementation process. Multiple data collection tools were used concurrently to ensure data triangulation and diversity. Additionally, data were gathered at various times throughout the process. To prevent data loss and ensure the richness of the data, the researcher made regular daily observations, took field notes, kept a diary, recorded the lessons using both video and audio devices, distributed printed worksheets to students and collected them at the end of each lesson. The methodology section provides a comprehensive account of each step, from identifying the research topic to the conclusion of the implementation phase, to further enhance the study's credibility. The data analysis procedures are also described in detail. Moreover, feedback and suggestions from the validity committee members, thesis monitoring committee members, and participants were continuously sought throughout the research process to support the credibility of the findings.

Transferability refers to the extent to which the findings of a qualitative study can be applied to other contexts or groups. As Miles and Huberman (2015, p. 279) state, "in order to determine whether the findings of a study can be generalized, many factors—from the research environment to the characteristics of the participants—should be described in detail." In line with this, the researcher provided detailed descriptions of the school, classroom, participants, implementation process, data collection tools and procedures, data analysis, and findings to enhance the study's transferability.

Consistency requires that the data remain consistent and stable over time and across conditions. Johnson (2014) emphasized that consistency among data is essential for ensuring reliability. To meet this criterion, multiple data collection tools were employed, and individuals responsible for different stages of the research were actively involved throughout the process. The researcher met weekly with validity committee members to analyze the data and update action plans accordingly. Furthermore, the researcher shared data, macro-level analyses, and details of the research process with the thesis monitoring committee every six months, obtaining their feedback and approval. During the reporting phase, the findings derived from different data sources were presented in a consistent and mutually reinforcing manner. The video and audio recordings of the implementation and interviews with participants were transcribed and checked by two experts for accuracy. In addition to qualitative data collection tools, quantitative tools were also utilized. It is believed that the results obtained from these quantitative tools helped enhance the reliability of the research by supporting and strengthening the qualitative findings.

Confirmability addresses the objectivity of the research. While complete objectivity is rarely possible in qualitative research, it is essential to take measures that ensure findings are clearly derived from the data rather than researcher bias. Yıldırım and Şimşek (2016) argue that findings must be continuously supported and verified by the collected data to establish confirmability. In this study, both quantitative and qualitative data were used to achieve this aim. The Cornell Critical Thinking Test was employed to measure students' critical thinking skills, and the Torrance Test of Creative Thinking was used to assess their creative thinking levels. To collect qualitative data, tools such as observation, diaries, semi-structured interviews, video, and audio recordings were used, and the data obtained through these tools were presented in a complementary and supportive manner.

13. Research Environment

In qualitative research, it is essential to provide a detailed description of the research setting. This allows for a better understanding of the context in which the data were collected and helps to determine the relevance of the findings to similar environments (Ekiz, 2004).

The implementation of the study was conducted over a period of 12 weeks during the first semester of the 2022–2023 academic year, between November 1, 2022, and January 20, 2023. The research took place in a seventh-grade classroom of a public middle school located in a central district of a metropolitan city in the western part of the Eastern Anatolia Region. The school serves students from a low socioeconomic background and operates under the authority of the Ministry of National Education, with instructional hours from 08:30 to 15:25. The school also includes a kindergarten class. It is a five-story building located within a large garden and accommodates students through a transportation-based education system. The school was selected because it is where the researcher was currently employed, and the students' low socioeconomic status further supported this decision.

The classroom in which the research was conducted is located on the second floor and includes 20 students. The classroom is equipped with 18 student desks, one student cabinet, one teacher's desk, one teacher's chair, a smart board, and a classroom bulletin board. While the desks are designed for two students, each student sits individually. Upon entering the classroom, the student cabinet is immediately to the left, the teacher's desk and chair are directly in front, and the student desks are positioned on the right. During the lessons, a video camera was placed next to the teacher's desk to capture all students. The layout of the research environment is illustrated in Figure 3.

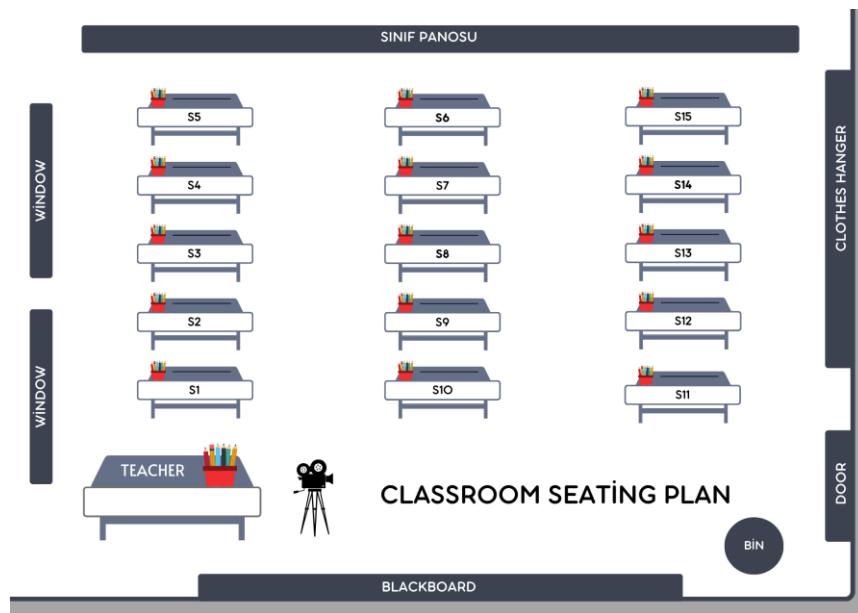


Figure 3. Classroom Seating Plan

Analysing the Data

1. Analysis of Qualitative Data

In this study, data were collected and analysed on a weekly basis. Based on the results of these analyses, action plans were developed. During the implementation process, classroom sessions were recorded each week using a video camera. The researcher transcribed these video recordings into written text every week. Macro-level analyses of the video data were conducted, and the findings were shared with the validity committee on a weekly basis. In addition to the macro analyses, interviews were conducted with the students every two weeks, specifically at the end of each book. The interviews were transcribed immediately after they were conducted and were presented to the validity committee biweekly.

The qualitative data were analysed using content analysis through thematic coding. Content analysis involves organizing and interpreting similar data under specific themes and concepts in a way that is understandable to the reader (Yıldırım & Şimşek, 2016). In qualitative research, data triangulation is used to prevent misinterpretations and to enhance the validity and reliability of the results (Stake, 1995). As Mayring (2011, p.148) notes, the purpose of triangulation in social sciences is not necessarily to obtain identical results across tools, but to interpret findings from multiple perspectives. Bogdan and Biklen (1998, p.104) also argue that data from multiple sources provide a deeper and more comprehensive understanding of the studied phenomenon. Accordingly, the study utilized multiple qualitative data collection tools, and the results were supported by quantitative instruments.

Video and audio recordings were analysed weekly at a macro level, and then micro-level analyses were conducted to identify moments where students demonstrated critical thinking, problem solving, and creativity. These segments were transcribed with time stamps (minutes and seconds) from the recordings. Student and researcher diaries were also reviewed after each session. Entries related to critical thinking, problem solving, and creativity were recorded and dated. Biweekly semi-structured interviews were conducted with students about the process, and these were documented both in written form and as video/audio recordings. The interviews were then coded for indicators of critical thinking, problem solving, and creativity. These procedures were aimed at developing a deep understanding of the phenomenon under investigation.

2. Quantitative Data Analysis

In addition to qualitative methods, the study employed quantitative instruments. The Cornell Critical Thinking Test was used to assess students' critical thinking and problem-solving skills, and the Torrance Test of Creative Thinking was used to measure their levels of creativity before the implementation phase.

Analysis of the Torrance Test of Creative Thinking

The researcher received formal training on scoring the Torrance Test of Creative Thinking. Following this training, she scored the students' pre-tests and entered the results into a Microsoft Excel file. Based on the class average, creativity levels were categorised into three groups: low, medium, and high. After the post-tests were administered, the researcher repeated the scoring and classification process. To ensure the reliability and validity of the scores, a second trained researcher independently scored the tests. The two sets of scores were compared for consistency. Students' pre- and post-test results were then compared individually to assess their development.

Analysis of the Cornell Critical Thinking Test

Because the copyright for the Cornell Critical Thinking Test is held by an educational company, the test was purchased based on the number of participants. After the test was administered, all student test sheets were sent to the company via mail. The company scored the tests and returned the results to the researcher.

Findings

This section evaluates the effectiveness of the strategies and practices implemented throughout the process on the development of students' critical thinking, problem-solving, and creativity skills.

Findings on the Contribution of the Teaching Activities to the Development of Critical Thinking Skills Among Students from Low Socioeconomic Backgrounds

As part of the implemented action plans, a total of 16 activities aimed at developing critical thinking skills were designed and applied using five children's books. To prevent data loss, both video and audio recordings were taken during student interactions. The data obtained from these recordings, along with students' written responses to the activities, were analyzed and are presented below.

Table 7. Findings on the Development of Critical Thinking Skills

Action Plan	Code	f
1. Action	Interpretation	9
	Giving importance to descriptive definitions	7
	Making inferences from data	12
	Supporting conclusions with reasons	20
	Creating solid reasons	9
	Free decision making	5
	Self-awareness	7
2. Action	Evaluation	8
	Separating irrelevant information	5
	Creating sound justifications	10
	Recognising inconsistent judgments	9
	Interpretation	11
	Making inferences from data and findings	7
	Supporting conclusions with justifications	15
	Including descriptive definitions	11
	Determining reasonable criteria and making decisions accordingly	3
	Solving the problem in a planned way	5
3. Action	Creating sound reasons	10
	Free decision making	29
	Determining rational criteria and making decisions accordingly	22
	Using spoken and written language effectively	3
	Interpretation	8
	Evaluation	11
	Including descriptive definitions	6
	Testing the reliability of information sources	4
	Recognising inconsistent judgments	9
	Being aware of one's own thoughts	9
	Analysis	12
	Supporting conclusions with reasons	15
4. Action	Interpretation	39
	Evaluation	56
	Making inferences	13
	Self-regulation	9
	Being aware of knowledge deficiencies	20
	Including descriptive definitions	11
	Supporting results with reasons	15
	Making decisions according to rational criteria	11
	Asking effective questions	6
5. Action	Analyzing	33
	Evaluating	40
	Making inferences	14
	Making decisions according to rational criteria	22
	Asking effective questions	8
	Questioning	20
	Interpreting	20

Table 7 provides an overview of the activities and their corresponding critical thinking components. Specifically, 2 activities were conducted in the first action plan, 3 in the second and fifth, and 4 in the third and fourth action plans. The codes and themes recurring across these activities were

grouped and analyzed collectively. The components targeted in designing the activities were identified during the literature review and are outlined in Table 7. In the first action plan, students were asked to reflect on the name and cover image of the book *Grandpa's Grocery*. They were then encouraged to discuss the profession chosen by the main character and share which profession they would like to pursue in the future. Additionally, they were prompted to invent a new food or beverage inspired by the protagonist's inventions. Students also initiated a charitable campaign, performing random acts of kindness for their peers (chosen by lottery), and shared their reflections through videos uploaded to the EBA virtual classroom. Subsequent activities followed a similar structure with content adapted to the themes of different books.

When evaluating the first action plan in terms of critical thinking, it was observed that while students were capable of offering justifications for their opinions and making basic inferences from the text, they struggled to distinguish irrelevant information and construct well-reasoned arguments. Their inference and interpretation skills were found to be at a moderate level, but their self-awareness and independent decision-making abilities were limited. Most students described events as they occurred without synthesizing or integrating them with personal insight. Many were unable to draw inferences based on available information. Sample student responses:

S2: "The cover of the book is impressive and eye-catching." (Written on activity sheet)

S3: "Why is he apprenticing with his grandfather when there are so many other professions?"
(14:09 mm:ss)

When the second action plan was evaluated in the context of critical thinking, it was noted that students once again tended to describe the current situation without offering their own analysis or interpretation. Their responses lacked depth and were not supported by robust reasoning. While there was a slight improvement in supporting their ideas with reasoning, their decision-making skills and use of descriptive language remained weak. Inference-making skills were still below the desired level. Sample student responses:

S2: "I think the cover and the content match well." (04:45 mm:ss)

S4: "It is harmonious." (Written on activity sheet)

S5: "The title and the cover image match the content. The character is a little black fish."
(Written on activity sheet)

When the third action plan was evaluated within the context of critical thinking, it was observed that students were able to justify their opinions and make independent decisions based on their own ideas. Rather than repeating ideas heard from others, they were able to evaluate content critically and express their own original thoughts. This improvement is believed to be a result of consistent teacher guidance throughout the process, including reminders to avoid repetition and encouragement to present individual perspectives. In this plan, students appeared to structure and present their thoughts in alignment with key dimensions of critical thinking. It was generally observed that students were unable to use oral and written language effectively. This issue is believed to be linked to the students' lack of regular reading habits. Moreover, for most students, Turkish is not their native language. Since the language spoken at home differs from the language used at school and in broader society, students struggle to use the language effectively. It was observed that two students were able to incorporate explanatory definitions while expressing their thoughts and demonstrated awareness of inconsistencies, indicating an improvement in their self-awareness compared to earlier action plans. It was generally observed that students were unable to use oral and written language effectively. This issue is believed to be linked to the students' lack of regular reading habits. Moreover, for most students, Turkish is not their native language. Since the language spoken at home differs from the language used at school and in broader society, students struggle to use the language effectively. It was observed that

two students were able to incorporate explanatory definitions while expressing their thoughts and demonstrated awareness of inconsistencies, indicating an improvement in their self-awareness compared to earlier action plans. The observed decrease in the frequency of explanatory definitions was not due to a regression in this skill but rather to the limited number of activities targeting this component in the third action plan. Students continued to show weakness in questioning information sources. This is thought to be due to their limited access to digital tools, the fact that most live in rural areas, and a general lack of internet connectivity. However, they appeared to adopt a questioning attitude rather than uncritically accepting information. Representative student responses include Sample student responses:

S6: *"Everyone comes to the shop after seeing the adverts. These are also shared on social media to make the product more attractive. It influences people because everyone likes it and buys it. Some ads really offer us things we actually need."* (Activity Sheet)

S7: *"Sometimes there are negative aspects of ads, and he tells people about them. I think he explains them clearly and critically. This shows he is honest."* (Activity Sheet)

S8: *"People can restrain themselves."* (Activity Sheet)

When the fourth action plan was evaluated in terms of critical thinking, a significant improvement was observed in students' abilities to interpret, evaluate, and make inferences, compared to previous action plans. This improvement is attributed to the frequent inclusion of activities targeting these dimensions in earlier stages and the students' ability to develop their ideas through peer interaction. The post-test scores in critical thinking also support this positive development. It can be said that students reached an adequate level of self-awareness. Although students initially had difficulty comprehending the texts during individual reading, they reported better understanding when engaging in classroom activities. This suggests that text-based group work contributed to their comprehension. One student expressed this as follows:

S9: *"Teacher, I was a bit bored while reading the book. I didn't understand much, especially at the beginning. But when we did the activities here with my friends, it all made sense. Now I understand it better."* (Interview, 20.12.2022)

Student responses suggest that they have also improved in asking effective questions, although this skill has not yet reached a fully satisfactory level. They demonstrated sufficient performance in the dimensions of questioning, interpretation, evaluation, expressing original ideas, and drawing conclusions from available data. The students' interest in activities such as creating questions about the books, evaluating character traits, writing alternative endings, and participating in group work likely contributed to this development. The researcher noted the following in the field diary:

Researcher: "After the lesson, students came to me and said they found the activities very enjoyable. Even if they didn't fully understand the books while reading, they said they comprehended them better through the group activities. They expressed a wish to do similar work for every book." (Researcher Diary, 19.12.2022)

Overall, student responses indicated that they were able to evaluate the current situation, articulate their interpretations, and draw logical inferences from the data. In this context, it can be said that their performance in these dimensions was satisfactory. Sample student response:

S10: *"I think the colours were nice. The illustrations were funny and beautiful, and they matched the content. The pictures gave clues about the story. There was nothing wrong with the page layout."* (06:05 mm:ss)

When the fifth action plan was evaluated in the context of critical thinking, the responses of students whose critical thinking skill levels were low prior to implementation were examined, and it was observed that they were at a sufficient level in the analysis and evaluation codes. The fifth action plan included activities focused on the students' abilities to support their conclusions with reasons, make independent decisions, and recognise inconsistent judgements, which were areas where they struggled to show improvement. In this context, a significant improvement was observed in the students' abilities to analyse, evaluate, draw conclusions, and make decisions based on logical criteria compared to their pre-implementation and first action plan levels. It was also determined that students' abilities to question, interpret, and ask effective questions were at a sufficient level. When the answers of students whose critical thinking skill levels were at an intermediate level before the application were examined, it was seen that they were able to analyse and evaluate while expressing their thoughts, were at a sufficient level in terms of making inferences and were able to determine reasonable criteria when making decisions. The relevant student answers are given below:

S11: "Sir, when you mentioned artificial intelligence, I became very curious. My interest in the content increased. Because it was giving hints about the content." (3.27 mm:ss)

Before the application, the answers of students with high critical thinking skill levels according to their class were examined. It was observed that the students were able to analyse and evaluate while expressing their thoughts, were at a sufficient level in terms of making inferences, and were able to determine reasonable criteria when making decisions. The relevant student answers are given below:

S12: Whenever I buy a book, I look at the inside and outside of it before purchasing it. This is because I want to choose books that I can read. (Activity Sheet).

S13: It arouses my curiosity. This is because we read the summary on the back before buying the book. After reading the description, my curiosity about this book was aroused. (Activity Sheet).

When examining the students' post-application critical thinking final test scores, a significant increase was observed. It is thought that designing activities targeting each component of critical thinking and implementing these activities interactively in the classroom through different group work was effective in this case. In this sense, it can be said that the students showed improvement in their critical thinking skills.

Findings Regarding the Contribution of Applied Teaching Activities to the Development of Problem-Solving Skills in Students from Low Socioeconomic Backgrounds

A total of eight problem-solving activities aimed at developing problem-solving skills were prepared and implemented for students in the action plans applied, focusing on five children's books read to the students. These activities focused on developing students' problem recognition and solution generation skills by focusing on the problems encountered by the book's characters and their ways of solving them. The characters' ways of recognising problems, solution steps were examined, and solutions were evaluated. In this regard, efforts were made to develop students' abilities to recognise problems, develop solutions, solve problems by setting reasonable criteria, and evaluate the results. Both audio and video recordings were made to ensure that there was no loss of data regarding the students' answers. The data obtained from the student activity responses were presented using the video and audio recordings.

Table 8. Findings Regarding the Development of Problem-Solving Skills

Action Plan	Code	f
1. Action	Selecting the problem	13
	Identifying the problem	6
	Evaluating the pros and cons	5
	Solving the problem	15
2. Action	Selecting and defining the problem	30
	Setting realistic and achievable goals for the problem	17
	Generating alternative solutions	22
	Developing an action plan	14
	Choosing options for solving the problem	9
	Evaluating the pros and cons of the problem	7
3. Action	Selecting and defining the problem	39
	Setting realistic and achievable goals for the problem	39
	Generating alternative solutions	15
	Choosing options for solving the problem	15
	Developing an action plan	33
	Evaluating the results	1
4. Action	Selecting the problem	20
	Defining the problem	20
	Solving the problem	8
5. Action	Setting realistic and achievable goals for the problem	31
	Generating alternative solutions	25
	Selecting options for solving the problem	23
	Developing an action plan	26
	Evaluating the results	9

Looking at Table 8, a total of 8 activities were carried out to develop students' problem-solving skills: 1 in the first and fourth action plans and 2 in the second, third and fifth action plans. Repeated codes and themes have been combined and presented. When the first action plan was evaluated in the context of problem solving, it was observed that students could generally select the problem but could not define it, and even if they solved it, the solutions were not appropriate. It was determined that they could not reach an appropriate solution because they could not evaluate the positive and negative aspects of the problem. However, five students with high-level problem-solving skills were able to select and define the problem, evaluate its positive and negative aspects, and produce appropriate solutions. The relevant student responses are provided below:

S14: My friend forgot to do his homework. He panicked a little. I immediately asked him to take out his book and we determined which homework he hadn't done. However, there was no time and we couldn't do it. (On the activity sheet)

S6: The other day my friend got into a fight. I immediately ran to help him. We did what was necessary. (On the activity sheet)

S15: When we arrived at school in the morning, I saw that my friend felt sick. I think he hadn't had breakfast. If he didn't eat something, he could have felt worse. I went and got something for both of us from the canteen. We ate and chatted. He said he felt better. I felt good too. (On the activity sheet)

When the second action plan was evaluated in the context of problem solving, it was observed that students showed a certain degree of improvement in selecting and identifying problems. It is thought that the designed activities were effective in this case, primarily because they aimed to enable

students to identify an existing problem and gain awareness of the issues. However, looking at the students' answers, it was seen that they were far from the problem-solving stages and did not offer meaningful solutions. This situation is thought to be related to the fact that students are not involved in any problem-solving process in the family environment and are left alone in the context of problem solving.

When examining the responses of students with problem-solving skills at an intermediate level for their class, it was observed that they were able to identify the problem and generate alternative solutions. It was also observed that they were able to develop action plans for these alternative solutions. Compared to the previous action cycle, it was noted that they showed improvement in taking action rather than merely verbally expressing the ways to solve the problem. For example, they have participated in activities where they needed to be aware of their friends who needed help and not only express this but also initiate campaigns for them. It can be said that project-based activities are effective in this case, as these types of group work were designed. It was also observed that students developed awareness in setting realistic, achievable, and tangible goals for the problem. The relevant student responses are provided below:

S7: I would beg my mother, saying, 'Please, Mum, whatever you do.' I would say I wouldn't let myself be crushed like a black fish. I would say that if I found something new, our name would go down in fish history. I would say that if we all went together, united, we wouldn't be afraid. I would speak sweetly to my mother, trying to persuade her. (Activity Sheet)

When the third action plan was evaluated in the context of problem-solving skills, it was observed that students solved the problem by mastering the problem-solving stages. It can be said that activities and classroom applications that worked through the problem-solving process step by step were effective in this case. Students who were insufficient in generating alternative solutions were also found not to evaluate whether the solution worked or not. Some students' failure to read the book simultaneously with their peers, their reluctance to participate in activities, and their inability to listen to and evaluate each other's thoughts contributed to this situation. Furthermore, family interviews revealed that these students were also excluded from the process in family problems. The relevant student responses are provided below:

S2: If it were me, I would apologise and try to make amends. Then I would buy a gift, go to them and celebrate again. (Activity Sheet)

When examining the responses of students with an intermediate level of problem-solving skills, it was observed that they progressed through the stages of problem-solving and identified achievable goals for the solution by selecting and defining the problem. It was also noteworthy that they generated alternative solutions and made choices. The frequent implementation of activities targeting these components and the awareness gained in this regard were effective in this development. The relevant student responses are provided below:

S7: I would say, 'I have work to do, I'll be right back,' and walk away. Or I would be straightforward and tell them. Or I would buy something from the grocery store. Or I would give them a cherished item from my home as a gift. (Activity Sheet)

When examining the responses of students with higher problem-solving skill levels, it was observed that they followed a path consistent with the stages of problem solving. After selecting and defining the problem, the students were able to set realistic goals and generate alternative solutions. The relevant student responses are provided below:

S12: I would tell him the truth and make him a gift myself that day. I would take great care to ensure it was a gift he would like. (42.57 mm:ss)

When the fourth action plan was examined in the context of problem-solving skills, it was observed that the students were able to select and define the problem. In terms of proposing solutions to the problem, the responses of students coded as Ö11 and Ö10 were noteworthy. The relevant student responses are provided below:

S11: Cutting down trees to build houses. Machines producing everything. Products past their use-by date still being on the shelves in shops. Animals' natural habitats not being protected. Animals being harmed. We need to educate people to put an end to all this. (15.54 mm:ss)

When examining the responses of students with high problem-solving skill levels prior to the application, it was observed that they had no difficulty selecting and defining the problem, but some students were inadequate in generating solutions. It is thought that the students' perception of themselves as adequate in problem-solving and their failure to participate in the application process at the desired level were effective in this situation. The relevant student responses are given below:

S10: The people working in the canteen give priority to their acquaintances. This is unfair. The woman should be warned about this. People are swearing. Rubbish is being thrown on the floor. (14.53 mm:ss)

When the fifth action plan was examined in the context of problem-solving skills, it was observed that in the previous plans, students generally did not evaluate the usefulness of the solution after resolving the problem. The perception that problem-solving ends once a solution is found appeared to influence this outcome. However, in this action plan, nine students were found to have paid attention to this aspect and evaluated the results of their solutions.

An analysis of the responses from students whose problem-solving skill levels were low prior to implementation revealed that they were able to set realistic and achievable goals. However, student S4 was found to have difficulties in this regard; this student neither established realistic and attainable goals nor proposed plausible solutions. The student response is as follows:

Ö4: "I will do my best. I would give my life for him. If he dies, I'll kill myself too." (21:57 mm:ss)

In the coding category of generating alternative solutions and offering options, students were found to be at a sufficient level. Similarly, they demonstrated adequate competence in developing action plans for solving the problem. In this regard, the responses of students Ö14, Ö2, and Ö1 stood out. Sample responses are provided below:

Ö14: "I would do everything I can to help him get better. For example, I would buy medicine, take him to the hospital, and help him feel better." (19:09 mm:ss)

For students whose problem-solving skill levels were at a moderate level before implementation, it was observed that they could set realistic and attainable goals, generate alternative solutions, and make choices among those solutions. In the related activities, students were asked to propose different solutions from those used by the book characters, select the most appropriate option, and evaluate the outcome. These activities are thought to have contributed to the development of the mentioned skills. However, with the exception of students S15 and S13, the others were found to be insufficient in evaluating the outcomes of the problems. The responses of students S15 and S13 were notable in this regard:

S13: "In that situation, I would call all the pharmacies. After school, I'd give him healing fruits and vegetables. I'd make bone broth soup. I'd save up money to buy medicine. These usually work. These are the things that help me recover quickly when I'm sick." (21:45 mm:ss)

Among students who had high levels of problem-solving skills before the intervention, it was found that they were able to set attainable goals, propose solution paths, and develop actionable plans—sometimes even using artificial intelligence as a tool. Regarding the evaluation of the outcomes, students S10, S13, and S17 gave responses that were considered sufficient. Sample response:

S10: "The problem is that students run to the cafeteria. So, a camera will be installed at the cafeteria door. It will take pictures of students who run, and the system will detect them and delay their lunch by 10 minutes. This way, there won't be any unfairness and everyone will be happy." (44:02 mm:ss)

It is known that students previously struggled with the evaluation of results component in problem-solving. Through the implemented activities, an effort was made to teach students that solving the problem is not the final step; instead, the solution must also be evaluated for its effectiveness and appropriateness. In this regard, students appeared to gain awareness over time and showed improvement through continuous engagement in the activities. Overall, it can be concluded that students demonstrated noticeable progress in their problem-solving skills. The increase in their post-test scores supports this finding. However, students Ö4, Ö5, and Ö2 showed no significant improvement.

Findings on the Contribution of the Implemented Instructional Activities to the Development of Creativity Skills in Socioeconomically Disadvantaged Students

Throughout the action plans, a total of 19 creativity-oriented activities were designed and implemented based on five children's books assigned to the students. To prevent data loss regarding students' responses, both audio recordings and video footage were collected. The findings presented in this section are based on the data obtained from these audio-visual materials and the students' written responses to the activities.

Table 9. Findings on the Development of Creativity Skills

Action Plan	Code	f
1. Action	Fluency	43
	Originality	11
	Flexibility	7
	Abstractness of titles	8
	Enrichment	20
	Resistance to early closure	1
	Creative forces	6
2. Action	Fluency	31
	Flexibility	7
3. Action	Fluency	93
	Originality	10
	Flexibility	14
	Abstractness of titles	15
	Enrichment	6
	Creative Forces	12
4. Action	Fluency	100
	Originality	9
	Flexibility	12
	Abstractness of titles	6
	Enrichment	3
	Creative forces	2
5. Action	Fluency	158
	Originality	8
	Flexibility	10
	Abstractness of titles	19
	Enrichment	8
	Resistance to Early Closure	3
	Creative Forces	4

As shown in Table 9, a total of 19 activities aimed at developing students' creativity skills were implemented—three in the first and third action plans, two in the second, five in the fourth, and six in the fifth. Repeating codes and themes were merged and presented collectively in the table. Since creativity was found to be the most challenging skill to develop throughout the study, the action plans were revised, and the number of creativity-focused activities was increased particularly in the final weeks. When the first action plan was evaluated in terms of creativity, it was observed that during the activity in which students were asked to introduce their family members, they failed to produce descriptive and fluent expressions. The descriptions were generally short and inconsistent. Students did not introduce their family members using creative expressions; they merely mentioned physical attributes without referring to any personality traits. This outcome is believed to be related to students' limited vocabulary, low reading habits, and a tendency to think using fixed patterns. Sample student responses:

S14: "My grandfather is quite angry and authoritative. In contrast, my grandmother has smiling ears. Even if people speak badly, she always hears the good. She is cheerful and optimistic and constantly tells us stories. My aunt is as short as a vegetable seedling but has a nose as long as a poplar tree. She pokes her nose into everything. My mother and father are ordinary people. My father goes to work every day, and my mother does housework and takes care of us. They are both short but very compassionate. My mother has jet-black eyes just like mine. I won't even start on my siblings. They are like the three mischievous dwarfs." (41:30 mm:ss)

S17: "My grandfather and grandmother are two cranky old people who are always bickering. Both are chubby, incompatible, and stubborn. My grandfather is tall with tiny ears. My grandmother is short with a very long tongue—probably long enough to reach my grandfather's ears. My parents don't get a chance to argue because of them. I love my sister Zeliş. She takes care of me a lot. She's like a fairy godmother—she has huge wings and flies from place to place." (47:55 mm:ss)

These responses show that students were able to generate ideas within the fluency dimension of creative thinking. Those with a medium level of creative thinking ability used more descriptive expressions, attempting to describe their family members both physically and in terms of personality. Phrases like "a tongue long enough to reach grandpa's ears" and "a nose as long as a poplar tree" demonstrate how students stretched descriptive language to convey different meanings. However, the responses lacked originality in terms of unique expression. When their visual activities were analyzed, students were found to be insufficient in abstract thinking, resistance to premature closure, and use of creative forces; however, they were relatively successful in enriching their visuals. This outcome is thought to be associated with students living in rural areas, having limited access to cultural and artistic experiences that foster creativity, and lacking access to books that could help them explore the world. Their pre-test scores on the Torrance Tests of Creative Thinking also support these findings.

In the context of the second action plan, which included a group work activity, students were able to generate ideas in terms of fluency, but no group produced an original idea. Below are excerpts from a play script written by students about helping an elderly woman:

S9: "Let's quickly go to her. Sister, if you allow us, we'd like to help you."

S1: "I wish you would help. That would be really great."

S9: "Can you tell us what we need to do?" (She explains everything to us.)

S12: "Everything else is done. Only this task remains. We'll finish it in two hours."

S1: "Thank you. If it weren't for you, it would have taken me two days. By then, I would've boiled from the heat." (From student activity sheets)

When evaluated in terms of creativity, the third action plan revealed that students were able to generate ideas fluently ($f = 93$). Moreover, a subset of students ($f = 10$) demonstrated some improvement in producing original outputs. Compared to previous action plans, they also showed better performance in *flexibility*. The third action plan included activities targeting visual creative thinking skills. Students were asked to invent a completely new and unheard-of food or beverage based on the book they had read, write an advertisement for it, and design a poster. It was found that students used more descriptive language when naming their products and paid greater attention to enriching their designs with drawings and objects. None of the students left their designs incomplete or open-ended; all finalized their creations. When 12 students' designs were analyzed in terms of creative forces, they were found to differ in aspects such as emotional expression, movement, inner visualization, richness of imagination, and vividness of imagination.

Among students with lower levels of creative thinking, it was observed that although they were able to generate ideas fluently, they struggled with flexible thinking and transferring function or meaning. Their responses remained closely tied to the content of the book, and they listed their thoughts without significant modification. As a result, the products they created were similar to each other and lacked originality. Related student responses are presented below (Figure 1): S12:

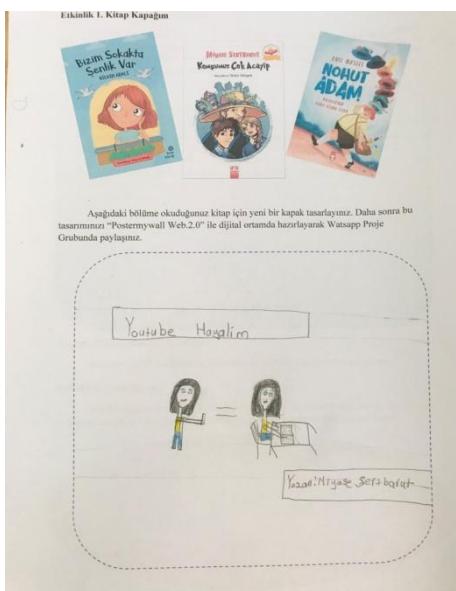


Figure 1. Student Activity Sheet

When the fourth action plan is examined in the context of creativity, it is observed that all students were able to generate multiple ideas fluently and without restriction. However, it can be said that these ideas did not demonstrate flexibility or the ability to transfer meaning and function. It was found that the students were not yet competent enough to generate original ideas. This action plan also included figural activities aimed at developing students' creativity. When students' figural designs were examined, it was observed that, compared to previous action plans, they performed lower in terms of the abstractness of titles, failed to enrich their visuals, and showed a significant decline in terms of creative strengths. Although students whose creative thinking skill levels were low before implementation were sufficient in terms of fluency, it was determined that they were unable to produce flexible and original thoughts. A relevant student response is given below:

S1: Dear friends, I will tell you about the importance of April 23. April 23 is a day for children to have fun. We can buy them toys and make them happy. (38:48 mm:ss)

When the fifth action plan was examined in terms of creative thinking, it was observed that students were able to fluently generate multiple ideas. However, they had not yet reached the expected level of originality, and compared to previous plans, a decline was noted in originality and flexibility.

In this plan, the number of creativity-oriented activities was increased by the researcher, and especially in figural activities, the sub-dimensions of creativity were targeted for improvement. Although there was an increase in the frequency values of the sub-dimensions such as abstractness of titles, enrichment, resistance to premature closure, and creative strengths compared to previous plans, this was attributed more to the increased number of activities and the focus on figural activities than to an actual improvement in creativity.

The most challenging activities for students were those requiring creative thinking skills. As a result, students reported feeling bored during these activities. They preferred giving short, thoughtless answers and refrained from volunteering. When the researcher-teacher tried to involve students in the process by asking for their opinions, students gave brief responses. Based on interviews with families, it was concluded that because students had been expected to think within certain rules and norms from an early age, it became difficult for them to break out of these patterns and think flexibly and creatively. This situation is thought to have influenced their inability to reach the desired level of creative thinking skills. When the responses of students whose creative thinking skill levels were moderate before the implementation are examined, it can be said that they showed progress and were sufficient in terms of fluency. However, they did not reach the desired level in terms of flexibility and originality. Relevant student responses are given below:

S18: Dear children, I have good news for you for April 23. Free toys will be distributed to you. You can go shopping with the cards we give you. Additionally, financial support will be provided to your families. Thank you for listening. (37:13 mm:ss)

When the responses of students whose pre-implementation creative thinking skill levels were high relative to the class are examined, it is seen that they were adequate in terms of fluency and flexibility but lacked in originality. Relevant student responses are presented below:

S8: Dear friends, first I will explain to you the difficulties under which April 23 was gifted to us. Then I will explain what we will do for this holiday. Our ancestor gifted this holiday to children. The fact that he gifted it to all children shows that all children are equal. In some places, children are forced to beg. We must prevent this. Some children cannot be outside like us. They are now in hospitals trying to overcome some difficulties. They cannot enjoy this holiday. You can make more donations for these children. Thank you for listening. (31:50 mm:ss)

When the students' responses were examined, it was observed that although they showed progress in terms of creative thinking, this development was not at the desired level. It was discovered through the activities in the fourth action plan that students had difficulties with abstract thinking, particularly with idioms and proverbs. They created texts using the idioms and proverbs in their literal meanings. It is thought that students who produce simple ideas based on close associations need to be exposed to more texts and books in the context of creative thinking. Additionally, introducing students to various artistic activities that foster creative thinking is considered to be effective. Ayaydin (2011) states that art has an influence on children's creativity. Social activities are believed to be important in helping students, who are accustomed to thinking within fixed patterns and rules due to their family structures, to gain a more diverse perspective and flexible thinking. Developing a reading habit and culture, and getting to know different characters and lives, are believed to benefit students in terms of thinking differently.

Since students' creative thinking skills did not develop to the desired level during the process, the number of activities aimed at creative thinking was increased in the fifth action plan. In this plan, efforts were made to develop students' creative thinking skills both verbally and figural. It was determined that students showed a significant improvement in terms of fluency; however, a decline in the frequency values of originality and flexibility was observed compared to previous action plans. This indicates that students were not able to reach a standard level in originality and flexible thinking and did not show permanent development.

S19: I would do something fun and nice. I would try to assign adventurous and design-based homework or books. From another perspective, I would assign colorful and sweet tasks just like the ones you gave us. This process helps us enjoy reading, and it would help them too. (13:10 mm:ss)

The student's response indicates a positive attitude toward the implementation process and emphasizes that it was a process that fostered a love for reading. The fact that students constantly encounter different activities related to creative thinking necessitates the development of new ideas. However, it has been observed that students struggle to produce new and different ideas each time.

When the responses of students whose creative thinking skill levels were at a moderate level before the implementation are examined, it was found that they were sufficient in terms of fluency, showed progress in flexibility although not at a sufficient level, and remained inadequate in originality. Relevant student responses are provided below:

S10: If it were me, I would ask fun questions about the book, but ones that cannot be answered without reading the book. Then if kids who don't like to read wanted to answer, they would have to read the book. (10:21 mm:ss)

It was generally observed that students had difficulty with activities that required creative thinking. Although there was a slight increase in the final test scores related to creative thinking skills, it was found that students were still not at a sufficient level in terms of producing original ideas and products. Factors such as a lack of life experience, limited social activities, fear of being mocked by peers when sharing ideas, and being raised in families with rigid norms and stereotypes from an early age are believed to slow down students' developmental pace. When the responses of students whose creative thinking skill levels were low before implementation are analyzed, it is seen that they were sufficient in terms of fluency and showed progress, although not sufficient, in flexibility and originality. In figural activities, however, it was observed that students did not show consistent development in codes such as abstractness of titles, resistance to premature closure (delaying immediate decision-making in the face of uncertainty), and enrichment (making the learning process more diverse); frequency values varied depending on the number of activities. In general, although there was an improvement in students' creative thinking skill levels, this development was not at a satisfactory level.

Discussion

In order to determine the critical thinking skill levels of the students in the study group, interviews were conducted with other subject teachers who taught these students and with their families. In addition, the Cornell Critical Thinking Test was administered as a pre-test. These initial evaluations revealed that the students' critical thinking skills were at a low level. In the literature, similar findings are reported. For example, Candaş (2024) identified low pre-implementation levels of critical thinking in students in her study on the effectiveness of lessons enriched with critical thinking methods. Similarly, Zorlu (2023) found that the critical thinking skills of 61 fifth-grade students were inadequate and investigated the effects of argumentation-based instruction on students' critical thinking and informal reasoning skills. It can be inferred that such studies aim to enhance students' critical and informal reasoning skills. Likewise, Mutlu (2023), in his study with fifth-grade students, observed insufficient critical thinking skills and aimed to improve these through a differentiated thinking instructional program. Ergin (2023), in a study with five-year-old children, investigated the effects of interactive book reading on their critical thinking skills and concluded that this method was effective in promoting critical thinking. Savaş (2023) also aimed to develop students' critical thinking skills through an approach based on logical fallacies. It was found that students with low levels of critical thinking skills before the implementation showed a certain level of improvement afterward.

Başkalyoncu (2023) similarly determined that the critical thinking levels of students were low before various in-class practices, which were found to have a significant positive effect post-implementation. Overall, studies in the literature show that various models and instructional materials focusing on the development of students' critical thinking skills lead to considerable improvement (Arduç, 2023; Bilir, 2023; Bolattaş-Gürbüz, 2023; Ercan, 2023).

Numerous initiatives have been made to define 21st-century skills through various frameworks. Among these, the most widely accepted is the P21 Framework. This framework emphasizes that next-generation learners should develop inquisitive perspectives, analytical thinking skills, self-regulation abilities, creativity, and a problem-solving approach to real-life issues. Consequently, education systems that focus on enhancing these skills are gaining increasing importance. In line with this, the literature shows a growing number of studies aimed at improving students' critical thinking abilities. These studies emphasize the effectiveness of project-based approaches, out-of-school learning, and experience-based methods over traditional ones (Asil, 2023; Candaş, 2024; Demircioğlu, 2024; Kuru, 2023). The instructional activities developed during the research focused on students' experiences to ensure cognitive engagement and included technology-based learning opportunities. The activities incorporated group work such as drama and cooperative learning, along with the use of Web 2.0 tools to create technology-supported learning environments. Literature reviews confirm that such practices have a positive impact on student learning (Bedir, 2023; Bilir, 2023; Çetin, 2023; Gedik, 2023; Özbilen, 2023).

To enhance critical thinking skills, students must first understand the concept itself and gain awareness. They also need to know how to access information, analyze and evaluate it, and make inferences. However, factors such as socioeconomic status, family structure, and living environment hinder students' access to information. Thus, the instructional activities in this study were designed using methods such as drama, Web 2.0 tools, and cooperative learning to support students' access to information and experiential learning. Additionally, books promoting critical thinking were selected to raise students' awareness.

According to the research findings, there was a noticeable improvement in students' critical thinking skills. Similarly, Uyulan (2024) reported that activity-based critical thinking instruction leads to more effective and lasting learning. It was observed that students were particularly active in drama and group work supporting cooperative learning. Taşkın Serbest (2023) emphasized that contemporary teaching approaches foster critical thinking skills more effectively than traditional methods. Students demonstrated improvements in questioning, analyzing, inferring, decision-making, reasoning, and evaluation skills, indicating enhanced critical thinking. Researchers noted that students' acquisition of an inquisitive and descriptive perspective was an expected outcome (Kan, 2023). In conclusion, activities that support inference, decision-making, and justification contributed positively to the development of students' critical thinking.

The study found a significant improvement in all subdomains of critical thinking skills for all students except two. These findings align with those of Kaya (2023) and Öztürk (2023). Despite the students' disadvantaged socioeconomic backgrounds and some academic deficiencies, the results indicate that with sufficient effort and time, development is possible.

The data obtained from interviews with teachers and families, as well as from the Cornell Critical Thinking Test, showed that seventh-grade students had low problem-solving skills. Similarly, Sarıkoç-Bilir (2023) found low problem-solving skills among ninth-grade students. Kaptan (2023) observed that reading comprehension instruction had a significant positive impact on students' problem-solving skills. Türk (2023) also noted that orienteering activities significantly improved students' problem-solving abilities. Çoban (2023) concluded that activity-based instruction positively influenced students' problem-solving skills. Factors such as low socioeconomic status, illiterate parents, and limited access to resources like books and libraries were identified as causes for poor problem-solving abilities. Broader life experiences (Adıgüzel, 2006), access to more resources, support and interest from families (Kamışlı, 2018), and a sense of responsibility (Ergin & Dağ, 2013) are thought to positively influence problem-solving skills.

Activities aimed at helping students understand the problems of characters in books through empathy and apply these problem-solving skills in real life were conducted. Cooperative group activities, drama, and digital design tasks were used to engage students in problem-solving processes. Oğuz (2023) found that Turkish lessons incorporating creative drama improved the creative thinking and problem-solving skills of gifted students. In this study, it was found that the students had no difficulty in defining and describing problems. Kanmaz (2023) noted that this is an expected outcome. However, students needed further development in setting realistic goals and generating alternative solutions. Alın (2023) also found that interdisciplinary problem-solving activities contributed to students' ability to define realistic goals and produce alternative solutions. The current research supports these findings.

It was noteworthy that students lacked the habit of evaluating outcomes after solving problems, suggesting that reaching a solution was perceived as the final step in the problem-solving process. Although four students showed progress in the evaluation stage, most were found to be inadequate. Altun (2023) reported a weak correlation between students' ability to evaluate outcomes and their overall problem-solving success, supporting the findings of this study. Overall, the study suggests that when students are actively engaged in the process, they participate more willingly and are more open to learning. Therefore, allocating more time and incorporating such activities more frequently is essential to further developing problem-solving skills.

The results of the instructional activities showed that students' creative thinking skills did not improve to the desired level. Although students participated willingly in activities aimed at enhancing digital competence and creativity, the expected progress was not achieved. While there was some improvement compared to their initial state, it did not meet the targeted level. Atalay (2023) also found no significant difference in verbal creativity scores before and after interventions involving creative home environments and motivation to learn creative thinking. Kalayci (2023), in a study on inquiry-based instruction, also found no statistically significant improvement in scientific creativity despite a positive trend in post-test scores. The fact that none of the students had university-educated parents and that their families were economically disadvantaged may have limited their participation in artistic and creative activities. This may explain the limited development in creative thinking. Despite progress in digital competence and creativity-focused activities, the improvement in creative thinking remained limited. Avcu (2014) showed that students produced more creative products in technology-oriented activities, supporting the present study.

When examining subdomains of creative thinking, the fluency subdomain showed more progress than others. Sağlam (2023) found that creative problem-solving modules enriched with the history of science improved the critical, creative, and problem-solving skills of 5th and 7th-grade students, although not to a statistically significant extent. While students succeeded in the fluency domain, they struggled with originality. This trend aligns with findings from Budak Kaymaz (2022), who studied the effect of digital game prototyping education on the creative thinking of 10-year-old children and found a slight but statistically insignificant increase in post-test scores. All these studies support the findings of the current research.

Conclusion

Content analysis of students' responses to the activities revealed that their initial negative perceptions of the concept of critical thinking had changed, and they had developed an understanding of its meaning. Following the activities, it was observed that, except for two students, all showed improvement in their inquiry skills. Through the books they read and the activities they participated in, students enhanced their ability to make inferences from data and to make predictions aimed at reaching conclusions. However, desired progress was not achieved in the sub-dimensions of analysis and evaluation. Only four students demonstrated sufficient improvement in these areas. Nonetheless, students made progress in setting rational criteria for decision-making and supporting their thoughts with sound reasoning. Interview data indicated that students became more aware of critical thinking and were able to transfer this skill into their daily lives. During the final interviews, students expressed enjoyment of the activities and a desire to participate in more.

Findings from student activities also revealed improvements in their problem-solving skills. It was observed that the indifference they exhibited before the implementation had disappeared, and they had gained knowledge about the problem-solving process. After reading selected books and engaging in the designed activities, all students were able to select and define problems without difficulty. It was found that they improved in setting realistic and attainable goals for solving problems and in generating alternative solutions. However, eight students still fell short in developing actionable plans. Although some progress was observed in evaluating outcomes, this improvement was not at the desired level. In the final interviews, students indicated that they had gained knowledge about addressing problems and had made progress in their problem-solving abilities.

According to the findings obtained from the student activities, a noteworthy number of students showed sufficient improvement in the fluency sub-dimension of creative thinking. While the number of students demonstrating improvement in flexibility and originality increased after the implementation, the level of improvement was still below expectations. Some students also exhibited slight progress in emotional expression and richness of imagination. During the final interviews, students emphasized that the activities and books that fostered creative thinking enriched their imagination and helped them advance in generating ideas. They stated that the difficulty they previously experienced in producing ideas had been overcome and that they now possessed a rich pool of thoughts. However, it was also observed that they had not yet developed original ideas and had not reached the desired level of improvement in the sub-dimensions of creative thinking.

In conclusion, the findings of this study show that the activities designed based on children's books led to a certain degree of improvement in students' critical thinking and problem-solving skills. Although there was some development in creativity skills, the improvement did not reach the desired level.

Recommendations

Based on the findings obtained from this research, the following recommendations are presented for implementation and for future studies:

Recommendations for Practitioners

The results of the study indicate that the implementation process enhanced students' critical thinking skills. Considering that today's students are digital natives who frequently use social media and are exposed to various stimuli, the importance of critical thinking skills becomes evident. In this context, it is believed that critical thinking education should hold a significant place in school curricula. The study also revealed the need for more supportive activities to foster the development of students' creativity. Furthermore, it was determined that problem-solving skills can be improved in a relatively short period of time. Consequently, it is recommended that various measures be taken to promote students' reading habits and support their academic success.

Recommendations for Future Research

This study was conducted in a school located in a low socioeconomic area. Future research may explore the effects of similar instructional content on students in schools from medium and high socioeconomic backgrounds and examine their developmental outcomes. The current study was carried out with seventh-grade students. Future studies may evaluate the effects of lesson plans designed to enhance critical thinking, problem-solving, and creativity in students from the 5th, 6th, and 8th grades. Additionally, the impact of the implementation on either all-female or all-male student groups can be investigated separately. Due to the limited duration of the intervention, the activities aimed at fostering creativity were restricted. Therefore, future studies could incorporate a greater number of creative thinking activities and children's books that support creativity.

Due to challenges in obtaining legal permissions, extracurricular social and artistic activities were excluded from the lesson plans. However, future studies may consider including such out-of-school educational activities aimed at developing students' critical thinking, problem-solving, and especially creativity skills. The activities in this study were primarily designed around Turkish language, visual arts, and information technology content. In future research, more original activities can be developed by integrating diverse subject areas. Furthermore, due to the inadequate technological infrastructure of the school, information technologies could not be fully utilized. Thus, future implementations may benefit from the use of more advanced digital tools and computer programs as instructional resources.

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Effectiveness of group music therapy in reducing exam anxiety in high school senior students

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Abstract

The aim of this study is to compare the effect of group music therapy practices on test anxiety and the effectiveness of the music lesson taught in accordance with the united annual lesson plan in high school seniors who are preparing for the university entrance exam. Two months before the exam, 49 students studying in the last year of Osmangazi Anatolian High School in Afyonkarahisar province in the 2022-2023 academic years participated in the research. Students were randomly assigned to "Music Therapy" and "Music Lesson" groups. The music therapy group was included in the group music therapy process for 8 weeks, while the music lesson group took only the elective music course in the curriculum. "Westside Exam Anxiety Scale" was used as a data collection tool in the study, and comparisons between groups were made with independent sample t-test, chi-square analysis and factorial mixed design analysis of variance methods. In addition, semi-structured interviews were conducted with the students and the effect of the music therapy sessions was evaluated with the opinions of the participants. In conclusion; it has been observed that students can control their test anxiety through music therapy practices and strengthen their internal audit-based motivation by developing a foresight through affirmation. Moreover; it was stated by the students in the therapy group that peer interaction, music culture and music-based expression skills improved, and that music therapy sessions had a positive effect on them. It was determined that the students in the Music Lesson group experienced a certain increase in their anxiety levels with the approaching of the exam date, and it was difficult for the students to make sense of the music lesson outputs for the curriculum. In this study, it was determined that goal-oriented music therapy practices performed in the school environment were effective in reducing test anxiety. It is thought that the results of the study will contribute to the national and international literature.

Keywords

Music therapy
Group music therapy
Test anxiety
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Introduction

Although studies on the effects of anxiety on human beings and coping methods have originated in an anonymous time, they have not lost their relevance and have become even more important today. Young generations shaped by age can be thought to experience anxiety processes much more dimensionally than their peers in the past. It would not be wrong to claim that the most common anxiety for young people who continue their academic vocational education is exam anxiety. In particular, how high school students preparing for the university entrance exam can help themselves in the process of coping with their exam-related anxiety has been widely examined in the literature as a general question. However, the extent of the desired effects of group music therapy for high school students on test anxiety has not been studied in the literature previously. Therefore, the question "What is the effect of group music therapy in the process of coping with anxiety in high school students preparing for the university entrance exam?" is considered important in the context of the relationship between exam, anxiety, and music. Certainly, when this process is analyzed in the context of anxiety, test anxiety, music therapy, and group music therapy, the general framework of the subject will gain clarity with a broader perspective.

Anxiety can be considered a general mood process that occurs due to the physical and emotional effects of the images that individuals create in their minds about the process in the face of uncertain situations (Pattee, 2020). In other words, anxiety is the emotional response of a person's body to stimuli (Özer, 2002). Experiencing anxiety is natural. While in some cases, the anxiety process is limited to a short period of time, in others, it can be much longer. Nevertheless, the experience of fear is a natural process. Individuals are often able to regulate or extinguish this feeling with their internal dynamics. In some cases, individuals may not be able to cope with their anxiety. These are more persistent anxiety states. It would not be wrong to say that modern man has experienced an increase in the level and variety of anxiety, as well as the technological and logistical conveniences offered to him by the new age. Especially the concern processes that young people will go through in their professional lives can trigger anxiety and depression when they persist for a long time and can cause undesirable consequences. One of these triggering anxiety states is test anxiety.

Test anxiety is a mental process in which a person doubts their knowledge and abilities and experiences a thought process as if they will fail (Bozanoğlu, 2005; Wu, 2002). It can be considered a physiological mood process that negatively affects students' social behavior, cognitive abilities, and psychological mechanisms in educational processes (Sawka-Miller, 2011; Uğur, 2005; Whitaker Sena et al., 2007). While test anxiety causes distraction in individuals, there is also a risk of low academic performance (Akbulut & Taşçı, 2019; Maviş & Saygın, 2004; Totan & Yavuz, 2009). Studies conducted on high school students show that test anxiety starts to increase, especially in the days before the exam time (DordiNejad et al., 2011; Şahin et al., 2006; Yıldırım & Ergene, 2003).

With the increasing population in developing countries, the examination process, one of the oldest elimination methods of mankind, has become more systematic and frequent. Test anxiety can manifest as tension, fear, and nervousness with the effect of emotional components and common symptoms such as sweating, crying, and heart palpitations with the effect of somatic components (Kavaklı et al., 2011). At certain levels, test anxiety has a positive effect on academic performance. However, severe test anxiety negatively affects performance and creates additional anxiety that is difficult for many people to manage (Musch & Broder, 1999). In such cases, individuals need complementary elements to support them and experts to organize them. In the literature, the positive effects of music and music components on anxiety have been mentioned (Hammer, 1996; Jiang et al., 2016; Lilley et al., 2014; Liu & Li, 2023; Scheufele, 2000). At this point, music and music-based practices can be considered one of the complementary elements for coping with anxiety that students may feel during exam processes. Although studies have demonstrated that playing an instrument or making music as part of a professional or academic duty does not reduce anxiety (Piji Küçük, 2010), the positive effect of music interactions other than professional parameters on mood, stress, anxiety, and concern has been scientifically evidenced (Thompson & Andrews, 2000).

Music can be thought of as conveying one's imagination and emotions through sound patterns that form a rhythmic and melodic structure. Although the effects of music are seen as a means of emotion, expression, and interaction on a common plane, each individual's perception scheme of music is different. Many studies reveal that musical elements such as melody, rhythm, and movement have positive somatic reflections on anxiety processes (Lilley et al., 2014; Smith, 2005). In this context, it is stated that music holistically affects the brain networks that manage the emotional state of individuals, including the limbic system, and reduces the level of anxiety and related somatic effects (Torun, 2022). On the other hand, the concept of music therapy can be referred to when structured scientific support is needed in the process of fighting against anxiety with music-mediated methods.

Music therapy is a therapeutic process in which music-mediated methods are clinically and evidence-based applied in a therapeutic relationship by a music therapist within discipline-specific models, principles, and rules to meet and support the health needs of the individual (DeNora, 2000; Torun, 2020). This process can be viewed as meeting the physical, psychological, social, and spiritual needs of individuals on a therapeutic axis in which music is a crucial tool.

There are many studies in the literature that address a common and multidimensional phenomenon such as anxiety from the perspective of music and music therapy (De L'etoile, 2000; Hammer, 1996; Juslin & Laukka, 2004; Scheufele, 2000; Wilson & Smith, 2000; Wu, 2002). Music therapy research, which is the source of evidence for the positive effects of music-based interventions on anxiety, shows that music has a positive and stimulating effect on the nervous system, helps individuals regulate their mood, and can be used as an effective adjunct to relaxation and stress management (Ellis & Thayer, 2010; Torun, 2020). What needs to be investigated here is who and how the music-based therapy applications affect (Bull, 2000). Test anxiety differs in each student according to age, grade, and course. Considering student groups continuing their education, it can be said that the most intense test anxiety is experienced by senior high school students preparing for the university exam. At the same time, senior high school students are open to peer interaction and share a common culture with their peers with whom they interact. It is known that especially high school youth listen to music with peer self-engagement, and, in some cases, this music deepens the emotional processes in a negative way. It can be said that this situation affects students' focusing processes and increases their anxiety levels. It is necessary for healthy and holistic development for students to recognize and experience constructive approaches to the difficulties they experience in every period. Especially when preparing for important exams, it is crucial to support their internal dynamics to identify possible anxiety states, to know their source, to recognize self-motivational devices, and to cope with them. Guidance studies to increase students' intrinsic motivation for test anxiety and to keep their anxiety levels under control are of great importance (Piji Küçük, 2010, p. 46). If it is known how anxiety-inducing emotions arise, it will also be easier to develop insight into anxiety. Because the main factor that causes anxiety is actually how the event is interpreted (Koruklu Öner et al., 2006).

It is a common fact that young people who cannot develop internal foresight for the process they are going through or who do not receive expert help, experience emotional, social, and physical problems during the preparation process for the university exam (Bozanoğlu, 2005; Doğan, 2020; Güler & Çakır, 2013; Kavakci et al., 2011; Koruklu Öner et al., 2006; Özer, 2002; Şahin et al., 2006). Therefore, practices to be carried out with peer groups accompanied by an expert can both contribute to their healthy socialization processes and strengthen their empathy processes by allowing them to share with their peers who experience the same anxiety processes as them (Skewes, 2002). At this point, group music therapy practices developed for the stress and anxiety experienced by senior high school students in preparation for university exams can be seen as an effective and complementary element.

Group music therapy can be viewed as a process in which therapists work with the group to identify the group's needs and create a musical universe for groups that have come together for a specific purpose (Ans dell, 2003). Because group music therapy is the experience of meaningful communication and purposeful interaction between people from different cultural backgrounds and with different physical and mental difficulties through music (Proctor, 2002, p. 101). In group music

therapy processes, participants are expected to be as open as possible with each other and to develop a verbal protocol with the therapist prior to the session. In this protocol, a verbal agreement is made that what happens in the group will not be taken out of the process by the group members and that the competencies of each individual will be accepted and not judged within the group (Torun, 2022). Ansdell (2003) in his study mentioned group music therapy processes and group differences, emphasizing that each group has its own dynamics and that the models to be applied are specific to that group.

For example, it is not possible to talk about a common musical taste when using a group of volunteers of different ages and socio-cultural backgrounds who do not know (or know of) each other but have come together for a common purpose. Therefore, group music therapy differs from individual music therapy in many ways. For example, in group music therapy, not all musical ideas may be accepted by other group members; at this point, musical actions should be determined by the therapist's competencies and the dynamics of the group. In other words, in group music therapy processes, as opposed to individual music therapy, the performance in the group and the dynamics of the groups being worked with affect the process and all individuals. Verbal and musical rhythmic sharing during the sessions increases the interaction within the group, helps them realize the existence of common concerns, and helps them develop their sense of empathy (Koruklu Öner et al., 2006).

Group music therapy practice with high school students focusing on the university entrance exam should be conducted in a setting where students can feel comfortable expressing themselves in the group, and the students' competencies should be taken into consideration. It is believed that group music therapy practices will help high school students, especially those with test anxiety, to develop new internal insights about their feelings and to focus on their goals.

In the literature reviewed from the above perspective, the intensity of studies on test anxiety in high school students is striking in terms of quantity. However, there are almost no studies that deal with a therapeutic application process, especially the evidence-based music therapy process. To the best of our knowledge, there is no study in the literature on the effects of group music therapy practice on test anxiety in high school students who are about to take the university entrance exam. In this context, it was observed that there is a need for research on the effects of evidence-based group music therapy practices on test anxiety. In a process such as the university entrance exam, which affects millions of young people and families each year, it is considered of great importance to present examples of music-based interventions to reduce test anxiety in young people and to include them in the music therapy literature. Sharing the results of the study is also considered necessary in order to reveal the contextual and formal contours of evidence-based music therapy practice. For this reason, it is believed that this study will contribute to the literature by shedding light on future research by providing the first data on the effects of music therapy on college entrance exam anxiety. In addition, the study was planned to be compared and analyzed with the effects of music education according to the unified annual plan published by the Turkish Ministry of National Education. In this way, it will be examined to what extent the music lessons in the final curriculum of high school seniors are effective in supporting the relaxation and motivation process, which is accepted as one of the goals.

1. Research Hypotheses: In this study, it was thought that Group Music Therapy practices may be effective in reducing test anxiety levels in senior high school students and that the music lesson based on the united annual curriculum does not reduce test anxiety. In this direction, the following hypotheses were tested:

- **Hypothesis 1:** (H0) There is no significant difference between the pre-test test anxiety scores of the Music Therapy (MT) and Music Lesson (ML) groups.

(H1) There is a significant difference between the pre-test test anxiety scores of MT and ML groups.

- *Hypothesis 2:* (H0) There is no significant difference between the pre-test and post-test test anxiety scores of the MT group.
(H1) There is a significant difference between the pre-test and post-test test anxiety scores of the MT group.
- *Hypothesis 3:* (H0) There is no significant difference between the pre-test and post-test test anxiety scores of the ML group.
(H1) There is a significant difference between the pre-test and post-test test anxiety scores of the ML group.
- *Hypothesis 4:* (H0) There is no significant difference between the pre-test and post-test test anxiety scores of the MT and ML groups.
(H1) There is a significant difference between the pre-test and post-test test anxiety scores of the MT and ML groups.

In line with the research hypothesis, answers were sought to the following questions.

- What are the Test Anxiety Levels of the Groups before the Practice?
- What are the Test Anxiety Levels of the Groups after the Practice?
- What are the Results of the Comparison of the Change in Test Anxiety Levels of the Groups Before and After the Practice?

2. Aim: The aim of this study was to examine the effect of group music therapy practices on test anxiety in high school students preparing for the Higher Education Institutions Examination (YKS) by comparing the effect of music lessons taught according to the unified annual curriculum. In line with this purpose, we aimed to introduce the results obtained from the high school seniors, who participated in group music therapy practices in the school environment, regarding test anxiety to the literature.

3. Importance: It is known that senior high school students experience a certain increase in their anxiety levels due to the approaching exam date and that they have difficulties in self-managing their anxiety levels. It is thought that this study is important for introducing the effects of goal-oriented and evidence-based music therapy practices in the school environment on reducing test anxiety to the literature. In line with this importance, comparing the changes in the test anxiety levels of the participating groups is thought to contribute significantly to the literature.

4. Assumptions: It was assumed that the group of senior high school students participating in the study was appropriate to examine the problem, that the participants represented all field students, that the data obtained from the Westside Test Anxiety Scale reflected the reality, that the scoring obtained from the Westside Test Anxiety Scale reflected the correct results, and that the sample group with whom the study was conducted reflected the population.

5. Limitations: This research is limited to the scoring obtained from 49 voluntary students, who would take the university entrance exam in 2023, in the school (Anatolian high school) where the researcher works and in the province, using the Westside Test Anxiety Scale with the facilities of the school where the study was conducted.

Method

Research Model

This experimental study was designed to compare the effects of music therapy and curriculum-based music lessons on test anxiety in senior high school students. A pre-test/post-test comparison design was used to explore the effectiveness of the two interventions. Curriculum-based music lessons, unlike music therapy practices, do not involve goal-specific structured interventions. For this reason, in comparisons regarding the effectiveness of structured active music therapy practices, it was thought sufficient to include only the ML group who received the curriculum-based lesson, and a control group was not included in the study.

Study Group

This study includes senior high school students preparing for the YKS exam. The study was started to be conducted 80 days before the YKS exam in the 2022-2023 academic year at Afyonkarahisar Merkez Osmangazi Anatolian High School. Out of a total of 221 students studying in 7 different classes, 52 students voluntarily participated in the study. To avoid selection bias, these students were randomized into two groups using an open access computer-based program. In this program, students numbered from 1 to 52 were randomly assigned to one of the two groups (<https://www.graphpad.com/quickcalcs/randomize1/>). Consequently, 26 students were randomly assigned to the music therapy (MT) group and 26 were assigned to the music lesson (ML) group. The MT group included only the students who were to receive music therapy, and the ML group included only the students who were to receive curriculum-based music lessons. Three students in the music lesson group withdrew from the study due to their excuses. Accordingly, the study was completed with a total of 49 participants, 26 students in the MT group and 23 in the ML group.

General characteristics of the population: In our country, the final year of high school is considered as the last step of the 12-year compulsory education. It is not possible to enroll in any institution of higher education without graduating from the final year of high school. In order to enroll in higher education, it is necessary to get a certain score from Higher Education Institutions Examination (YKS). According to the data of the Council of Higher Education, 3,527,443 people applied to YKS in 2023, whereas the number of people enrolled in any of the 208 universities in Turkey in 2024 was 591,257. The constantly developed and renewed exam system requires students, especially those studying in general education institutions such as Anatolian high schools, to undergo an intensive study tempo. Therefore, it is known that the anxiety levels of students studying in Anatolian high schools who want to enroll in a department that provides at least 4-year education increase especially as the exam approaches. It can be suggested that studies to be conducted in order for students to overcome this process at the most possible level are still up to date.

Data Collection Tools

Westside Test Anxiety Scale: The Westside Test Anxiety Scale was used as a data collection tool in the study. The scale was first developed by Driscoll (2007) and adapted to Turkish by Totan and Yavuz (2009) and its validity and reliability were established (2009). Totan (2018) introduced the scale to the literature by conducting its validity and reliability for secondary school students (middle and high school). While Driscoll's scale consists of ten items, Totan and Yuvuz's adaptation consists of eleven items. The Westside Test Anxiety Scale is the only scale that has been adapted into Turkish for secondary education and is the only scale whose validity and reliability have been established and which has been available for high school students' test anxiety. The scale is accepted as the most widely accepted secondary school test anxiety scale in the database of the General Directorate of Measurement and Evaluation of the Ministry of National Education and is among the most widely used test anxiety scales in our country. Totan found the Cronbach's alpha validity of the scale to be 0.92 for middle school and 0.91 for high school. The scale, in which holistic cohesion disorder and anxiety are accepted as a single factor, is scored on a 5-point Likert scale. The reliability of the scale was found to be significantly correlated ($p<.001$) at the level of 0.74 in high school with a two-week interval. Accordingly, the scale is scored as (5) Always True, (4) Mostly True, (3) Occasionally True, (2) Rarely True, and (1) Never True. The lowest score that can be obtained from the scale, which does not include reverse-coded items, is 11, and the highest score is 55. Low-level test anxiety ranges from 11.0 to 25.0 points, moderate test anxiety ranges from 26.0 to 40.0 points, and high-level test anxiety ranges from 41.0 to 55.0 points (Driscoll, 2007, cited in Totan, 2018).

Forms: Between March and June 2023, when the research was conducted, all the participants were within the age of 18, the participants were considered to be of legal age since they were 19 years old, and the *voluntary participation consent form* was obtained from the participants themselves. *The participant information form* is not a measurement or assessment tool and was collected only from the students in the music therapy group. Four questions were asked to the students. They were asked to write down the types of music they listen to, the singers they follow, the songs they like to sing, and their thoughts about music. The information obtained was used only for the improvement of music therapy sessions for the participants and the sessions are detailed in the group music therapy implementation section. **Participant evaluation form:** After the eight-week music therapy intervention, an evaluation form was given to the music therapy group and the music lesson group, and they were asked to write down their thoughts about what they gained or lost in the process. The information obtained aimed to evaluate the results of the research.

Research Process

The practices continued for 8 weeks and 2 hours per week. One hour of the counseling course was spent with only the MT group and the other hour was spent with only the ML group in separate classrooms.

The study was conducted within the framework of ethical rules by obtaining the necessary permissions (Afyonkarahisar Provincial Governorship and Anadolu University Health Sciences Scientific Research and Publication Ethics Board, Türkiye). Since the study was conducted openly in the school environment, it was not possible to use single- or double-blind methods. The age factor was not included in the study as a sociometric data because the ages of the participants were close to each other in days and months. All participants were born in 2004-2005.

Prior to implementation, the goal was to reach an agreement between the participants and the practitioner and establish group rules. In this context, after reaching a verbal agreement with the music therapy group on transferring the principles of music therapy practices, providing information about the process, and determining the general framework of the process and group rules, the 8-week implementation process began.

The sessions included active music therapy practices developed within the framework of the Neurocreative Music Therapy approach (Torun, 2020). Neurocreative Music Therapy was developed by Prof. Şükrü Torun based on music-brain interactions and functional neuroplasticity processes in brain network organization and is a holistic music therapy approach that determines the health/educational needs and therapy goals of individuals or groups from a phenomenological perspective, uses correlational and behavioral active music therapy methods and techniques with a creative and eclectic approach in line with therapy goals, and focuses on improving the individual's quality of life (Torun, 2020).

The weekly implementation plan and session content are detailed in Table 1 and Table 2. The group music therapy practices structured in this context were carried out by focusing on the management of test anxiety in adolescents. The methods included in the group music therapy implementation process can be listed as composing songs, writing new lyrics to known songs, improvisation exercises, rhythm exercises, movement exercises, active music listening activities based on interaction and sharing, and musical conversations.

Competencies of the practitioner: The practitioner received music therapy practitioner training approved by the Ministry of Health and obtained a certificate approved by the Traditional, Complementary and Functional Medicine Practices Department of the Ministry of Health after the training. The practitioner is also the first person in our country to be accepted to and graduated from the Master's Program of the Department of Music Therapy, which was established in 2021 with the approval of the Council of Higher Education under the leadership of Prof. Dr. Şükrü Torun at the Institute of Health Sciences at Anadolu University. In addition, the practitioner attended several courses organized by the Nordoff-Robbins Music Therapy Center and worked with Polish music therapist, Agnieszka Rynkiewich, for two semesters within the scope of the EU-supported UA project.

Group Music Therapy Implementation Process

Music is an elective lesson in high school. The curriculum is not inclusive for senior high school students. It is known that students have negative thoughts about this lesson, about which no questions are asked in the university entrance exam. In light of this information, the researchers tried to examine the question "How can senior high school students preparing for the exam process benefit from music outcomes based on their goals?". Based on this question, the main outlines of the study were developed in line with the question "Can the goal-oriented implementation of music-based outputs in the school environment reduce anxiety levels?". To this end, the researchers developed an eight-week program and implemented it to the music therapy group.

Table 1. Music Therapy Weekly Practice Plan

Session	Practice Contents
Week I	Presentation and Introductions (Consensus Process)
Week II	Process of practicing self-expression
Week III	Music-based biography and self-identification through music
Week IV	Verbal and rhythmic improvisation practice process for test anxiety
Week V	Anxiety-focused music-based imagery practice process
Week VI	Compositional practice process for test anxiety
Week VII	Improvisation-based confidence work and dampening process
Week VIII	Evaluation and closure process

Table 2.1. Music Therapy Group Detailed Session Plan

Session	Session Contents	Session Goals
Week I	It includes group music therapy practices for test anxiety.	Recognition of the group music therapy process, self-definition, emotional awareness, and sharing.
Week II	It includes group music therapy practices for test anxiety.	Increasing process-oriented immediate motivation and self-management skills.
Week III	It includes sessions on music, relationships, and music-based group interaction.	It was determined as obtaining therapeutic gains within the framework of music-based awareness and developing the competencies of evaluating and predicting the anxiety process with group work.
Week IV	It includes exercises on the traces that music and songs leave in our memories.	In developing predictions for test stress, it was determined as discovering the positive and negative effects of music and contributing to the process of developing insights to cope with test anxiety.
Week V	It includes group music therapy exercises on writing new lyrics to known songs (Lyricising).	Contributing to the process of developing insights to cope with test-related anxiety by writing lyrics and singing songs.
Week VI	It is an interactive MT application, from pictures to music. It includes practices on the realization of a therapeutic process through drawing a picture.	Recognizing the effect of the combination of painting and music on the way of predicting test anxiety and experiencing the competence of colors and music in test anxiety management.
Week VII	It includes music-based practices on self-esteem expression studies.	Music-based free improvisation studies on how to improve the mood-state relationship based on self-confidence for test anxiety.
Week VIII	It includes practices on damping and ending the process and transferring the gains to real life.	It was identified as a sharing for process evaluation and making connections to real life.

Music Lesson Process According to United Annual Plan

Music is an elective lesson in high school. The content to be taught at each grade level in this lesson is based on the United Annual Curriculum published by the Board of Education of the Ministry of National Education. The learning outcomes of the lesson are mainly focused on topics such as music theory, makam knowledge, and music culture. If the program is fully coved, it is obvious that it will make a great contribution to raising generations with deep musical culture and knowledge. However, as mentioned before, these lessons do not aim to reduce exam anxiety.

Table 2.2. Detailed Lesson Plan for the Music Lesson Group

Lesson	Lesson Content	Lesson Acquirements
Week I	General features of Turkish music from the 20th century to the present day were covered.	Students recognize the general characteristics of Turkish music. They recognize the composers of Turkish music.
Week II	A repertoire was created by listening to Turkish music.	Students develop an appreciation for the pieces of Turkish music. They listen to the works of Turkish music.
Week III	Musical pieces of Turkish music were performed.	Students recognize the works of Turkish music. They sing in Rast maqam and Hicazmakan.
Week IV	Students were enabled to associate folk music instruments from different parts of the world with Turkish music instruments.	Students distinguish the instruments. They recognize Turkish folk music instruments, traditional Balkan instruments, and traditional Middle Eastern instruments.
Week V	Students listened to examples of leading orchestra-choir conductors and their performances.	Students listen to choral pieces, orchestral pieces. They distinguish orchestral works. They recognize Hikmet Şimşek, Gürer Aykal, and Rengim Gökmen.
Week VI	Western music interpreters in our country were covered.	Students recognize the interpreters of polyphonic Turkish music. They recognize Leyla Gencer, İdil Biret, Suna Kan, Şirin Pancaroğlu, and Şefika Kutluer.
Week VII	Students practiced distinguishing according to the genres of the music played.	Students distinguish the pieces of Turkish music. They distinguish the pieces of Turkish folk music, polyphonic music, and the pieces of pop music.
Week VIII	The subject of conducting music-related research and studies using information technologies was covered.	Students search for musicians by using information technologies. They investigate the life stories of musicians by using information technologies.

Analysis of the Data

The study revealed the effects of group music therapy practices on test anxiety in senior high school students preparing for the YKS. As a result of the literature review, it has been seen that the Westside Test Anxiety Scale is a valid scale for measuring test anxiety, identifying change, and comparing data, and therefore it was used in the study. In this context, the pretest and posttest data collected using the Westside Test Anxiety Scale from two different groups who participated in group music therapy sessions and music lessons based on the curriculum for 8 weeks were analyzed using the IBM SPSS 25 program. In the analysis, primarily, the personal information of the MT and the ML groups were presented using descriptive analysis methods, and the differences between the groups were examined using independent samples t-test and chi-squared analysis methods. Then, the Kolmogorov-Smirnov normality test was performed to check whether the participant scores on the Westside Test Anxiety Scale showed normal distribution. This test measures the variation of the sample distribution from a normal distribution. As a result, the lower the D value, the higher the probability of a normal distribution of the data. The p-value quantifies this probability; a low probability indicates that the data

deviate from a normal distribution. Low D and high p (>0.05) values indicate that the data are normally distributed. In addition, the closer the skewness and kurtosis values are to zero, the higher the probability that the distribution is normal (Table 3).

Table 3. Normality Test Results (Summary of Kolmogorov-Smirnov Distribution)

Statistical Value	
Number (n)	49
Mean	36.87755
Median	36
StandardDeviation	5.692219
Skewness	-0.086037
Kurtosis	1.131959
Result	
K-S Test Statistics (D)	0.15373
p Value	0.17773

The results of the normality test show that the distribution is normal. In addition, the comparisons between the MT and ML groups were examined using the independent samples t-test, chi-square analysis, and factorial mixed design analysis of variance methods. Finally, the relationships between participants' personal information and test anxiety scores were examined using independent sample t-test and Pearson correlation analysis methods. The significance level was set at 0.05 in the analyses.

Results

Results of the Groups on Test Anxiety Levels Before Implementation and Interpretations

The pre-test and post-test findings regarding the students' test anxiety before and after the implementation are given below.

Table 4. Findings Regarding the Westside Test Anxiety Scale

Test anxiety	Group	N	Mean	SD	t	p
Pre-test	MT group	26	39.04	4.51	3.062	.004
	MD group	23	34.43	5.98		
	Total	49	36.88	5.69		
Post-test	MT group	26	32.92	5.44	-1.638	.108
	MD group	23	35.70	6.41		
	Total	49	34.22	6.01		

Table 4 shows the pre-test and post-test scores of the participants on the Westside Test Anxiety Scale. A high scale score indicates a high test anxiety level. According to the findings obtained from the pre-test, the mean test anxiety score of the participants in the MT group was 39.04 ± 4.51 . In the ML group, the mean pre-test test anxiety score was 34.43 ± 5.98 . According to the independent samples t-test, when the pre-implementation (pre-test) scores of the groups were compared, it was determined that the test anxiety score of the MT group was significantly higher than that of the ML group ($t = 3.062$, $p = .004$).

According to the post-test findings, the mean test anxiety score of the participants in the MT group was 32.92 ± 5.44 . In the ML group, the mean post-test test anxiety score was 35.70 ± 6.41 . According to the independent samples t-test, when the post-test scores of the groups were compared, no significant difference was found between the test anxiety scores of the MT and ML groups ($t = -1.638$, $p = .108$).

Findings and Interpretation Regarding the Test Anxiety Levels of the Groups After Implementation

Below are the results of the effects of music lessons and group music therapy practices, conducted according to the unified annual curriculum, on the test anxiety of senior high school students.

Table 5. Comparison of Percentage Frequencies of Participants' Test Anxiety Levels After the Procedure

Test Anxiety Levels	Pre-test				Post-test			
	MT group		ML group		MT group		ML group	
	f	%	f	%	f	%	f	%
Low	0	0	2	8.7	5	19.2	1	4.3
Moderate	16	61.5	16	69.6	20	76.9	16	69.6
High	10	38.5	5	21.7	1	3.8	6	26.1
	$\chi^2 = 3.496$, $p = .174$				$\chi^2 = 6.523$, $p = .038$			

According to the findings in Table 5, 61.5% of the MT group had moderate test anxiety and 38.5% had high test anxiety in the test anxiety pre-test. In the pre-test, 8.7% of the ML group had low test anxiety, 69.6% had moderate test anxiety, and 21.7% had high test anxiety. According to the chi-square test, no significant difference was determined between the pre-test test anxiety levels of the MT and ML groups ($\chi^2 = 3.496$, $p = .174$).

According to the post-test findings, 19.2% of the MT group had low test anxiety, 76.9% had moderate test anxiety, and 3.8% had high test anxiety. In the post-test, 4.3% of the ML group had low test anxiety, 69.6% had moderate test anxiety, and 26.1% had high test anxiety. According to the chi-square test, there was a significant difference between the test anxiety levels of the MT and ML groups in the post-test, ($\chi^2 = 6.523$, $p = .038$). Accordingly, it was determined that the participants in the observation group had a significantly higher test anxiety level than the participants in the experimental group.

The results of the comparison analysis, which was conducted to confirm that the groups differed significantly by reducing the error rate, are also presented below (Table 6).

Related to the Comparison of the Change in Test Anxiety Levels of the Groups Before and After the Procedure

Table 6. Comparison of Pre-Test and Post-Test Scores of Groups According to Factorial Mixed Design Analysis of Variance Method and Post-Hoc Test

Test anxiety	MT group		ML group		F	p
	Mean.	SD	Mean.	SD		
Pre-test	39.04	4.51	34.43	5.98	93.695	.001
Post-test	32.92	5.44	35.70	6.41		

Table 6 compares the pretest and posttest scores of participants in the MT and ML groups on the Westside Test Anxiety Scale. A factorial mixed design analysis of variance was used to make the comparison. In this analysis, the MT group and the ML group represent the 2-group independent variable, while the pretest and posttest mean represent repeated measures. According to the results obtained as a result of the analysis of variance, it was seen that the pretest and posttest scores in the study differed significantly according to the MT and ML groups, $F(1, 47) = 93.695$, $p < .001$.

The Bonferroni post hoc test was used to interpret the significant difference. When the graph in Figure 1 is analyzed according to the results of the post-hoc test, it is seen that the test anxiety post-test score of the MT participants in the experimental group decreased significantly compared to the pre-test ($p < .001$), while the test anxiety post-test score in the ML group increased significantly compared to the pre-test ($p = .028$) (Figure 1).

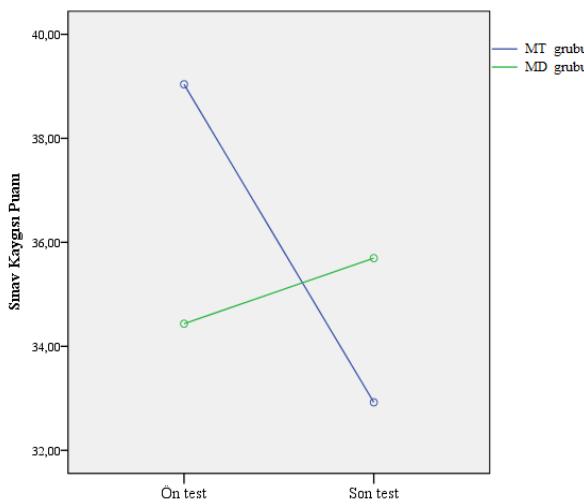


Figure 1. Comparison of Groups According to Pre-Test and Post-Test Scores

Discussion and Conclusion

In the study, the mean anxiety score of the MT group, which was 39.04 ± 4.51 at the beginning, significantly decreased to 32.92 ± 5.44 . In the ML group, the mean anxiety score, which was 34.43 ± 5.98 before the implementation, increased to 35.70 ± 6.4 after music lessons. Due to this reverse change in anxiety scores, it is natural that there was no significant difference between the anxiety levels of the two groups at the end of the intervention. While there was a slight increase -rather than a decrease- in the anxiety level in the ML group who received music lessons according to the annual plan, a significant decrease was observed in the group who received music therapy. It is thought that this finding shows the effectiveness of group music therapy implemented on high school seniors in reducing test anxiety.

The increase in anxiety in the ML group can be explained by the increase in negative emotions related to the exam in parallel with the passage of time and the fact that the music lessons had no preventive effect on this increase. On the other hand, the anxiety-reducing effect of the group music therapy sessions structured within the framework of the neurocreative music therapy approach, in accordance with the goal of reducing test anxiety through the use of music and music components, is clearly seen. This positive change can only be explained by the effect of group music therapy, given the similarities in the other characteristics of the groups.

In the evaluation interviews conducted after the eight-week music therapy intervention, the students in the MT group stated that they had a very constructive process toward the YKS exam, that their self-motivation for the exam was strengthened, that being able to express themselves through music strengthened their sense of achievement, that their musical culture developed through peer interaction during the group music therapy sessions, and that they realized that they had the same concerns as their peers, which contributed to their sense of empathy. On the other hand, the students who took music classes only according to the unified annual plan stated that the outcomes of this course were difficult for the senior class and that the academic outcomes of the music course, which is a cultural course, were challenging for the students who were preparing for the exam, that the student's expectations of the course did not match the outcomes, and that the learning outcomes of the course were not fully achieved for the students, that the student's expectations for the course did not match the outcomes and that the learning outcomes of the course were not fully achieved for the students, and that in general, the students could not concentrate during class because they wanted to study for the exam, so they were in the act of constantly experiencing anxiety and excitement. This information is consistent with the Westside Test Anxiety Scale scores.

In the literature, there are mostly studies that measure the anxiety related to the examination processes of student groups studying at the university level. In the studies of authors such as Bodas et al. (2008), Güler and Çakır (2013), Kavakçı et al. (2011), Piji Küçük (2010), it is seen that different inventories such as State Anxiety Inventory, Test Anxiety Inventory, Depression Inventory, Self-Esteem Inventory are used and these studies include relational data to determine students' test anxiety levels and psychological effects of anxiety. The results of the studies indicate that test anxiety triggers depression and that variables such as family and gender affect anxiety. It can be said that these studies differ from our study in many aspects in terms of purpose, design, scales used, methods, study group characteristics, and of course, results. In this context, while addressing the studies that appear to be related to the subject in the literature, it is seen that the literature gap regarding the possible role of music-based approaches in reducing test anxiety is at a remarkable level. In our study, a process focused on self-awareness and self-regulation within the framework of music interactions on how to cope with test anxiety was carried out and the data obtained through the Westside Test Anxiety Scale are presented. It is observed that other studies do not address how to provide self-control for anxiety management. Although the utilized scales vary, it is possible to come across studies that measure the level of test anxiety using the Westside. Doğan's (2020) research is a study that should be evaluated in this context. The results of this study, which was conducted on 675 students, indicate that the anxiety level of university students is higher than that of high school students and that anxiety increases with age. In this respect, Doğan's study differs from our study. While this study examined how test anxiety changed between two groups before and after the application, Doğan's study aimed to identify the group with high test anxiety rate between groups.

Again, it is seen that the Westside Anxiety Scale was used in the studies of Küçük (2010), Taşkın and Çetin (2021), Yücel et al. (2019). However, it can be seen that these studies were not specifically addressed in the context of a purposeful structured application, and the relationship between the pre-test and post-test was not investigated. Küçük (2010), on the other hand, examined the effect of test anxiety experienced by music department students on instrumental performance in performance exams. In this study, it is seen that the measurements were made immediately before the exam, it was not based on practices that would support the students motivationally, and the data were collected more on the axis of the anxiety-performance relationship. Yücel et al. (2019) conducted their research from the perspective of "investigating the exam anxiety status of individuals who receive music education" for students who are studying at Fine Arts High School. In this study, it can be seen that the pre-test and post-test models were not used, the measurements were made at an unspecified time interval, it was not clearly determined on which axis the measurement was based, and the motivation of the students was not supported. As can be seen from these examples, these studies did not focus on the effects of an intervention on test anxiety, but rather on determining the situation of high school students with regard to the exam. However, there are also studies in the literature on motivational support for students preparing for university entrance exams and students who experience test anxiety in other areas using various methods. The study of Koruklu Öner et al. (2006) is in this direction. In the study, which included a group of 60 students divided into experimental and control groups, the "Coping with Test Anxiety Program" was applied to the experimental group for eight weeks, and Automatic Thinking and State Anxiety Inventories were used as pre-test and post-test. As a result, the data showed that the program was beneficial. As can be seen, it is not possible to talk about music-based application processes in these studies. In addition, there is no goal that it provides sustained anxiety management through group practice. In the literature on test anxiety and music therapy, Akbulut and Taşçı (2019) conducted a study that examined the effectiveness of music-based practices for state conservatory students just before their exams. In this study, it is not clear what data was collected about the students before or after the exam, but it is observed that they determined the data through a self-developed questionnaire and that the application was more related to the state anxiety process. Nevertheless, results show that this research reveals a crucial process in developing a student's internal control through music-supported practices. Based on this idea, it was thought that specially designed group music therapy applications in our research would contribute more to the

motivational devices that can be developed for high school students' test anxiety and the prediction of their own anxiety processes. To the best of our knowledge, there is no other study in the Turkish literature that is similar to the structure of our study, which consists of a combination of group music therapy and test anxiety designed according to the principles of music therapy in education.

In reviewing the international literature on test anxiety, Ergene's the meta-analysis study published in 2003 is noteworthy. In this study, which analyzed 56 studies with a large number of participants (2480), results showed that 75% of the participants who were involved in some kind of support process for test anxiety achieved positive results compared to those who did not receive support. In other words, according to the results of the meta-analysis, individualized and goal-oriented intervention processes reduce test anxiety. In addition, Ergene states that based on the results, there is a serious lack of research and practice on test anxiety reduction programs for these student groups, although programs that combine individual and group counseling formats produce significant changes in primary and secondary school students. These results and comments are considered important because they contain a supportive emphasis that overlaps with the purpose, quality, and outcome of our research.

In 2013, Jiang, et al. (2013) worked with 144 undergraduate music students. Their study examined the effect of playing calming music on individuals who were experiencing anxiety. The participants were randomly divided into four different experimental groups. The groups were as follows. Group 1 were those who chose the soothing music themselves, Group 2 were those who chose the highly stimulating music themselves, Group 3 were those who had no right to choose the soothing music (the music they listened to was chosen by the researchers), Group 4 were those who had no right to choose the highly stimulating music (the music they listened to was chosen by the researchers). Before the research, the individuals' tension was measured with the anxiety scale, and the same test was applied again after the research. As a result, it was revealed that there was a decrease in the state anxiety level of the subjects who listened to calming music without the right of choice, but there was no significant difference in the state anxiety level between listening to calming music and listening to stimulating music. These striking results are consistent with the idea that high school students determine the music they listen to through peer and environmental interactions and that anxiety levels increase when they do not make sense of the music they listen to.

Again, according to the results of another study conducted by Jiang et al. (2016) with 200 participants in 2016, it is emphasized that the effect of music in reducing anxiety depends on the music preference and the most important factor in reducing anxiety is determining the degree of enjoyment of the music listened to. In both of the Jiang et al. studies, it was found that liking/enjoyment of the music being listened to affected anxiety levels more than recognition. During the music-based interaction and communication-based sessions of our study, it was observed that students enjoyed the applications and were, therefore, more willing to express themselves through music, and that this process was effective in developing insight into test anxiety and minimizing test anxiety by motivating themselves through music. Results showed that during the structured group music therapy sessions included in our research, participants were exposed to different music and performed music-based practices with it, which allowed for a decrease in anxiety levels.

Galal et al. (2021) conducted an experimental pilot study on the effectiveness of music intervention in reducing test anxiety with approximately 200 undergraduate students. The study is described as an "evaluation of the effectiveness of a brief classroom activity involving music on anxiety". Randomly assigned students were divided into music-playing and music-listening groups. Pre- and post-test assessments of attitude, perception, and anxiety scales were administered to all students. In this respect, the study is parallel to our research. In addition, the results obtained from the music intervention sessions of Galal et al. indicate that the effect of music-playing groups and music-listening groups on students' test anxiety does not create a significant difference. Another unexpected result from this study is that test anxiety was high before the music intervention and decreased after the session. The researchers state that even a short-term music intervention process helps reduce state test

anxiety. Although the results of the study overlap with our study, Galal et al.'s study was conducted with state anxiety scales and included a single and short-term session process. Our study, on the other hand, was not instantaneous, lasted for eight weeks, and focused on measuring process-oriented test anxiety levels in the music therapy group and the curriculum music class group and determining the extent to which intrinsic motivational devices for test anxiety could be strengthened with group music therapy. Therefore, although our results do not fully overlap with the pattern of results obtained by Galal et al., they converge in the conclusion that music-based approaches are effective in reducing test anxiety.

Liu and Li (2023) conducted their research with 240 undergraduate students. The students were randomly assigned to control and experimental groups. The experimental group participated in 24 group music therapy sessions three times a week for a total of 2 months. Each therapy session was divided into five parts: 1-warm-up/initiation, 2-rhythmic percussion and instrumental ensemble, 3-singing, 4-conclusion/closure, and 5-evaluation. While there was no significant difference in the anxiety scores of the control and experimental groups before the research, it was observed that a highly significant difference occurred in the anxiety scores of the experimental and control groups after the intervention. The results of the research suggest that music therapy interventions significantly reduce students' anxiety processes and that goal-oriented music therapy sessions have a positive effect on school/test anxiety processes and improve students' quality of life. The results of Liu and Li's study overlap with the results of our study. However, our study was conducted with a limited group of students, and it is believed that research results with more intensive participation are needed.

There is only one study in international literature that is considered similar to our study. This study was introduced to the literature by Sharafati et al. in 2022. In their study, they aimed to determine the effectiveness of music therapy applications based on pre-test and post-test scores in the process of reducing test anxiety in about 30 secondary school students randomly divided into experimental and control groups. As in our study, a single test anxiety scale was administered to the research groups. In their study, 15 students in the experimental group received 90-minute group music therapy sessions for eight weeks. In our study, eight music therapy sessions of 40 minutes each were organized for 26 students. The results were analyzed using the SPSS program and analysis of variance as in our study. The results of the Sharafati et al. study suggest that goal-oriented group music therapy processes significantly reduce test anxiety scores of secondary school students. In our study, the same result was obtained for high school students. Although the fact that our study did not include a control group with no music interaction seems to be a limitation, it is noteworthy to compare and examine the changes in test anxiety levels of the groups that experienced two different music-based interactions. In our study, while test anxiety scores decreased in the music therapy group, anxiety increased in the curriculum-based music instruction group. It can be seen that Sharafati et al. did not clearly state the setting in which the goal-directed group music therapy sessions were conducted and how the application provided internal control and motivation for test anxiety. While in our study there was a single age scale and a specific exam focus such as the YKS, the distribution in Sharafati et al.'s study addresses all groups of secondary school students between the ages of 12-18 and all school exams. In this respect, it is not clear how the intervention reduces test anxiety holistically and how long this process lasts. While the processing of the research suggests a reduction in state test anxiety, the presentation of the research data points in the direction of a reduction in process-oriented test anxiety. It is considered a shortcoming that the researchers did not discuss their studies with this aspect in mind. In this regard, it is believed that our research addresses the relationship between test anxiety and music therapy in a cause-and-effect relationship and will contribute to the literature in an "eclectic, empirical, and generalized" line.

Recommendations

It is thought that group music therapy strengthened the motivational devices of senior high school students to cope with their test anxiety and contributed to the development of their internal control to affirm test anxiety on the basis of music. It may be recommended that such studies be conducted more comprehensively in Anatolian and Science high schools, religious vocational high schools, and other vocational high schools that accept students based on exam results.

Considering the insufficiency of studies on music therapy in the school environment (in education) in the literature, it is thought that this study will provide a pioneering resource for researchers who want to conduct new studies in this field.

The fact that the participants of the study consisted of a small number of high school students from a particular school is considered a limitation. It is believed that studies conducted with larger samples of students who study in different schools and better represent the sociocultural diversity of society will provide more reliable results.

For future studies, it may be recommended to compare music therapy interventions with other specific interventions structured to reduce test anxiety rather than typical music lessons.

The challenging aspects of the research include the facts that some session contents needed to be developed, that the research was conducted over a long period such as eight weeks, that the practice was carried out with a relatively large group, and that the process was carried out by only one researcher. It is thought that there is a need for overall data from future studies to be conducted by more than one researcher, at different times, in shorter periods, and with fewer participants to contribute to the literature on the subject in a multidimensional way.

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Teacher attrition: why do teachers leave the profession? *

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Abstract

Although the teaching profession is generally regarded as being a respected, even “sacred”, career in many societies, there is no doubt that it is also highly demanding and challenging. The difficulties involved in teaching are causing a significant number of teachers worldwide to either leave, or consider leaving, the profession. Teachers resigning before reaching retirement, but after having taught for at least one year, is called ‘teacher attrition’. These high numbers of resigning teachers is having profound implications, including financial costs, human resource challenges, and disruptions to learning and instruction, making a comprehensive examination of the phenomenon essential. The aim of this study is to contribute to this examination by exploring how teachers who have left and in-service teachers perceive the reasons of teacher attrition. The study also investigates when teacher attrition occurs and leavers’ career trajectories after leaving teaching. By employing a phenomenological research design, the study considers 27 leavers and 15 in-service teachers, selected through snowball and maximum variation sampling methods. Data was collected via semi-structured interviews developed by the researchers. Content analysis revealed three primary themes within the reasons of teacher attrition: (a) pre-service education, (b) work-life experiences, and (c) career dissatisfaction and alternative opportunities. Key triggers of attrition included the quality of pre-service education, the lack of mentorship, relationships with administrators and colleagues, excessive workload, the status of the teaching profession, low salaries with insufficient compensation, and alternative job opportunities. The results also indicated that attrition is most prominent in the first three years of teaching, but gradually declines as teachers approach retirement. Furthermore, the results showed that many leavers transition to other careers, both within and outside the education sector, while others exit the workforce entirely.

Keywords

Teacher attrition

Leaving teachers

Reasons of teacher attrition

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Introduction

In the industrial age, the teaching profession was celebrated as a “secure, life-long” career path (Dwyer & Wyn, 2001) upon which teachers were expected to remain until retirement. However, the perception of teaching has changed dramatically during recent decades due to increasing levels of stress and inadequate compensation until, for some, teaching has become perceived as a form of “emotional labor” (Johnson et al., 2005) that is akin to other extremely stressful and challenging care related professions. As a result, significant numbers of teachers have resigned, while many others are considering resignation (Grissmer & Kirby, 1987; Harmsen et al., 2018).

The increasing global rates of teacher attrition, the process of teachers voluntarily leaving the profession (Kelchtermans, 2017) after working in a school for at least a year and before reaching retirement has become a serious concern in recent decades (Den Brok et al., 2017; Ingwersoll, 2001). For example, almost 50% of teachers in the United States (Ingwersoll, 2003), and around 25% in Belgium and Australia, leave teaching within the first five years (Australian Government Productivity Commission, 2012, as cited in Harmsen et al., 2018). Furthermore, the recent COVID-19 pandemic has increased rates of teacher burnout and reduced career satisfaction, thus exacerbating global attrition rates still further (Bastian & Fuller, 2023; Koerber et al., 2023). Global surveys revealed that 90% of teachers in the United States have experienced burnout at some point in their careers (National Education Association [NEA], 2022a), and that nearly 600,000 teachers left the profession during 2021-2022 during COVID-19 (NEA, 2022b).

Statistics relating to teacher attrition in some areas of the globe are well-documented, but the extent of teacher attrition in Türkiye remains largely unknown due to the limited nature of official national data. While the Ministry of National Education (MoNE) does announce the number of teachers who leave public schools due to retirement, resignation, and miscellaneous reasons, including death or career changes, (according to official data, 1,632 teachers left public schools in 2020; 2,030 in 2021, 1,654 in 2022; and 2,772 in 2023 for reasons other than retirement (MoNE, 2021, 2022, 2023, 2024)), these figures only relate to public school teachers. As the figures do not include private school or contracted teachers, it is difficult to determine the full extent of teacher attrition in Türkiye. That said, and despite the lack of comprehensive national data, it is widely acknowledged that there is profound teacher dissatisfaction in Türkiye. A nationwide survey revealed that 70% of teachers would consider leaving the profession if they were to find alternative better paid employment (Eğitim-Sen, 2018). This figure only confirms how teacher attrition is as at least as much a growing risk in Türkiye as it is in other countries. The importance of examining the phenomenon is clearly expressed in an analogy used by Merrow (1999): “The teaching pool keeps losing water because no one is paying attention to the leak”. Clearly, it would be a mistake to imagine that, just because there is a lack of national data, the situation is not a cause for concern in Türkiye. Although educational faculties in Türkiye do produce a steady supply of new teachers, persistent teacher shortages in many regions, combined with the loss of experienced teachers due to attrition, are having a negative impact on instructional quality, school stability, students’ learning experiences, and learning outcomes, particularly in disadvantaged schools (Ronfeldt et al., 2013).

There are multiple and serious repercussions to teacher attrition, including financial costs and disruptions to the school and to learning in general. It is estimated in the United States that it costs an estimated \$20,000 to replace every teacher that voluntarily leaves before retirement (Carver-Thomas & Darling-Hammond, 2019). In addition to financial costs, there are the inevitable human costs of teacher attrition in terms of the time and resources that was allocated to teachers during pre-service education and in-service training going to waste (Manuel, 2003). Teacher attrition also is an unavoidable cause of disruption to students’ learning (Ingwersoll & Smith, 2003; Kini & Podolsky, 2016) with students becoming “more likely to be taught by inexperienced and ineffective teachers” (Miller & Chait, 2008, p. 10). This is particularly the case in economically disadvantaged areas (Ronfeldt et al., 2013). Other important factors include high attrition rates harming collaboration among teachers (Guinn, 2004) and disrupting the stability (Ronfeldt et al., 2013) and culture of the school (Kelchtermans, 2017).

There are several frameworks/models in the literature, which provide valuable insights into the complex array of influences on teacher attrition. For example, Chapman's (1983) "social learning theory", based on "social learning theory" and Krumboltz's (1979) "career decision-making theory", outlines factors which impact whether teachers decide to remain the profession or not, including "educational preparation, initial teaching experiences, and professional integration". Another study by Clandinin et al. (2015) distinguished the factors that influence teacher attrition in terms of the individual and contextual dimensions. Some of the individual factors identified in the study include burnout, resilience, and demographic features, while contextual factors include elements such as salary, professional development opportunities, and collaboration among colleagues. Studies by Glazer (2018), as well as Vagi and Pivovarova (2016), categorized previous research based on theoretical approaches and highlighted organizational theories that focus on the fit between educators and their workplaces, rational choice theories that emphasize individual decision-making, and self-efficacy theories that underscore feelings of competence. Finally, Mason and Poyatos Matas (2015) suggest a more theoretically informed framework and presented a new model, which incorporated elements of "human capital, social capital, structural capital, and positive psychological capital theories" (p.58).

The research available, which explore the reasons of teacher attrition, predominantly focus on individual influences (e.g. initial motivation to teach, beliefs about self-efficacy and teacher training background) and contextual influences (e.g. school environment, leadership and support, financial incentives and organizational culture). In this context, such studies highlight the critical role of pre-service education (Ingersoll et al., 2014); namely, the effectiveness of teaching practicum, the availability and quality of courses related to teaching methods, pedagogical knowledge during pre-service education, the route to entering the profession; whether by earning a degree from a faculty of education or through alternative certification programs (Carver-Thomas & Darling-Hammond, 2019).

Another important determinant highlighted by the available research is the quality of teaching experience, particularly during the first few years of a teacher's career. Numerous studies emphasize that the lack of support and mentoring that teachers receive from colleagues and administrators has a crucial influence on attrition (e.g. Brown, 2001; Freedman & Appleman, 2009; Zhang & Zeller, 2016), and that difficulties regarding classroom management and the lower self-efficacy beliefs of teachers can also impact attrition (Lindqvist & Nordänger, 2016; Mason, 2017).

Available research studies also emphasize the pivotal role of working conditions. These are related to multiple factors such as negative organizational culture, strained relationships with other teachers and school administrators (Grayson & Alvarez, 2008), insufficient salaries (e.g. Hahs-Vaughn & Scherff, 2008; Johnson & Kardos, 2008; Solomonson et al., 2018), and excessive workload (e.g. Schaefer et al., 2012; Solomonson et al., 2018; Welch et al., 2017), all of which were identified as major contributors to teacher attrition. Other significant influencers of attrition include societal perception of the teaching profession and its overall status, (e.g. Schleicher, 2019a; Welch et al., 2017), and the availability of alternative career options. (With, 2017).

In terms of demographics, previous studies indicate mixed findings regarding gender (e.g. Borman & Maritza Dowling, 2008; Guarino et al., 2006; Wushishi & Baba, 2016) and civil status (e.g. Borman & Maritza Dowling, 2008; Schaefer et al., 2012). However, they underscore that younger teachers are more likely to quit the profession compared to their older counterparts (Ingersoll, 2001). Literature also indicates that teachers with lower self-efficacy beliefs and reduced self-confidence are more prone to leaving as they have more difficulties coping with professional difficulties (Mason, 2017).

Regarding the timing of attrition, the literature consistently indicates that the most teachers exit the profession within the first five years of their careers. Numerous studies argue that the attrition rate is the highest early in the career, and that it decreases mid-career, only to increase again toward retirement (e.g., Glazer, 2018; Hancock & Scherff, 2010; Solomonson et al., 2018). Huberman (1989) suggested that examining teachers' professional lives can provide insights regarding their experiences. *The Professional Life Cycles of Teachers* (Huberman, 1989) framework provides teachers, researchers, administrators and policymakers with important data regarding why certain teachers' experiences lead to attrition. Huberman (1989) suggests that teachers may go through several phases during their career, such as "survival/discovery", "stabilization", "experimentation/reassessment", "serenity/conservatism", and "disengagement". He argues that although these phases are descriptive and common, different teachers may experience them at different times, or there might be certain phases where they do not experience them at all. Huberman's (1989) framework of these critical phrases not only provides significant insights regarding why teachers chose to exit the profession, but also enables the determination of targeted interventions and support to potentially reduce attrition.

In regards to the subsequent career paths of leavers, although a limited number of studies have been conducted, findings reveal diverse trajectories; while many leavers continue to work within the educational sector (e.g. librarian, university instructor), others prefer to leave the sector entirely (e.g. manager, sales, service sector) (Mawhinney & Rinke, 2018). Furthermore, some studies also found these leavers are more satisfied in their new careers (Goldring et al., 2014; Howes & Goodman-Delahunty, 2014), and that there was no incentive that would make them return to the profession (Buchanan, 2012).

The literature review of teacher attrition located few studies conducted in Türkiye. While the majority of studies focus on teachers' job satisfaction, burnout, challenges, or intention to leave, there are only a limited number of studies, which have specifically investigated teacher attrition. One such was a recent study by Çakır et al. (2024), which examined the reasons behind attrition among private school teachers in Türkiye. The researchers interviewed nine teachers who have left, or intended to leave, and found that the main reasons for attrition among the private school teachers surveyed were a heavy workload and low income. Another study by Keçeci and Kesinkılıç Kara (2023), which focuses on the influences of teacher attrition, found that three main factors were contributing to attrition: "economic reasons" (e.g. insufficient salary, delayed salary payments, lack of compensation), "personal and environmental reasons" (e.g. lack of personal and family time, intense stress, childcare responsibilities), and "organizational reasons" (e.g. collegial relationships, job insecurity, negative attitude of administrators, and excessive bureaucratic tasks). A further study conducted with English language teachers in Türkiye similarly found that alternative job opportunities, unfavorable working conditions, insufficient salary, and inadequate administrative support, were all significant contributors to attrition (Yastibaş et al., 2022).

An examination of the previous studies indicates that the perspectives of teachers who have left the profession are underrepresented in the literature. This is because they are no longer part of the school system and their whereabouts are often unknown (Karsenti & Collin, 2013; Mawhinney & Rinke, 2018). Investigating such perspectives and experiences is crucial as it can offer valuable insights into the phenomenon of teacher attrition and provide researchers, professionals, and policymakers with a more comprehensive understanding of various dimensions of the teaching profession.

With full consideration of all of the above, the aim of this study was to explore teacher attrition and answer the following research questions:

1. Why do teachers leave the profession before their retirement, as perceived by the leavers themselves, and in-service teachers?
2. Based on Huberman's (1989) classification of the professional life cycle of teachers, in which phase do teachers most frequently leave the profession?
3. What are leavers' next possible career paths?

Method

Research Method

A phenomenological research (Cohen et al., 2018) approach was chosen for the study as it was the best method of exploring the meaning of participants' individual experiences (Creswell, 2007) and gaining insight into, and describing, the commonalities that different people perceive in similar experiences (Bogdan & Biklen, 2007; Fraenkel et al., 2012). This decision aligns with Moustakas' (1994) suggestion that phenomenological studies are most appropriate when the goal is to fully assess the shared experiences of multiple individuals regarding a phenomenon. The overall aim of this study was to investigate the scarcely studied phenomenon of teacher attrition in Türkiye, and to explore the unique experiences of participants and their perceptions of teacher attrition. Therefore, instead of focusing on a few specific aspects of the issue, it was determined that the complex nature of teacher attrition could be better explored through a phenomenological approach.

Participants of the Study

Study participants comprised of two groups: leaving teachers who had voluntarily left the teaching profession after having taught for at least one year, and the in-service teachers who were still actively teaching in schools that had experienced teacher attrition. Several strategies were employed to contact potential participants who were deemed to be able to provide useful information on the research questions. First of all, both of the researchers have a background in education, with one already being acquainted with a number of leavers and in-service teachers. A strategy was to use the social media platform X (formerly known as Twitter) to enable researchers to identify multiple leavers and in-service teachers. X is useful as many experiences are shared on social media, and there are numerous news sharing and announcement accounts related to the teaching profession. The third strategy utilized was that participants were kindly requested during the data collection process to suggest other leavers or in-service teachers who might be interested in participating in the study.

Snowball sampling and maximum variation sampling methods were employed in conjunction with these strategies. The aim of maximum variation sampling was to ensure diversity among participants in terms of gender, age, routes into teaching, school type, subject area, grade level taught, teaching experience, and geographical region. This approach helped to enrich the data and mitigate the potential limitations of the snowball sampling method. The use of the snowball sampling method is particularly valuable in reaching leavers who are often "out of touch" (Karsenti & Collin, 2013, p. 143) and therefore a challenge to locate.

Data was collected for the current study until data saturation was achieved (Marshall & Rossman, 2016). This resulted in the formation of diverse group of participants consisting of 27 leavers and 15 in-service teachers. Table 1 and Table 2 profile the leaving teachers and in-service teachers who participated in the study, respectively.

Table 1. Profiles of the Leaving Teachers in the Study

Participant	Gender	Age	Pathway into the profession	Teaching Experience	Subject Area	School Type
L1	Female	30	Faculty of Ed.	3	English Language	Private
L2	Female	26	Faculty of Ed.	2	English Language	Private
L3	Female	32	Faculty of Ed.	2	English Language	Private
L4	Male	29	Faculty of Ed.	2	Science	Public
L5	Female	33	Pedag. form.	4	Religious Culture	Public
L6	Female	29	Faculty of Ed.	6	Pre-school	Public
L7	Female	28	Faculty of Ed.	2	English Language	Private
L8	Female	31	Faculty of Ed.	6	English Language	Private
L9	Male	28	Faculty of Ed.	3	Social sciences	Public
L10	Male	31	Faculty of Ed.	2	Mathematics	Public
L11	Female	24	Pedag. form.	1	Music	Private
L12	Female	30	Pedag. form.	6	Mathematics	Public
L13	Female	29	Faculty of Ed.	8	Pre-school	Private
L14	Female	45	Pedag. form.	18	History	Private
L15	Male	59	Pedag. form.	32	Physical Ed.	Public
L16	Female	42	Pedag. form.	6	Mathematics	Private
L17	Male	30	Faculty of Ed.	3	Computer Tech	Private
L18	Male	31	Faculty of Ed.	1	Mathematics	Public
L19	Female	48	Pedag. form.	4	English Language	Private
L20	Female	45	Pedag. form.	1	English Language	Private
L21	Male	30	Faculty of Ed.	1	English Language	Private
L22	Female	36	Faculty of Ed.	15	Physics	Private
L23	Male	39	Pedag. form.	6	Mathematics	Private
L24	Female	33	Faculty of Ed.	6	English Language	Public & Private
L25	Female	26	Pedag. form.	1	English Language	Private
L26	Female	36	Faculty of Ed.	9	Pre-school	Public
L27	Female	47	Faculty of Ed.	3	English Language	Private

In terms of the characteristics of the teachers who had left the profession, 19 were female and eight were male. 17 had graduated from faculties of education, while 10 had completed a pedagogical formation teaching certificate program³. The teaching experience of the group ranged from one to 32 years. In terms of employment history, 17 had worked in private schools, nine had worked in public schools, while one had experience in both public and private schools. The initial commitment to the teaching profession varied significantly among leavers. While many expressed strong intrinsic motivation, describing teaching as their "childhood dream" or a lifelong aspiration, others had not been so personally inspired to enter the profession. Several participants cited the influence of teachers in the family, stating that they were encouraged or inspired by their relatives' experiences. Among those who had completed pedagogical formation programs, a few had done so because of a genuine interest in teaching, whereas others had chosen a teaching career primarily due to external influences, such as their parental pressure.

³ These are alternative certification programs that university graduates outside faculties of education must successfully complete in order to qualify as teachers.

Table 2. Profile of the In-service Teachers in the Study

Participant	Gender	Age	Pathway into the profession	Teaching Experience	Subject Area	School Type
T1	Female	27	Faculty of Ed.	4	English Language	Private
T2	Female	38	Faculty of Ed.	18	Pre-school	Public
T3	Male	42	Faculty of Ed.	21	Physics	Public
T4	Female	26	Faculty of Ed.	5	English Language	Private
T5	Male	30	Faculty of Ed.	4	Mathematics	Public
T6	Male	32	Pedag. form.	7	Physical Ed.	Public
T7	Male	27	Faculty of Ed.	1.5	English Language	Public
T8	Female	25	Faculty of Ed.	1.5	English Language	Public
T9	Male	25	Faculty of Ed.	1	Turkish Language	Public
T10	Female	44	Pedag. form.	16	Physics	Private
T11	Female	41	Faculty of Ed.	17	Elementary	Private
T12	Female	46	Faculty of Ed.	23	Pre-school	Public
T13	Male	38	Faculty of Ed.	7	English Language	Private
T14	Female	50	Faculty of Ed.	24	Chemistry	Private
T15	Female	46	Pedag. form.	13	Pre-school	Public

Among the 15 in-service teachers who participated in the study, nine were female and six were male. Twelve had graduated from faculties of education, while the remaining three had completed a pedagogical formation teaching certificate program. The teaching experience of the group ranged from one to 24 years. In terms of employment history, six were working in private schools and nine in public schools. As with the teachers who had left, the in-service teachers also had diverse motivations for entering the profession. Many were initially passionate about teaching and viewed it as a meaningful career choice, which had often been inspired by personal experiences or influential teachers from their own education. However, some participants admitted that they had never seriously considered teaching and, in some cases, had even disrespected the profession before entering it. Despite this, the majority of these individuals reported that they had since developed a deep appreciation for teaching.

Data Collection and Analysis

The data in this phenomenological study was collected from leaving teachers and in-service teachers via two separate semi-structured interviews in order to obtain in-depth information on participants' perceptions and experiences of teacher attrition. The use of semi-structured interviews (interview guide approach) (Patton, 2014) was invaluable in this study because it enabled the researchers to build up a complete picture of the participants.

The guidelines of Cohen et al. (2018) were followed in the preparation of the interview schedules. The research questions and literature review were used to formulate the interview questions and ensure that they were open-ended and clearly stated. During the formulation of questions, complex vocabulary, double-barreled questions, and speculative inquiries were avoided (Arksey & Knight, 1999). The interview schedules were then reviewed by three experts in educational sciences, as well as by a leaving teacher who was also a doctoral candidate in the field. Minor suggestions regarding the flow, readability, clarity, and comprehensibility of the questions were provided by experts, and necessary revisions were made accordingly. An example of a revision is the question "Did you choose to become a teacher willingly?" being revised to "Can you please explain your reasons for choosing the teaching profession?" to elicit more detailed responses. Similarly, initial questions such as "What is your most recent educational degree?", "Which university and department did you graduate from?", and "When did you graduate from the university?" were, following expert recommendations, consolidated into a broader question: "Can you briefly talk about your educational background?".

To finalize the interview schedules, one pilot study with a leaving teacher and one with an in-service teacher were conducted to assess their suitability. Each pilot interview lasted approximately 60 minutes. The results of the pilot studies confirmed that the interview schedules were clear and appropriate for the collection of in-depth data, and so no further modifications were needed. The next stage was to obtain the approval of the Middle East Technical University Human Subjects Ethics Committee (Protocol no. 338-ODTU-2021).

The final versions of the interview schedules consisted of six demographic and 14 open-ended questions for leavers and five demographic and 10 open-ended questions for in-service teachers. The demographic section comprised of questions related to the participants' gender, age, educational background, teaching experience, subject area, grade level taught, school type, employment status, geographical region, and current career (for leavers). The open-ended questions explored various aspects of teaching experience gained (e.g. entering the profession, challenges faced, mentorship received, relationships with colleagues and administrators, working conditions, workload, and leaving/intention to leave the profession).

To initiate data collection, participants were contacted via phone or e-mail to schedule individual interviews. Due to the COVID-19 pandemic and the logistical challenges of travelling to multiple cities, most interviews were conducted via online video calls using online platforms such as Skype, Zoom, or WhatsApp. Only a few interviews were conducted in person when a participant's preferred interview location was near one of the researchers. At the beginning of the interviews, consent was obtained from participants for audio-recording before they were informed of the purpose of the study, the estimated duration of the interview, and that their responses and personal information were confidential. The interviews lasted for around 60 minutes.

Content analysis, which involved organization of large amounts of text into smaller categories derived from theoretical frameworks (Cohen et al., 2018; Patton, 2014), was used to analyze the interview data. This study followed an "inductive content analysis" approach (Elo & Kyngäs, 2008), which allowed themes to emerge from participants' narratives, rather than being predetermined by an existing framework. Before beginning the analysis, all interviews were manually transcribed by one of the researchers to ensure the data could be thoroughly examined. Two transcripts, one from a leaver and one from an in-service teacher, were selected based on their representativeness and richness. These transcripts were reviewed by three experts in the field to ensure consistency in coding and categorization as part of the inter-coder reliability process. Analysis of the remaining transcripts was conducted after 96-99% agreement had been achieved.

A structured approach was used in the coding process. This approach began with open coding, which included a thorough word-by-word examination of the transcripts and the assigning of codes to meaningful or relevant words or sentences. The next stage was the creation of MS Excel sheets upon which the codes were transferred. This was followed by axial coding in which "certain words, phrases, patterns of behavior, subjects' ways of thinking, and events that repeat and/or stand out" were identified as categories (Bogdan & Biklen, 2007, p. 173; Gibbs, 2007, p. 50). The final stage was the identification of themes based on the relevancies and connections among categories.

As with any research, this study has certain limitations. One key limitation relates to participant inclusion using the snowball sampling method, which carries the risk of a lack of diversity in the selection of participants. Leaving teachers are a highly specific group who are difficult to access since they are no longer in the school context, and their career trajectories are often unknown. As a consequence, the number of participants in this study was limited, and relying on referrals may have influenced the diversity of perspectives. However, as pointed out by Noy (2008), sequential sampling can introduce variation with the adding of new participants. Another limitation is that leavers and in-service teachers in this study did not work in the same schools, which meant that the findings do not capture shared experiences within the same school environment. If teachers from the same schools had

been compared, this could have provided deeper insights into how specific school conditions and environments influence attrition and retention.

The trustworthiness of this study was ensured by utilizing multiple strategies based on the criteria of Guba and Lincoln (1982). In order to ensure credibility, the interview schedules were presented to experts in educational sciences, pilot studies were conducted, and the inter-coder reliability process was implemented. The member-checking strategy was also used, in which data and interpretations were checked with participants, both throughout and at the end of the study, to ensure that it was felt that the codes and themes were accurate and unbiased. In order to enhance transferability, the snowball sampling method was complemented by the maximum variation sampling method, thus ensuring that a wide range of characteristics relevant to the study's purpose were represented in the participants. Additionally, detailed description of context, participants, data collection and findings was provided. The dependability and confirmability audit strategy was implemented, in which experts in the field monitored the research process to ensure transparency and accountability, while also providing feedback and suggestions.

Results

This section, which is structured into three main parts, presents the findings of the content analysis utilized to answer the research questions. The first part outlines the results related to the first research question and explores what, according to leaving and in-service teachers, are the reasons for teacher attrition. The second part reports the findings of the second research question with a focus on the timing of teacher attrition, according to Huberman's (1989) classification. Finally, the third part examines the results of the third research question, which investigates the new career paths taken by teachers after exiting the profession.

1. Reasons for Teacher Attrition

The responses to the first research question identified three key themes contributing to teacher attrition: a) pre-service education, b) work life experience, and c) career dissatisfaction and alternative opportunities. Tables 3, 4 and 5 summarize the themes, sub-themes, and categories that emerged from the inductive content analysis.

1.1. Pre-service Education

The findings indicated that pre-service education plays a significant role in teacher attrition. Two key aspects, which emerged from the analysis are the pathways into teaching and the quality of pre-service education.

Table 3. Reasons for Teacher Attrition: The Theme of Pre-service Education

Theme	Sub-themes	Categories
Pre-service education	Pathways into teaching	Graduating from a Faculty of Education Completing a pedagogical form, certificate program
	Quality of pre-service education	Incongruence between pre-service education and professional experience Teaching practicum experience

Pathways into Teaching: The majority of leavers stated that pedagogical formation certificate programs are "superficial", "perfunctory", and inadequate in terms of content. These leaving teachers argued that such short-term programs fail to provide sufficient preparation for the complexities of teaching. As a result, many participants suggested that only those who graduate from a Faculty of Education should be considered qualified to teach. One leaving teacher, who worked for a year as an English language teacher after qualifying through a pedagogical formation program, expressed her frustration as follows:

I cannot say that I have seen any benefit from the courses I took in pedagogical formation. How can it be possible to cover four years of training in just six months? It's because I'm not a graduate of a Faculty of Education that I didn't want to be a teacher from the beginning. [L25⁴]

It was seen that leavers who qualified as teachers through a pedagogical formation certificate program felt that the accelerated nature of these programs left them feeling unqualified to be effective teachers. This lack of confidence led them to question their skills and knowledge, which in some cases contributed to their decision to resign.

In-service teachers also agreed that the pedagogical formation certificate programs are insufficient and lack content, although they also argued that alternative methods of becoming a teacher do not necessarily lead to attrition. Instead, these teachers believed that it is hands-on experience in the real classroom environment that truly makes someone a good teacher, regardless of whether they completed a certification program or graduated from a Faculty of Education. They stated that their pathway to teaching was not a cause of any feeling of being "insufficient" or "inadequate" as a teacher. The findings therefore suggest that while the pathways to education do play a role in shaping teachers' experiences, and contribute to attrition in certain cases, it does not indicate a direct impact on attrition.

Quality of Pre-service Education: The findings revealed that one contributor to attrition is the mismatch between pre-service education and actual teaching experience. Many participants from both groups reported feeling "frustrated" and "shocked" once they started the profession and realized that their pre-service experience had not adequately prepared them for actual classrooms. One of the leavers who had worked as a pre-school teacher for eight years stated that:

The classroom environment portrayed during undergraduate studies is far from reality. For example, in university, we take courses on classroom materials and organization. However, in practice, some schools don't even have proper classrooms. Even if they do, the space is often cramped, overcrowded with students, and lacking essential resources. How am I supposed to arrange the classroom? Simply fitting in a few chairs feels like an accomplishment." [L13]

Many participants from both groups felt that the teaching practicum was too short and failed in many ways to prepare prospective teachers for the real-world challenges of the profession. Many participants described their practicum experiences as "just for show" [L1], and that they did not match "real" school environments. One participant, who is a mathematics teacher in a public school, elaborated on this issue:

During the practicum, everything was structured. The mentor teacher was always present, and the students behaved well because they knew they were being observed. But once I started teaching on my own, I quickly realized that real classrooms are completely different. I felt completely unprepared. [T5]

The findings showed that the lack of exposure to real classroom dynamics during pre-service education left many novice teachers experiencing a "reality shock", which significantly impacted their motivation and confidence. The findings indicated that the mismatch between pre-service education and real-world teaching experiences, along with insufficient practicum experience, could be a contributing factor to the decision of teachers to exit the profession, especially when combined with other difficulties.

⁴ The direct quotations are labeled as follows: 'L' represents a leaving teacher while 'T' denotes an in-service teacher. The accompanying number corresponds to the participant's assigned identifier in the study.

1.2. Work Life Experience

The work life experience of teachers emerged as the second influencer of teacher attrition. The results indicated that first year experience, classroom management, school climate, teacher autonomy, workload, employment conditions, along with contextual and personal constraints, are all significant contributors to teacher attrition.

Table 4. Reasons for Teacher Attrition: The Theme of Work Life Experience

Theme	Sub-themes	Categories
Work life experience	First year experience	Categories Feelings of insufficiency
	Classroom management	Lack of mentorship Establishing authority in the classroom Responding to the needs of special needs students A lack of auxiliary help
	School climate	Crowded classrooms Relationships with the administration School administrator's orientation
	Teacher autonomy	Relationships with colleagues
	Workload	Excessive busyness Lack of leisure/personal time Taking a day off/sick leave
	Employment conditions	Job security Teacher turnover Schools becoming business enterprises Unethical practices at private schools
Contextual and personal teacher constraints the class		The obligatory service period of public school Challenges caused by refugee students in Teacher status Family/care responsibilities Personal security concerns

First Year Experience: The first year of teaching was identified as being a significantly vulnerable period for attrition. Many participants reported feeling unprepared, overwhelmed, and inadequate in their teaching skills and self-efficacy during this period, which contributed to their early departure from the profession. They stated that they "felt incredibly inadequate" [L1] and "did not know anything" [L6], and that they "had no idea how to put university knowledge into practice" [L2]. Another participant similarly stated:

"The first year of teaching was a nightmare for me, I used to come home crying every day, saying that 'I guess I'm not cut out to be a teacher.' It was a very difficult time for me" [L13].

A lack of mentorship further exacerbated these struggles. The results reviewed that private school teachers received no formal mentorship, while public school teachers received mentorship in the form of bureaucratic formalities, rather than meaningful support mechanisms. The participants described their experiences with mentorship as "just for show", and it made them feel "alone" and "helpless". For instance, one of the participants, who was a pre-school teacher in a private school, said:

I think having a mentor would have made things a little easier. Would I still have come home crying every day in the first year? I don't think I would have because I would have known that other people were also having a hard time. I would have received support from my mentor. [L13]

The findings showed that mentorship provided to early career teachers is crucial for teachers' well-being and retention, particularly during their first year in the profession. A significant number of participants in the study emphasized that a lack of mentorship make teachers feel "alienated", "demotivated" and "inadequate", which could be a contributing factor in feelings of frustration and decisions to exit the profession.

Classroom Management: A large proportion of the leavers felt that classroom management was one of the biggest challenges involved in teaching, particularly during the first few years. The results revealed that, regardless of participants' views of their pre-service education, establishing classroom authority was a significant struggle. One of the leavers, who worked as an English language teacher in a private school for two years, described her struggle to establish authority:

The moment you enter the classroom; you are alone as a teacher. You are the authority in the room and it was really difficult for me at first to establish this authority. I mean, I tried a lot of classroom management tactics; I acted like I was angry, I shouted at students to shut up, I tried to take the class under my control by piling on the agony, or I don't know, I joked and played for laughs. [L2]

Another significant issue, which emerged was a lack of training and resources to support special needs. Participants reported that they felt, although they were very eager to help every student in their classes, unequipped to meet the needs of special needs students. The wearisome impact of not having any help with special needs students in their classrooms was an issue that was mentioned by both leavers and in-service teachers at all levels (pre-school, elementary, high school, etc.), and is definitely a cause of stress, burnout and eventually, attrition. One teacher who had resigned described her experience of having more than a couple of special needs students in her pre-school classroom:

That year was incredibly difficult for me. For the first time in my life, I experienced depression. I even went to a psychiatrist because I had no idea how to help the children in my class. ... Then summer came, the school year ended, and I started feeling better. That's when I realized that I didn't want to be a teacher. ... Fortunately, that same month, some friends from the Ministry of National Education visited me and mentioned a vacancy in their office. I didn't even ask what the job was about; I just knew I no longer wanted to be a teacher. So, I resigned. [L26]

It was also discovered that pre-school teachers, in particular, need auxiliary help regarding cleaning the classrooms and helping younger students look after themselves. Additional support is also required for teachers at various grade levels with special needs students' self-maintenance and learning, as well as with other extra-curricular duties, such as hall monitoring.

Crowded classrooms emerged as an additional contributing factor to attrition, particularly in public schools. Many participants from both groups felt that classrooms are too crowded to properly maintain order, and that it is overwhelming and stressful for novice teachers when every student speaks at the same time. While in-service teachers acknowledged that classroom management was certainly challenging, they argued that it is not enough as a reason for leaving the profession. However, there is no doubt that classroom management can be the final straw for teachers who already struggling with other challenges, such as workload or lack of mentorship, and are considering resigning.

School Climate: School climate, particularly interactions with the school administrators, administrators' orientation, and interactions with colleagues, were all found to be significantly contributing factors to teacher attrition. It was revealed in the study that nearly all teachers, both leaving and in-service, face, or have faced, challenges in their relationships with their administrators. The majority of participants, who have varying characteristics in terms of the subject area they teach, their teaching experience, and the type of school where they work, reported that lack of support, excessive micromanagement, mobbing, and negative attitudes of the administrator towards teachers, are all

significant causes of attrition. The following are accounts from an English language teacher who previously worked at a pre-school, a history teacher, and another pre-school teacher:

Even my restroom breaks were controlled. Believe me, it was my administrator who told me to go after the second class and wouldn't allow me to use the restroom during the regular class break. I'm a kindergarten teacher so I don't have official break times. You know, kindergartens don't have 10-minute breaks like other grades do. They even told me to wait until after 1p.m to use the restroom. [L1]

There was constant pressure regarding grading... One day, I received a message stating that no student should receive a grade lower than 50. Of course, I was against it and I had a few students whose grades I refused to change. But the administration could access our passwords in the e-school system, so the administrator changed my password and altered the students' grades using my account. I completely lost it. I felt powerless. This was a direct violation of teacher autonomy—something absolutely unacceptable. [L14]

The attitudes of administrators toward teachers... Just because they hold a higher position... Criticizing unfairly, being unconstructive, failing to provide guidance—these are all major issues. For instance, while I was eating during my lunch break, my administrator said, "You have two minutes, you're on duty." But I was already aware of that, and I was actively eating at that moment. I wasn't chatting with colleagues or wasting time. If my administrators had been just a little more understanding and supportive, I might have stayed in the profession. [L1]

Honestly, I am not happy with my administrator at this school. For example, they make decisions without consulting or informing us. When the COVID-19 pandemic first started, we were on semester break. When I returned from vacation, I couldn't find my classroom—it had been moved. I used to have my own classroom, but they piled up my belongings and placed me in another teacher's room. I was deeply upset and emotionally drained. I truly lost my motivation. My first thought was, 'Why wasn't I informed about this?' It affected me so much. Teachers should be notified about these changes in advance. This kind of administrative behavior—neglect, disregard, indifference—it's frustrating. People can only endure so much. [T2]

As it is evident in these accounts, school administrators play a major role in teachers' motivation, well-being and, ultimately, teachers' departure from the profession. Furthermore, in-service teachers are also fully aware that their colleagues leaving to the negative school climate and that this, in itself, is a demotivating factor. Few participants reported that they witnessed colleagues leave the profession due to administrative problems. One English language teacher who is working in a private school shared:

When I first started working in this school, one of my colleagues left mid-term because he was sick of the system. I can't say I blamed him. I saw many colleagues reach their breaking points, and sometimes I wondered when mine will come. It's demotivating. [T13]

These findings highlight that the school climate not only contributes to attrition, but that it also creates a cycle of dissatisfaction among the teachers who remain in the profession. It was also determined that school administrators' orientation can be a contributing factor in teacher attrition. The participants argued that administrators must be people who are highly qualified to become administrators: i.e. they must "come to the position with merit" [L27] and not be "appointed based on political ideologies" [L15]. For example, one of the leavers, who was a mathematics teacher at a public school, said the following:

The fact that administrators are appointed by certain political bodies to schools, such as unions, creates an environment where a particular political stance feels dominant. Even trying to remain neutral becomes uncomfortable. Many teachers experience this—there is significant pressure to join a union within the school, much more so than in other institutions. Especially in the first semester, there is a union membership count, and afterward, you start receiving persistent phone calls. If you don't take a clear stance, or if you respond cautiously, it can even escalate into workplace bullying. In this sense, school administration plays a concerning role in reinforcing this pressure. [L10]

While teacher unions in schools are generally perceived as being positive, many participants also noted that the pressure to join a particular union can create tension and mobbing, which may be a contributor to teacher attrition.

The results showed that interactions with colleagues, particularly rivalry, gossiping, and lack of collaboration, are factors in attrition, especially among private school teachers. The majority of leavers explained that teachers' rooms are "terrible places" [L2] and that teachers can be "selfish" [L26] and they do not "help each other" [T2].

The results showed that, given the significant amount of time teachers spend together each day, all participants from both groups valued a positive school climate and teacher cooperation. While the majority of the leavers emphasized that negative relationships with colleagues could contribute to attrition, current teachers believed that such issues would only lead to attrition if this negativity became extreme.

Teacher Autonomy: The findings revealed that a significant number of leavers believed that a significant contributor to their decision to leave teaching was not having autonomy regarding instruction, curriculum, student discipline, the power of sanction, interactions with parents, and grading. A number of participants particularly expressed their disappointment in not having classroom autonomy, with one complaining that "this was not the definition of being a teacher for me" [L14]. Similarly, another leaving English language teacher explained how she would have loved to have been able to tailor lessons for students' particular characteristics and interests:

I would have loved to have been able to prepare something for my own students, for every particular class, or to be able to choose readers, but my options were very limited, and my teaching seemed very inefficient. Yes, the child was learning in a way, but everything seemed to be very trite. ... I wished I could have made my own decisions in my own classroom. [L2]

Although in-service teachers did not indicate teacher autonomy as being a primary factor in attrition, they did identify a lack of autonomy in terms of teacher-parent interactions as a major factor in attrition. Many participants referred to parental interference as "the biggest challenge that comes to mind" [L2] about the profession, and as something which is "very frustrating" [L8]. Participants felt that parents try to interfere with everything, from grading to instructional methods, thus limiting teachers' authority, especially in private schools where school administrators sometimes side with parents instead of standing up for the teachers. One teacher currently working in a private school commented that:

Parents often question every detail; why I gave this homework, why I graded that way, why their child didn't get a special privilege. It's exhausting. And the worst part... Administrators rarely defend us. They want to keep parents happy at all costs, even if it means disregarding teachers' authority. [T4]

Another in-service teacher, whose colleague left the profession, said that "one of my friends in the school could not take this toxic environment anymore. He was a mathematics teacher and found a job in a bank. I am actually happy for him" [T14]. The findings showed that while autonomy may not

be the primary reason of attrition; a lack of perceived authority, freedom, and poor support can be a significant contributor to attrition.

Workload: The results showed that excessive workload is a major factor in teacher attrition; with teachers being given excessive responsibilities both during and after school hours, and having little personal or rest time. The majority of participants in both public and private schools described their workload as “unmanageable”. One leaver, who worked in a private school, stated that:

The workload was increasing in every way. It wasn't just about going in and out of the classroom; due to the pandemic, everything was shifted online. We had to convert the entire book into digital format and create animated slides. I even had to learn animation. I left because such unexpected tasks, which were not part of the original remit, were also too demanding and exhausting for me. [L8]

For some participants, the inability to take personal or sick leave without repercussions was a defining factor. A former mathematics teacher, who worked at a public school [L10], described how he had to accompany a family member undergoing surgery at a hospital. Although he informed the administrator in advance, he received a rude call from the administrator questioning his absence. He explained that this lack of empathy was the tipping point that led him to leave the profession. Similarly, a private school teacher [L16] explained that when her father passed away in another city, she was barely given any time off for the funeral, leaving her with the sense that she hadn't time to grieve. Another private school leaver [L1] recalled that after falling seriously ill and being taken to the hospital by ambulance, she was called by the administrator just an hour later and reminded about her next class, with no regard for her health. These cases highlight that while public school teachers may have more rights on paper, administrative attitudes and lack of support still influence attrition. Moreover, private school teachers, who often lack individual and formal rights, face even greater pressures, making these teacher attrition factors particularly significant for this group.

In-service teachers agreed with these concerns, emphasizing just how much they struggle with the workload. One in-service teacher, working in a private school, said:

People assume we work from 8 to 5, but it is far from the reality. After teaching all day, we're still expected to grade assignments, attend meetings, call parents, and deal with administrative paperwork. I barely have time to rest before another awful day starts. [T1]

Employment Conditions: The results revealed that employment conditions, especially in private schools, have a profound influence on teacher attrition. Participants complained that because teachers are laid off in case of sickness or pregnancy, there is little or no job security, thus increasing the teacher attrition rate. Many leavers felt that schools function more like business enterprises than educational institutions, and that it is these unethical practices that led to their decision to leave. For example, one of the leavers, who worked at a private school [L1], explained how the contract of a colleague being diagnosed with cancer was not renewed at the end of the year because it was felt that her treatment and condition would cause her to miss classes due to exhaustion and a lack of energy. Another leaver who also worked at a private school stated that:

The school administration openly prioritizes parent and customer satisfaction. So much so that we are told during the in-service training that: 'A parent may be just a parent to you, but for us, they are a customer.' When you hear this... over time, you begin to accept it—no matter how much it contradicts your ideology, background, or the education you received. [L13]

In-service teachers also reflected on these conditions, noting that witnessing high turnover rates among their colleagues affected their own morale. One teacher who works in a private school stated:

"Every year, we lose good teachers; not because they don't love teaching, but because they cannot keep up with this chaos. It's exhausting. Watching them, we wonder, when it will be our turn?" [T4].

It is clear that mismanagement and unethical practices at private schools are significant contributors to teacher attrition. Participants lamented how their employment conditions made them feel worthless and pessimistic about their future, thus provoking them to leave.

Contextual and Personal Constraints: While the reasons given above for teacher attrition were common across participants, there were others that were more personal and mentioned by only few individuals, yet remaining significant for teacher attrition.

One such influence was the obligatory service period of public school teachers, of which both leavers and in-service teachers described their feelings of isolation and emotional exhaustion. Many teachers who were first assigned to a rural or culturally different region describe their feelings of "imprisonment" and their struggles with adjusting to a new place while missing their loved ones. One of the leavers stated:

They are [young novice teachers] sent to east; "imprisoned" for three to four years. I say "imprisoned"- I'm sorry, but they can easily be imprisoned by depression when their familiar social environment is replaced by an unfamiliar place. They suddenly find themselves in an isolated setting, far from the social life they have known... Especially for those who grew up in the west, where the culture is vastly different from that of the east. You are forced to completely change your way of life and adapt to an entirely new reality. When assigned to a village school, for instance, sometimes you are the only teacher there and have to sometimes be the school's administrator. It can also be really hard to be accepted by the local community. [L5]

As Türkiye is currently hosting millions of refugees from neighboring countries such as Syria, Iraq, Iran, and other countries such as Pakistan, the country faces unique educational challenges (The International Organization for Migration, n.d.) with the increasing number of refugees enrolled in public schools. Many leavers and current teachers explained how they were deeply disturbed and demotivated due to the majority of the students having troubles at home, such as their fathers being involved in smuggling, or desperate economic conditions. Many participants also witnessed "refugees unlawfully approaching underage female students in schools" [L18]. Another serious problem stated by both leavers and in-service teachers was that many of the refugees often don't speak Turkish or do not have the necessary educational background; despite being placed in upper grades because of their age. Participants explained how this damages the classroom dynamics and greatly increases teachers' workload and responsibilities to the class. Having too many refugee students in classrooms was cited by several participants in their decision to leave, due to it being a cause of serious problems and stress, in addition to the other instructional problems they face.

Participants from both groups also highlighted that they were extremely motivated to teach all students in the classroom, regardless of their ethnicities, but were unable to do so effectively because a lack of rules and regulations with the integration of immigrants into the Turkish education system was creating chaotic school and classroom environments, all of which amounted to yet another cause of stress for teachers. This finding indicated that, although having many refugee students in classrooms may not be a direct cause on teacher attrition, it is likely to be a contributing reason for teachers who are already lacking support and additional resources.

A number of leavers in this study cited employment status as a reason for leaving the profession. These participants, who were employed as contracted teachers rather than permanent staff, explained how they felt disadvantaged due to differences in rights and working conditions. While official regulations grant contracted teachers many of the same rights as permanent teachers, participants perceived their status as limiting and insecure. These teachers complained about the parents of the students not taking them seriously, colleagues sometimes mocking them, and their salary being significantly lower than that of a permanent teacher, making it difficult to make ends meet. For these teachers, it was this sense of instability and lack of professional recognition that were the main reasons for them leaving.

Family responsibilities influenced the decision of some leavers. A couple of female participants explained how, for them, becoming a mother and childcare responsibilities made staying in the profession impractical as getting a job would mean that their entire teacher salary would go to child care. This was the reason that one of the participants gave for her decision, while another expressed her desire to go back to the profession after her child starts pre-school.

Finally, personal security concerns related to a traumatic experience was the main reason for leaving the profession for a mathematics teacher assigned to a southeastern province of Türkiye:

Rockets were falling on the Syrian side—about three times a day. They were landing dangerously close to us; one even struck a girls' dormitory just 200 meters from the school. Many of my students' homes were damaged, and 20 to 30 people lost their lives. Experts from the provincial defense came to train us on what to do when a rocket hit—how to protect the students. I was in shock and scared for myself, as well as for the students. There were attacks every single day. The windows would shake, and we would rush to press the kids against the walls, keeping them away from the windows. After that, you can't just act like nothing happened—I couldn't go back to teaching as if everything was normal. [L18]

Although this participant's reason for leaving was unique, it is important to highlight this experience. This participant emphasized that, no matter how much a person wants to be a good teacher and contribute to educating children in disadvantaged areas, the feeling of being in personal danger will always be more important, thus leading to his decision to leave the profession. Overall, these findings show that while systemic issues, like workload or a lack of administrative support, play a dominant role in attrition, such external challenges can also have a considerable influence on teacher attrition.

1.3. Career Dissatisfaction and Alternative Opportunities

The results revealed that monotony, a lack of challenge within career steps and opportunities for professional development, the status of the teaching profession, salary and compensation, and the pull of other job opportunities, all contributed to the teachers' decision to leave.

Table 5. The Reasons for Teacher Attrition: The Theme of Career Dissatisfaction and Alternative Opportunities

Theme	Sub-themes
Career dissatisfaction and alternative opportunities	Monotony A lack of challenge within the career steps and opportunities for professional development Status of the teaching profession Salary and compensation Other job opportunities

Monotony: While many participants felt that an advantage of the teaching profession was that it allowed them to stay energetic and creative, as they get to improve themselves and their teaching methods/skills, there were few leavers who stated that the main reason for them leaving teaching was monotony. These participants, regardless of subject area or school type, found teaching the same content year after year repetitive and uninspiring. One participant described feeling "tired of always doing the same thing" [L13], while another said: "Teaching the same thing over and over again feels soulless; I cannot imagine myself doing it for another 10 to 15 years" [L24].

In-service teachers also acknowledged that the repetitive nature of teaching could be discouraging for some, and believed that school support and opportunities for instructional innovation are required to maintain motivation. One in-service teacher reflected:

I've seen colleagues struggle with burnout because they felt like they were just doing the same thing again and again. It is not actually the case, I believe, but without collegial support and teamwork, I can understand why some would feel like that and leave. [T4]

A Lack of Challenge within the Career Steps and Opportunities for Professional Development: Many leavers expressed their frustration regarding the absence of well-defined career steps and opportunities for professional development. They believed that the teaching profession lacks challenging career steps that present opportunities for effective professional development. Moreover, the belief of these participants that their developmental efforts were not at all appreciated played a part in their decision to depart [L10]. One of the leavers, who worked in a private school, explained:

Teachers are absolutely not encouraged or allowed to improve. I worked at ... [a very prestigious school that is known for valuing quality education and for its highly qualified teachers], which is known for valuing quality education, but it is definitely not like that. They make us receive in-service trainings that do not help us improve at all, nothing else is allowed. The only job of the teacher was to stand before the disciples like a shepherd. It's quantity over quality for them. [L1]

Many participants agreed that the career steps in the teaching profession had not been well-thought out and do not encourage teachers to develop themselves professionally. One physics teacher working in a public school stated:

Even if you are passionate about teaching, it is frustrating when you realize that your hard work won't be appreciated. Some of my friends left because they felt they were not progressing in a meaningful way. [T3]

The findings showed that the lack of structured career steps and meaningful professional development opportunities were a contributor for some teachers to teacher attrition, and it also reduced the motivation and job-satisfaction of in-service teachers.

Status of the Teaching Profession: The vast majority of the participants from both groups believed that the reputation of the teaching profession and the social status of teachers have been declining in society. A significant number of participants shared several incidents from their daily lives where they were treated disrespectfully by others. They felt that people have a misconception about teachers: that they are low-paid, but it's a job that anyone can do and that it's easy money because you get a three-month holiday during the summer. The majority of the participants were very demoralized by this depiction, and felt like "slaves" who "have no personal rights and who do not see any value in the society" [L13].

Most leavers argue that while they began their careers positively motivated to influence the younger generation, they had become disillusioned after realizing that their contributions are not actually valued by others, and so they decided to leave the profession. Moreover, it was pointed out that as the cutoff score to enter the faculties of education is very low, the majority of new teachers are only teachers because their scores in the university entrance exam were not enough for them to select another faculty. One of the leavers said:

People often assume that we chose the teaching department simply because our university entrance scores were only high enough for teaching. They don't consider that we might have chosen teaching voluntarily. I believe the admission score should be higher because too many people enter the field just because their scores limit them to teaching. When that happens, it becomes completely normal to hear comments like 'It's okay'—as if they are trying to console you—when you tell someone, 'I am a teacher.' [L7]

In-service teachers also echoed these feelings, noting that they often feel undervalued. One teacher stated:

"We give so much of ourselves to this job, but no one sees it. I have seen many colleagues look for other jobs; they wanted to be respected, even if they earn the same, they chose to leave" [T6].

The results indicated that a significant proportion of participants from both groups feel unvalued and underrated, which eventually cause frustration and lead them to switch careers where they can feel more appreciated.

Salary and Compensation: Salary and compensation was one of the most common reasons of attrition according to both groups of participants. Many leavers stated that the main reason of their departure was the low salary, which they called "chickenfeed" and "barely enough" for their personal needs [L1], and it was very poor compensation for all of the hard work and effort they put in [L8]. Similarly, many in-service teachers described how they struggle to make ends meet each month and so often consider leaving. They also acknowledged that their former colleagues who left had made a sensible decision, especially if they had found better-paying jobs. One leaver explained that he loved teaching, but had to think about his future, and it would be "silly" to stay in teaching when he can earn more and work less [L17].

Participants further highlighted that teacher salaries in both public and private schools are not able to keep up with high inflation. The situation is particularly severe in private schools where many institutions often illegally pay teachers less than the minimum wage.

Other Job Opportunities: The results also indicated the availability of higher-paying jobs or better working conditions is a contributor to teacher attrition. Participants from both groups acknowledged that alternative career paths often offer higher salaries, more flexible work schedules, and a decreased workload. Although almost all of the participants still believed that teaching has sentimental value for them, and they started the profession mainly for intrinsic reasons, after working for a while, they eventually decided that their well-being and personal needs were a priority. An in-service teacher said that she sees more teachers leave for alternative jobs every year, which makes those who remain wonder if they should perhaps do the same [T11].

Overall, the results of the study revealed that teachers usually do not leave because of a single reason or an isolated incident. Instead, many of the struggles abovementioned accumulate during a teacher's career, whether short or long, and this will eventually lead to a decision to depart. The results also showed that some of the reasons might be particularly influential on teachers' decision. For example, while the relationships with the administrator or low salary are found to have a direct influence on attrition, having refugees in the classroom might be a triggering influence. It is likely that it is the simple addition of factors that is the ultimate cause of attrition.

2. When Do Teachers Leave?

In the present study, Huberman's (1989) classification of *Professional Life Cycle of Teachers* was used as the theoretical framework for the second research question regarding the timing of teacher attrition. Table 6 summarizes, in relation to the Huberman's (1989) framework, the periods of attrition of the leavers who participated in the study.

Table 6. The Teaching Experience of Leavers in relation to Huberman's (1989) Framework of Professional Life Cycle of Teachers

Phases Based on the Professional Life Cycle of Teachers	Years of Experience	f
Survival/Discovery	1-3	14
Stabilization	4-6	8
Experimentation/Reassessment	7-18	4
Serenity/Conservatism	19-30	0
Disengagement	31-40	1

Huberman suggested that the first three years are the "career entry phase", in which teachers may experience either an easy or difficult start to their career. If the beginning is perceived to be easy, this leads to the discovery period in which teachers enjoy having students, a classroom and colleagues, while a difficult beginning leads to a period of survival in which teachers face a reality shock and a variety of struggles. In this study, it was found that 14 teachers left in the period between the first to third years of their careers. The findings revealed that participants in the study who felt anxious, panicked, and inadequate at the beginning of their career had a difficult career entry and so decided to leave teaching. As one in-service teacher observed:

I have seen several new teachers leave after their first year. They were passionate and young, but without proper support, they felt lost. We also struggled, but we stayed ... We were lucky to have good colleagues and administrators at that time. [T14]

The second phase, spanning the forth to sixth years of teaching, is referred to as the "stabilization" phase. According to Huberman (1989), this is considered the most stable period regarding teacher attrition, as teachers in this phase tend to develop professional commitment and abandon alternative career prospects. However, eight leavers in this study exited the profession in their supposed 'stabilization' phase. Participants reported that, despite overcoming the initial challenges of their careers, workload and school climate remained as significant causes of stress. While Huberman (1989) referred to this phase as being a period of "stabilization", the findings of the present study suggest that attrition rates can still remain high during this period due to multiple contributing factors. Additionally, a few leavers and in-service teachers suggested that this was because some teachers do not quit immediately, but instead wait for a few years hoping that things will get better. However, when they realize nothing really changes, they eventually leave.

For the third phase, which spans between seven to 18 years of teaching, Huberman (1989) classified two possible trajectories: "experimentation/activism" or "reassessment/self-doubt". In the "experimentation/activism" phase, teachers may experiment with different instructional materials, or they might want to take on additional roles and responsibilities. During the "reassessment/self-doubt" phase, teachers may feel a sense of monotony, and have concerns that the possibilities of starting a new career are fading away. In the present study, four leavers left the profession between the seventh to 18th years of their career. These participants argued that they loved teaching initially, but then decided to leave because of the harsh working conditions, and the fact that there were other jobs they can do where they can earn more, or have more flexible schedules.

For the fourth phase, which spans the 19th to 30th years of teaching, Huberman (1989) suggested that there are two trajectories: "serenity/relational distance" or "conservatism". Teachers who are in the "serenity" phase may feel bored, but are relaxed as they accept the situation. In contrast, teachers who are in the "conservatism" phase may feel more pessimistic about the younger generation, believe that teachers are not sufficiently valued in society, and so have reduced commitment to teaching. None of the teachers in the present study left the profession during this phase.

The final phase, which spans the period between the 31st and 40th year of teaching, is referred to as the "disengagement" phase. In this phase, teachers may feel either serene, or bitter, as they eventually disengage from the profession. In the present study, there was only one teacher who left after teaching for 32 years. This participant explained that, while he loved being a teacher for intrinsic reasons throughout his career, he ultimately decided to leave after so many years due to the changes in the education system. More specifically, he was bitter about the evolving teacher and student profiles. He also emphasized that leaving the profession after many years is particularly challenging, as finding another job in mid-life is far more difficult than for younger teachers who leave early in their careers and can pursue training for alternative careers more easily. Furthermore, it was noted that only those with an additional source of financial income could afford to leave teaching after so many years in the profession.

Overall, the results have shown that in the present study, more than half of the leavers left the profession in the first three years of their career; a considerable number left in the following four to six years, and the number of leavers decreased mid-career and towards retirement. Due to the study employing a qualitative approach with purposive sampling and a limited sample size, it does not seek to generalize the results to the broader teacher population. Instead, the aim of the study is to provide rich and detailed insights into the specific experiences of the participants. The hope is that the valuable perspectives provided by participants can highlight the underlying patterns, which contribute to teacher attrition. Considering the findings of the study regarding the reasons of teacher attrition, it is of note that the majority of leavers were novice teachers, and thus reported struggles such as the receiving of mentorship, classroom management, or administrative support.

3. Possible Career Paths of Leavers

To address the third research question, leavers who participated in the present study were asked about their career trajectories following their departure from teaching. The findings revealed that six leavers have continued working within the field of education, 12 leavers have transitioned to careers outside the education sector, and nine leavers are currently not employed.

The results showed that there were few leavers who would like start teaching again one day, particularly if the working conditions were to be improved, because they loved the core of being a teacher. However, many felt that the systemic issues within the profession outweighed their passion for teaching. Similarly, the participants who still work within the field of education stated that they loved teaching for intrinsic reasons, but they had to prioritize their own needs. These participants argued that they are now happier because they still work with students in a way, without dealing with the struggles of the profession, and as they earn more money with flexible working conditions. They also mentioned that their current roles allow them to focus more on individualized student support, which they found fulfilling. One participant explained:

I still work with students, but now I do it on my own terms. I don't deal with grading, administrative pressure, or unrealistic expectations. I can actually focus on helping students where they need it most. [L19]

The participants who are now working outside the field of education generally agreed that they would never go back to teaching, although they admitted they sometimes miss their relationships with students. Many of these participants said they were "glad" that they left teaching as they now earn more and enjoyed better working conditions. For instance, two participants stated: "I would not go back to teaching unless I have to. ... I don't think I will ever want to experience the same things again." [L2] and "I didn't know what the job was like. If I had known, I would have never taken it" [L18]. Additionally, several respondents highlighted that their new careers provided opportunities for the professional growth that they felt was limited in teaching. Table 7 demonstrates the career trajectories of the leavers who participated in the study.

Table 7. Career Trajectories of Leavers

Participant	Gender	Profession after Leaving Teaching
L1	Female	OUT: Translator at an embassy
L2	Female	Marketing specialist in the cinema industry
L3	Female	Not employed
L4	Male	Not employed: Pursuing graduate studies
L5	Female	IN: Part time in Guidance Research Center, Preparing for KPSS
L6	Female	Not employed: Preparing for KPSS
L7	Female	Not employed: Preparing for KPSS
L8	Female	Not employed: Stay at home mother
L9	Male	OUT: Working at an embassy
L10	Male	IN: Research assistant
L11	Female	Not employed
L12	Female	OUT: Pilates instructor
L13	Female	OUT: Flight attendant
L14	Female	Not employed: Studying at university
L15	Male	OUT: Store owner
L16	Female	Not employed
L17	Male	OUT: Working at a bank
L18	Male	OUT: Air-traffic controller
L19	Female	IN: Private tutor
L20	Female	OUT: Worked at a bank and as a yoga instructor
L21	Male	OUT: Working at a medical company
L22	Female	Not employed: Stay at home mother
L23	Male	IN: Publishing, YouTube content creator, private tutor
L24	Female	OUT: Social media content creator, TV host, handcraft tutor
L25	Female	OUT: Data analyst
L26	Female	IN: Working in research and development in MoNE
L27	Female	IN: Faculty member at a university

Note: IN refers to professions related to education sector, OUT refers to professions unrelated to education sector

The findings are intriguing because they indicate that the leavers who received a thorough education, and were once highly motivated to become teachers, now believed that they would never go back to teaching in any circumstances. Such negative teaching experiences only underscores the seriousness of the situation, and the importance of teacher attrition research in exploring teacher opinions and views to combat attrition.

Discussion and Conclusion

The results of this study highlight the complex and multifaceted nature of teacher attrition in Türkiye, and so reveal the interplay between structural, cultural, and economic factors that influence the career decisions made by teachers. This section discusses the results of the study, in relation to the corpus, to better understand teacher attrition.

One of the results of this study was that it found that many teachers struggled with the transition from pre-service education to in-service teaching, some even describing it as a “reality shock”, and so felt unprepared for the realities of teaching and other classroom challenges. While this finding aligns with international studies on teacher attrition (e.g., Buchanan, 2012; Huberman, 1989; Kelchtermans & Ballet, 2002; Veenman, 1984), the situation in the Turkish context presents distinct challenges for teachers. As pedagogical formation certification programs create a gap between theoretical knowledge and practical classroom experience, it is often difficult for novice teachers to adapt to the profession. Support is provided by the conclusion of Carver-Thomas and Darling-

Hammond (2019), which is that when other factors are held constant, teachers who completed an alternative certification program are 25% more prone to resign from teaching when compared to teachers who qualified in more traditional ways (e.g. teacher education programs in universities). Moreover, many pre-service teachers, whether graduated from a faculty of education or having completed a pedagogical certification program, gain false expectations of what their teaching environment will be like due to the unrealistic classroom contexts presented on their training. The result is that they face with various challenges that lead them to leave the profession. This is particularly an issue for new teachers in disadvantaged areas.

That said, the results regarding what are the pathways to teaching and are the impacts on teacher attrition, remains contested. While some participants in this study felt that their alternative pathway to the profession did affect their decision to leave, other in-service teachers expressed their confidence in their abilities and skills as teachers. This discrepancy also raises questions about the quality of these certification programs. Although some teachers are satisfied with the pre-service education they received in pedagogical formation programs, the existence of these programs are creating a glut of teachers in Türkiye. Approximately 40,000 pre-service teachers graduated from a faculty of education in 2022-2023 (Council of Higher Education [YÖK], n.d.), and there were a total number of approximately 250,000 students in faculties of education in the 2023-2024 academic year (YÖK, n.d.). In addition, almost 80,000 graduates annually receive their qualifications through a pedagogical formation program (Çakır et al., 2024). However, the hiring capacity of the public schools remains around 40,000 teachers each year. This imbalance creates a highly competitive job market, unstable positions in private schools, and dissatisfaction among teachers and teacher candidates.

Another key driver of attrition found in this study is the negative influence of school administration and organizational climate. Many participants reported a lack of administrative support, excessive interference and micromanagement, a top-down hierarchy, and lack of leadership and guidance as significant influences on teacher attrition. These results align with previous studies in literature (e.g., Borman & Maritzza Dowling, 2008; Den Brok et al., 2017; Glazer, 2018; Gonzalez et al., 2008; Karadal et al., 2018; Mason, 2017; Troyer, 2018); but also acquire unique inferences in Türkiye, where participants argue that school administrators might be favored and assigned based on their political orientation. Another issue raised by participants is that teachers may feel pressured and decide to leave the profession in public schools in Türkiye where political influences shape the decisions made by administrators. In private schools, administrators may function more as business managers than educators, being much more concerned with prioritizing 'customer satisfaction' over teachers' rights and well-being. This was also reported as being the case by participants in the current study, as well as being highlighted in other research (e.g. Çakır et al., 2024; Şahin, 2022).

A number of leavers also emphasized that them having almost no autonomy on their classrooms or instruction was a lesson in the realities of teaching, which does not match their previous "idealistic" views. The rigid, exam-oriented structure of Türkiye's education system limits teachers' ability to innovate in the classroom, reducing their role to mere implementers of a standardized curriculum. Similar to the results of the present study, a few previous studies have also shown that lack of autonomy results in teachers feeling disconnected from the profession (Buchanan, 2012). This is particularly evident when there is a discrepancy between teachers' initial perceptions of the profession and their actual experiences in practice (Newberry & Allsop, 2017). In Türkiye's context, this is further heightened because of high parental involvement, where teachers often find themselves in conflicts between their work, parental demands and judgment. These tensions, combined with lack of administrative support and top-down hierarchy, create a sense of dissatisfaction, leading to teacher attrition.

Workload emerged in this study as another major influencer of teacher attrition. Participants explained that teachers are overworked, with excessive responsibilities including administrative tasks, hall-monitoring, grading, homework checking, all of which makes balancing professional and personal lives a struggle. Similar concerns have been widely documented in the literature as well (e.g., Buchanan,

2012; Day et al., 2006; Den Brok et al., 2017; Harmsen et al., 2018; Khawary & Ali, 2015; Mason & Poyatos Matas, 2015; Newberry & Allsop, 2017; Sammons et al., 2007; Struyven & Vanthournout, 2014; Sutcher et al., 2016). While most participants viewed workload as overwhelming, some specifically identified lesson planning, grading, and homework checking as particularly onerous. Unlike administrative tasks, which are only extraneous burdens that can be reduced, lesson planning, assessment, and feedback are essential aspects of teaching and instruction. Many leavers and in-service teachers also compared teaching to other professions, arguing that employees in other fields can leave work behind, whereas teachers often continue working after school hours. While this is a valid concern, teaching extends beyond classroom, requiring constant preparation and evaluation. Therefore, it needs to be acknowledged by teachers that, while bureaucratic demands might be minimized, certain responsibilities are intrinsic to the profession.

One of the key results, which emerged in the current study, is job security, particularly in private schools, which increasingly operate as business enterprises. Many participants reported experiencing unethical practices being practiced at such schools, including short-term contracts, salary fraud, and lack of benefits, as being their reasons of attrition. Given that private school teachers in Türkiye fall under Labor Law No. 4857, rather than Teacher Profession Law, their rights and employment conditions are less regulated, leaving them vulnerable to unstable working conditions (Çakır et al., 2024). In public schools, job security is stronger, but the obligatory service was identified as an influence on teacher attrition. Assignment to geographically isolated regions, or to disadvantaged schools, made adaptation to the profession particularly difficult, and lead to attrition for some teachers. This result aligns with previous research arguing that teachers in rural or difficult-to-staff areas tend to leave because of isolation, adaptation problems, and limited resources (e.g. Billingsley, 2004; Buchanan, 2010; Buchanan et al., 2013; Elfers et al., 2009; Güvendir, 2017; OECD, 2005; Roberts, 2015).

Another factor unique to Türkiye is the placement of refugees in schools. Concerns were raised about the lack of clear policies and regulations regarding these students' integration into the education system, insufficient teacher training for handling language and cultural barriers, and increased classroom management challenges, all of which all contribute to the decisions of teachers to resign. Research in other contexts also suggests that schools with increased number of minority students, particularly in disadvantaged areas where teachers do not receive support and/or specialized training, experience higher attrition rates (Wagner, 1993).

While the current study found well-documented influences of attrition such as workload, salary, or job security, a less-explored influence, which also emerged was the perceived monotony of the work. Several participants stated that their reason of leaving was mainly how boring and monotonous they found teaching. However, no direct links between boredom and teacher attrition were found the literature review. Undoubtedly due to perceptions of teaching as being monotonous is highly subjective; and while some people perceive teaching as repeating the same thing over and over for years on end, others perceive teaching as being very creative and open for improvement.

Another less expected result of this study was that almost all participants from both groups argued that working in a less equipped school actually motivated them as they felt more fulfilled in helping those students to explore their potential and increase their awareness. This contrasts with existing literature, which suggests a that lack of school resources or facilities can trigger attrition, especially in disadvantaged regions (Carver-Thomas & Darling-Hammond, 2019; Mason & Poyatos Matas, 2015; Solomonson et al., 2018). This contrast may mean that while participants in this study valued their professional fulfillment by working in a disadvantaged school, the cumulative burden of other challenges outweighed this motivation, leading to attrition.

The lack of challenge in career steps and opportunities for professional development was identified as being an influence on attrition. Some participants believed that, no matter how hard they work, they would remain in the same position without recognition, and so would not be encouraged to grow professionally and personally. This sense of stagnation decreased the motivation of the participants and contributed to their decision to leave the profession. Career progression is significant in teaching; as argued by Day (2012), and when career advancement is limited, teachers may feel disengaged and demotivated, thus increasing the likelihood of attrition. Similarly, participants in this study also found existing career steps and professional development opportunities ineffective, describing them as "not meaningful for personal and professional growth". Financial concerns further compounded these issues. Organisation for Economic Co-operation and Development (OECD) data indicate that teacher salaries increase with experience in many countries, whereas there is minimal difference in Türkiye between a new teacher's salary and that of a teacher with 15 years of experience (OECD, 2020). Results showed that this lack of financial incentives may also discourage teachers from staying in the profession (Demirel Yazıcı & Cemaloğlu, 2022).

Another notable result of the study was that many participants left, or considered leaving, the profession because they felt unappreciated and undervalued by society. This aligns with global trends in which the status of teaching has been declining (Borman & Maritza Dowling, 2008; Schleicher, 2019b; Welch et al., 2017). Participants believed that society perceives teachers as being underpaid and overworked, thus contributing to the decreasing attractiveness of the profession and leading teachers to seek higher-paying and more respected jobs (Goldring et al., 2014; Johnson & Birkeland, 2004; Keçeci & Kesinkılıç Kara, 2023).

A low salary and lack of compensation was underscored in the present study as key reasons of teacher attrition. Many participants, both from public and private schools, emphasized that financial struggles played a major role in their decision to leave. This result is consistent with prior research emphasizing low salary and lack of compensation as being major influences on attrition (Carver-Thomas & Darling-Hammond, 2019; Hancock & Scherff, 2010; Khawary & Ali, 2015; Loeb & Beteille, 2009; Mason & Poyatos Matas, 2015; Olsen & Anderson, 2007; Solomonson et al., 2018). However, other previous studies have suggested that low salary and lack of compensation are reasons of attrition only for teachers who are not intrinsically motivated to teach (Ashiedu & Scott-Ladd, 2012). Interestingly, this was not the case in the present study, in which the participants were generally eager to become teachers for intrinsic reasons and were thus committed to their students. However, these teachers made the decision to leave because they had serious difficulties providing for their families on a teacher's salary.

The availability of alternative career opportunities was also critical in teacher attrition. Many leavers stated that they left the profession once they found better-paying jobs, while many in-service teachers stated that they would leave for better alternatives. These findings are confirmed by certain studies, which found that having alternative job opportunities can be a reason of attrition, regardless of a teachers' initial commitment to teaching (Ingersoll, 2001; Olsen & Anderson, 2007). Moreover, previous studies suggested that having a master's degrees or specific degrees has an influence on attrition as those teachers are more sought after in the job market (Borman & Maritza Dowling, 2008; Mastekaasa, 2011; With, 2017). The results showed that, with the rise of alternative career opportunities, particularly in corporate training, publishing, or private tutoring, many teachers are looking for higher-paying and more flexible professions that allow for career progression.

With respect to periods of teacher attrition, the results of the present study showed that the attrition rate is highest in the early years of a teachers' career. This result aligns with previous studies that suggest that the first five years of a teacher's career is the riskiest period (e.g., Allen, 2005; Borman & Maritzza Dowling, 2008; Glazer, 2018; Hancock & Scherff, 2010; Huberman, 1989; Ingersoll, 2003; Ingersoll & Smith, 2003; Solomonson et al., 2018). However, unlike other studies which argue that teacher attrition has a U-shape curve, in which the highest rate is among younger teachers at the beginning of their career, the lowest towards mid-career, and increases again towards retirement (Arnold et al., 1993; Department of education and Science, 1990; as cited in Macdonald, 1999; Ingersoll, 2001), the current study found that the attrition rate decreases after mid-career. It is suggested that is largely because of the national economic instability and that teachers believe it would be difficult to find another job after so many years in a single profession. Moreover, while the job market is so unstable, and there is almost no job security in the private sector, teaching, especially in public schools in Türkiye, which is seen as a "guaranteed" civil service job, is very difficult to walk away from, particularly as many teachers have no extra savings or other income.

Finally, the results regarding career trajectories highlight how many leavers completely distanced from the profession, and so look to the better salaries, career development, and flexible working conditions available in other fields. Even those who remained in the field of education preferred alternative roles that allowed them to work with students, but outside the school context, where there are systemic struggles. This aligns with previous research arguing that attrition is often influenced by structural issues, rather than lack of passion and commitment (Ingersoll, 2001; Johnson & Birkeland, 2004).

Suggestions

This section provides several suggestions for practice and for further research based on the results of the present study and of the related literature. Firstly, the following can be suggested for practical implementation:

Improving Teacher Education and Preparation:

- The pedagogical formation certificate programs should be more selective, require higher completion thresholds, and include structured teaching practicum to better prepare teacher candidates.
- Pre-service education should provide more realistic teaching experiences, such as where in-service teachers share their experiences with pre-service teachers.
- The teaching practicum should start earlier in pre-service education and offer wider experiences in various types of school (public/private, city center/rural).

Supporting Novice Teachers in Schools:

- Schools should implement formal mentorship for novice teachers, both in public and private schools, ensuring mentors are trained and available for regular, face-to-face guidance.
- Novice teachers should receive structured support in classroom management strategies to increase their confidence and reduce stress.
- Schools/administrators should allocate tasks effectively to prevent excessive workload, ensuring that teachers focus on instruction, rather than last minute tasks and administrative burdens.

Enhancing School Conditions and Leadership:

- Where possible, class sizes should be reduced, and additional staff or auxiliary help should be assigned to classrooms with special needs students.
- School administrators must be highly qualified, and appointed based on merit, in order to create and maintain a positive school climate.
- Teachers should receive in-service training regarding their interpersonal skills, collaboration and teamwork skills to enhance collegial support and teamwork.
- Teachers should have more flexibility in instruction, course planning, and assessment methods while maintaining accountability.
- Policies should ensure that private school teachers receive fair wages and legal protections, with mechanisms to monitor compliance.
- Experienced, rather than novice teachers, should be prioritized for assignments in rural and disadvantaged areas as part of mandatory service. Teachers who originate from these regions could be given the opportunity to work in specific schools, as their familiarity with the local culture may enable them to connect with students more effectively. To make these placements more appealing, and to increase teacher motivation, a “total compensation” approach could be implemented. This might include higher salaries, housing assistance, access to counseling and psychological support, and the organization of social and cultural activities.
- Clear regulations regarding the placement of refugee students in schools should be established as a matter of urgency. These students require both academic and psychological support to facilitate their integration into the education system. Additional language courses could be incorporated into their educational program, along with tailored support programs to help refugee students better integrate.

Improving Teachers' Status in Society:

- The threshold for entering the faculties of education should be raised to ensure high-quality teacher candidates. Instead of expanding the number of faculties, existing programs should focus on quality improvements to align with national educational needs.
- Teacher salaries should be increased to improve the attractiveness of the profession and increase social status.
- Long-term workforce planning should be conducted to balance teacher supply and demand, thus considering unemployed teachers, while also ensuring that schools have sufficient teachers.

Increasing Public Awareness and Policy Transparency:

- Teacher attrition statistics both from public and private schools should be publicly available to raise awareness and inform policy decision on teacher retention.

Moreover, the following suggestions can be made for further research:

- Although teacher attrition phenomenon is frequently examined abroad, there is a limited number of studies conducted with leaving teachers in Türkiye. In order to investigate teacher attrition more thoroughly, more studies within the country's context should be conducted. Further studies with participants who possess different characteristics can also be conducted.
- Further studies examining the vastly different experiences of public and private school leavers can be conducted.

- Although there are several international studies which focus on teachers' initial commitment to teaching, the influence of initial commitment on attritions was not particularly examined in this study, and so could be further investigated.
- A further study adopting the life history method could be valuable in terms of understanding attrition through participants' personal and professional lives.
- The present study revealed that attrition is multifaceted and many interrelated factors over a teacher's career influence attrition. A further study can be conducted to build a model explaining the complex relationship of the multiple variables that lead to attrition.

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Evaluation of the professional development program for english teachers' professional development communities facilitator training course

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Abstract

The primary objective of this study is to evaluate the professional development program designed for English teachers as part of the 'English Together' project, with a particular focus on the 'English Teachers Professional Development Communities (PDCs). This study, using the Eisner Educational Connoisseurship and Criticism Model is designed as a case study. The Eisner's Educational Connoisseurship and Criticism Model offers a qualitative approach to program evaluation, emphasizing expert judgment and interpretive critique, much like the evaluation of art. The model, commonly applied in art and education, involves four interconnected dimensions: description, interpretation, evaluation, and thematic analysis -to deepen understanding of educational settings and guide educational improvement. The data were collected through interviews, observations, and document analysis and were analyzed by using the MAXQDA 2022 program. Through a content analysis, 17 themes were identified. As a result, the English Together project is considered well-structured and efficient, despite administrative issues such as the lack of project information, compulsory participant assignments, regional consistency challenges within the Ministry, insufficient financial support for project facilitators, and a lack of ministry-provided incentives or rewards.

Keywords

- English together
- Program evaluation
- Teacher education
- Professional development
- Professional Learning Communities (PLCs)

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Introduction

Organizational changes are crucial to adapt to the evolving world, and education is the key starting point. As society, technology, and individuals change rapidly, education needs to keep pace. Teachers must lead this transformation because they shape the future. Teachers are the bridge between old and new skills in schools, where learning occurs for both students and educators. With technology impacting learning and teaching methods, teachers require updated skills to effectively educate students in today's world. Professional development plays a pivotal role in empowering teachers to lead the necessary transformation in education, enabling them to acquire the updated skills and knowledge required to bridge the gap between traditional and modern educational practices amidst the rapid changes in society, technology, and individual needs. Traditional educational practices are often lecture-

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based and passive, focusing on generic, decontextualized content, while modern practices prioritize active, learner-centered engagement through collaboration, reflection, and real-world application, directly connected to classroom contexts (Darling-Hammond et al., 2017). Professional development entails endeavors directed at positively altering teachers' knowledge, attitudes, and behaviors to enhance their teaching practice (OECD, 2014). Professional development is described as a systematic process that involves planned learning opportunities and experiences, aimed at facilitating the professional growth of teachers (Guskey, 2000). According to OECD (2005), professional development activities vary and include facilitating policy reforms, task-focused development, school-based initiatives, and personally selected enrichment. In the Teaching and Learning International Survey (TALIS) across OECD countries, teachers participate in various activities such as attending courses, workshops, conferences, seminars, certification programs, school visits, networking, research, and peer observation within schools (OECD, 2014).

Teacher professional development encompasses various terms and practices aimed at continuous improvement in teaching. Continuing professional development emphasizes ongoing growth in expertise and practice. Teacher education focuses on learning experiences that enhance knowledge, skills, and practice. Training targets specific skills, such as teaching a syllabus or writing learning objectives. Mentoring involves guidance from experienced colleagues, while coaching provides structured support for skill development (Morgan & Nail, 2005). Professional learning communities facilitate idea-sharing and mutual support among practitioners (DuFour, 2004). In conjunction with collaborative learning and goal-setting, action research enables educators to engage in systematic, self-directed inquiry, facilitating the examination and enhancement of their teaching practices by addressing specific challenges encountered within their classrooms. Action research involves teachers researching their own practice to address specific issues or problems (Gibbs et al., 2017). Groundwater-Smith and Mockler (2009) emphasize that professional development involves teachers collaborating, setting their own learning goals, and constructing local knowledge. The impact of teachers' professional development on students' learning and academic achievement is supported by research (Basma & Savage, 2023; Darling-Hammond, 2010; Main & Slater, 2022; Morina et al., 2025; Rutten et al., 2024; Segal, 2024). However, it's important to note that teacher development activities vary from country to country. Based on the contextual needs and educational priorities of each region, teacher development programs can take different forms. For example, in Finland, professional development often emphasizes peer collaboration and reflective practices (Sahlberg, 2011), while in the United States, it may focus more on standardized training to align with national educational standards (Darling-Hammond, 2010). In some countries, such as Japan, teacher development is strongly linked to a culture of continuous improvement and lesson study, where teachers collaboratively analyze and refine their teaching practices through direct observation and feedback from colleagues (Fernandez & Yoshida, 2004). These variations illustrate how local educational contexts and policies shape the approach to teacher professional development.

Within the scope of in-service professional training in Türkiye, there are both voluntary and compulsory professional development seminars and courses that teachers attend. Among these activities are the compulsory professional development seminars held four times a year—at the beginning and end of each academic year, and since the 2019-2020 academic year, also during the November and April midterm breaks. These activities, referred to as courses or seminars, can be held in person or online through platforms like EBA (Educational Information Network) and OBA (Teacher Information Network), focus on enhancing teaching competencies. Teacher competence, initially focusing on practical skills, has evolved to encompass broader aspects including knowledge, values, and professional identity, with efforts emphasizing informed judgments, behaviors, and exploring cognitive and affective elements (Tran & O'Connor, 2024).

The 'English Together' project is part of the professional development program for English teachers, featuring the 'English Teachers Professional Development Communities (PDCs) Facilitator Training Course.' These communities, although termed professional learning communities (PLCs), are referred to as professional development communities by the Turkish Ministry of National Education. They aim to foster collaboration among educators to improve teaching practices and ultimately enhance student achievement (Harris & Jones, 2010; Mydin et al., 2024). A PLC refers to a group or network of individuals within the field of education who come together with a shared interest in improving schools (DuFour, 2004). This can include various combinations of stakeholders such as grade-level teaching teams, school committees, departments within a high school, entire school districts, state departments of education, national professional organizations, and others. The PLC model emphasizes collaboration, reflection, and ongoing learning among its members to drive positive change and improvement in education (Desimone, 2009). According to DuFour (2004), the widespread use of the term PLC has rendered it so common that there is a danger of it losing its original significance. As a result of this broad usage, the term has become diluted, losing its specificity and potentially causing confusion about its true meaning and purpose. When a term becomes overly ubiquitous, it can lose its effectiveness in conveying a distinct concept or practice. Professional development, as highlighted by Genç (2017), is facilitated through collaborative efforts of teacher teams within PLCs. According to Lomos et al. (2011), researchers have identified five key variables that define a PLC. These include reflective dialogue, which involves teachers engaging in professional discussions; deprivatization of practice, where teachers observe each other's classes to give and receive feedback; collaborative activity, where teachers work together within the PLC; shared goals, referring to agreement on the mission and principles of the PLC or school; and collective focus on student learning, indicating a shared commitment to improving student achievement. In the literature, numerous studies have been conducted on PLCs (Antinluoma et al., 2018; Prenger et al., 2019; Rutten et al., 2024; Tam, 2015; Truong et al., 2025; Yan & Yang, 2019; Yuan et al., 2025). Based on research findings, collaborative efforts among teachers have been shown to improve both student and instructor learning outcomes (Darling-Hammond, 2010; Datnow et al., 2012; Vescio et al., 2008).

In-service training objectives, crucial for evaluation, must be clearly defined, based on identified needs (Aydin, 2014; Clarke, 2001; Hayes, 1995). Evaluating these programs guides future training activities. Program evaluation, according to Demirel (2010), involves assessing effectiveness through data analysis to inform decisions on improvement, continuation, or termination. Yapıcıoğlu et al. (2016) stress its importance for program initiation and sustainability, while Fitzpatrick et al. (2011) highlight its role in shaping policies with meaningful insights. In contrast to traditional views in teacher education, curriculum theorizing starts by recognizing curriculum as a sociocultural creation that shapes environments, making curriculum design, content, and evaluation meaningful (Gershon & Helfenbein, 2023). Evaluation, defined as delineating and obtaining information for decision-making about educational programs, is integral to curriculum development. While various definitions highlight its pervasive nature, emphasizing understanding and worth, they all contribute to informed action and decision-making in education (Kemmis, 1982).

There are several program evaluation models that serve as a basis for program evaluation, and one of them is the Eisner Educational Connoisseurship and Criticism Model. Program evaluation studies conducted within the country have been based on the Eisner Educational Criticism Model in the literature (Çelik, 2018; Çetin, 2018; Ergin, 2021; Eyiol, 2019; Göçer, 2020; İnce & Yavuz, 2018; Karakuş-Özdemirci et al., 2020; Kumral & Saracaloğlu, 2011; Yazıcı & Taşgin, 2021; Yücesoy-Bakır, 2024). Similarly, studies conducted abroad have also been found (Craig et al., 2022; Edward, 2010; Goss, 2018; Khanipoor et al., 2017; Kime, 2008; Nordin & Wahlström, 2019; Nouri & Farsi, 2018; Service, 2014; Shahidi et al., 2014; Thompson, 2019; Watters et al., 2025). In the literature reviews conducted abroad, it has been observed that Eisner's educational critique model is predominantly utilized in the context of 'Art and Medical Education'. Eisner's Educational Connoisseurship and Criticism Model suggests program evaluation should be conducted by experts, akin to critiquing art, emphasizing qualitative aspects (Eisner, 1979). Erden (1998) underscores the importance of qualitative data collection post-

implementation. Stakeholders are considered vital sources of expertise. Program evaluation is viewed as an ongoing process integrated into all stages of program development. Eisner's Educational Connoisseurship and Criticism Model comprises four dimensions: descriptive, interpretation, evaluation, and theme (Eisner, 1979). Although distinct, these dimensions are interconnected. Description visually presents the scene, aiding critical evaluation. Interpretation delves into the meaning behind actions, addressing the 'how' and 'why' (Kumral & Saracaloğlu, 2011). Evaluation assesses educational processes, revealing underlying values. Finally, the thematic dimension identifies and formulates key messages or qualities (Eisner, 2002). In summary, the model involves describing, interpreting, evaluating, and identifying themes to understand and critique educational settings effectively. In his examination of educational criticism, Eisner (1979) questions the possibility of generalizing findings from such studies. While criticism doesn't predict outcomes, Eisner suggests that it can serve as a roadmap for the future by generating forms of anticipation.

This research aims to assess the effectiveness of the 'English Teachers Professional Development Communities (PDCs) Facilitator Training Course' within the 'English Together' project for English teachers. It focuses on evaluating how well the program meets teachers' needs, identifying strengths and weaknesses for improvement. Importantly, it addresses the gap in literature by applying Eisner's Educational Connoisseurship and Criticism Model to professional development program evaluation, contributing to future initiatives led by the MoNE. Evaluating the professional development program for English teachers within the 'English Together' project is vital for enhancing teaching quality and learning outcomes. Focusing on English teachers acknowledges their unique needs in language instruction. Given the evolving education landscape, continuous improvement of professional development is crucial. Applying Eisner's model fills a gap in literature and offers insights for policymakers and educators to enhance training effectiveness and student education quality. In this context, the following research questions were addressed:

- RQ1: What are the opinions of program stakeholders regarding the PDCs Facilitator Training Course, a professional development program?
- RQ2: What are the experiences of stakeholders regarding the PDCs Facilitator Training Course, a professional development program?
- RQ3: What are the limitations and areas for improvement of the PDCs Facilitator Training Course, a professional development program?

Method

Study design

This study aims to evaluate the professional development program implemented within the 'English Together' project according to Eisner's Educational Connoisseurship and Criticism Model. The study is designed as a case study in which the professional development program will be examined in-depth according to the stages of the model. Yin (2018) and Stake (1995) find the case study approach suitable and functional for program evaluation. However, Stake provides a clearer perspective and defines the program as a situation with its own limitations, providing flexibility for methodology and research design (Karakuş-Özdemirci & Akar, 2022). In this context, a holistic multiple case design was used to identify the unique structures of the professional development program considered as a case. In this design, facilitator trainers who provided the English Teachers PDCs Facilitator Training Course, facilitator teachers who completed the course, and participant teachers who attended the seminars conducted by these teachers have created multiple cases.

Data sources

The data sources for the research include the Facilitator Training Course for professional development, seminar programs, teachers (facilitators and participants), observed classrooms, and trainers involved in in-service training. A facilitator is an individual who has completed in-service training, such as the 'English Together' project, and is responsible for guiding and supporting professional learning communities (PLCs) within their respective provinces. Facilitators play a crucial role in fostering collaboration, sharing best practices, and providing ongoing professional development to their peers, ensuring the effective implementation of the project at the local level. Although the term 'facilitator' is commonly used in the literature in Türkiye, the individuals in question are assigned the role of 'implementer' within the scope of this project; therefore, the term 'implementer' has been preferred instead of 'facilitator' in this study. Also, teachers who attended the seminars are referred to as participants in this context. In-service training trainers were selected as data sources to obtain information about the development and implementation processes of the professional development program. Both interviews and observations data were collected from the primary data source, which is the English teachers who participated in the Facilitator Training Courses and seminars. Participant selection aimed to maximize diversity by considering factors such as the teachers' gender, professional experience, school level, educational background, and whether they were involved in a project. Within the scope of this study, interviews were conducted with facilitators from 15 different provinces and participant teachers from eight different provinces. In addition, the opinions of eight foreign teacher trainers working at the British Council were also obtained via e-mail. In total, qualitative data were collected from 31 participants. The data collection process began with examining the professional development program and developing interview and observation forms based on the obtained data. Interviews lasting 10-15 minutes were conducted with the facilitator and participant teachers, while data were collected via e-mail with the British Council trainers. Classroom observations and facilitator seminars were carried out in Batman and Denizli provinces. In total, 18 observations were conducted: eight seminar observations involving two facilitators from primary and middle schools and four from high schools, each delivering 90-minute sessions; and ten classroom observations of English teachers, including 2 from primary schools, 3 from middle schools, and 5 from high schools, each teaching 40-minute lessons. Observations were conducted in the classrooms after each seminar, and were completed within approximately 8 months according to the seminar schedules.

Data collection tools

Data collection involved interviews, observations, and document analysis, with separate interview forms prepared for each data source: teachers who received trainer training (facilitators), participant teachers, and course trainers. These forms were developed using relevant literature and expert opinions, then revised based on feedback and pilot interviews. The final interview forms contain 12 questions for facilitators, seven for participant teachers, and nine for British Council trainers. Some sample questions are as follows:

- What do you think are the significant features of the PDCs Facilitator Training Course program?
- What contributions do you think the seminars you attended have made to your teaching process?
- What are your thoughts on the content of the PDCs Facilitator Training Course program?
- Did you encounter any difficulties during this process, and if so, can you provide an example?

To obtain data related to the professional development program, two observation forms were prepared. These forms were designed to observe and gather data on the experiences of facilitators who completed the PDCs Facilitator Training Course with trainee teachers and by determining the situations where teachers who received educator training reflected the experiences they gained from the seminars they attended to their own classroom environments. Structured into five sections, these forms focused on warm-up, review, engage and share, reflect and evaluate, and closing of the teaching process. Seminars by facilitator teachers followed a Ministry-provided plan template, with notes taken

accordingly. To provide a comprehensive understanding of the program and its implementation, the content of the in-service training was also analyzed as part of the document analysis. The Professional Development Communities (PDC) program for English teachers is designed to support teachers' professional growth through collaboration and reflective practice. Within a total of 70 hours, the program covers various components, including activities focused on enhancing reflective thinking skills, and improving the teaching of core language skills such as writing, listening, speaking, and reading. It also includes sessions on grammar and vocabulary instruction, as well as effective assessment and evaluation practices. Teachers are introduced to the structure and goals of PDCs and are encouraged to collaborate with peers to share experiences and strategies. Additionally, the program promotes the integration of educational technologies, particularly the use of platforms like EBA for organizing online meetings and sharing materials. Overall, the PDC program combines theoretical and practical elements to help English teachers strengthen their teaching practices and foster a collaborative professional culture.

Data analysis

Before data analysis, the interviews and observations were transcribed into a digital format. The total length of the interview transcriptions was 113 pages, and the observation records amounted to 44 pages in Word documents. During the data analysis process, the MAXQDA 2022 qualitative analysis software was used. The data from various sources were analyzed using content analysis. After transcription, the process of familiarizing with the data was initiated. Initially, one of the researchers read all the data holistically several times, and the data obtained from interviews, observations, and documents were coded separately. Themes were developed using the MAXQDA 2022 program. In the second stage, the meanings of the codes and themes obtained from different sources were discussed with another researcher to identify similarities and differences. In the final stage, the codes and themes obtained from the three data sources were merged to create a comprehensive perspective. An example of coding is presented in Table 1.

Table 1. Coding Example

Text	Codes
I believe the most important feature of these communities is that they regularly bring together teachers from the same region and provide an opportunity to discuss their common problems. This is the key feature of these courses. (FT3) However, during the training, some facilitators did not follow our agreed-upon schedule. They decided to conduct different activities and set the break times differently. (CT7)	Finding common solutions to problems. Disharmony
I am in favor of diversifying the content of the seminars. (PT7) When asked about the purpose of the meeting, the group members responded similarly, saying, "We were just told that we would be meeting every month and discussing a different topic each time—that's all I understood." (ONF3)	Content oriented Lack of understanding of the PDC
It was noteworthy that classroom activities were heavily exam-oriented, and both teachers and students frequently used expressions such as "this might appear on the exam" or "if this happens, remember this" during the lessons. (ONT2)	Focus on the LGS

In Table 1, a coding example for each data source is provided, offering a clear illustration of how the collected data from interviews and observations were analyzed and categorized. Each example demonstrates the process of linking specific data excerpts to relevant codes, ensuring transparency in how the data was handled and interpreted during the analysis phase.

Validity and reliability

The research employed various data collection methods (interviews, observations, document analysis) and diversified data sources (teachers, trainers, course program) to enhance credibility. After data collection and analysis, member checking was conducted to validate the findings. Additionally, expert opinions were sought for the data collection tools. Purposive sampling and detailed descriptions

of participants and the context were provided to ensure transferability. To ensure consistency, variation was introduced by using different data collection methods and sources. Inter-coder agreement was established, and for confirmability, the research purpose, methodology, and findings were presented in detail. Codes such as FT (Facilitator Teacher), CT (Course Trainer), PT (Participant Teacher), ONF (Observer Notes for Facilitator), and ONT (Observer Notes for Teacher) were designated to represent roles, while participants were allocated pseudonyms like FT, CT, PT, etc., following the privacy policy, as indicated in the citation. The research has been approved by the Ethics Committee of Pamukkale University with the meeting/decision number 17-10 dated 12.10.2022.

Results

Eisner (1998) does not provide a specific formula for the structure of educational criticism and leaves it to the personal preference of the critic. He bases this attitude on his belief that research is dependent on the researcher's personal style and qualities and that the course of the study cannot be predicted with certainty. The findings obtained as a result of the research are presented within the framework of the four dimensions of the Eisner Educational Connoisseurship and Criticism model, collectively across groups, without making distinctions between them.

Descriptive

The explanatory aspect of educational criticism is primarily an attempt to determine, describe, or convey the relevant qualities of the educational experience (Eisner, 1998). In this dimension, themes and codes reached through interviews, observations, and document analysis are attempted to be explained by providing relevant quotations for the reader to visualize. The themes reached for the descriptive dimension are shown in Figure 1.

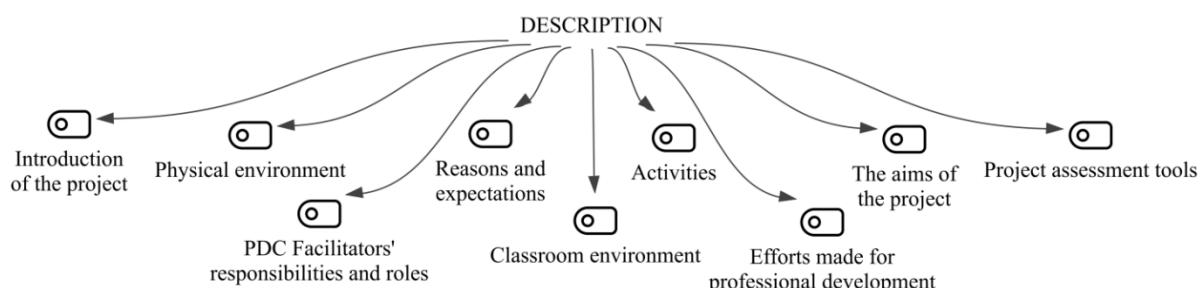


Figure 1. Themes for the descriptive dimension

Introduction of the project

The 'English Together' project, launched in 2020 through collaboration between the Ministry of National Education, the British Council, and the Sabancı Foundation, began with initial contact between the Ministry and the British Council in 2018. The project aims to enhance foreign language teaching and learning through in-service training activities. This includes the 'English Teachers Professional Development Communities (PDCs) Facilitator Training Course' and subsequent seminars. Document analysis identified two sub-themes: 'seminar' and 'course,' under the project's introduction theme. The course aims to enhance the professional development of Ministry-affiliated English teachers by improving their knowledge and skills. As such, it includes all English teachers working in these schools, such as those in vocational schools, Anatolian high schools, lower secondary school and other types of institutions. It covers General Competencies of the Teaching Profession over 70 instructional hours, taught by British Council trainers. Classes are limited to 25 individuals and conducted in a hygienic, socially distanced environment. The content is structured under specific headings and delivered using active learning methods, with assessments including assignments and presentations. Seminars cover similar topics in a four-hour duration, accommodating up to 30 participants and led by facilitators trained in the English Teachers PDCs program. All sessions adhere to hygiene and distance regulations, ensuring optimal learning conditions.

Physical environment

The physical environment, observed during seminars and in classrooms, is crucial for project implementation. Two sub-themes emerged: Seminar Environment and Classroom Environment, highlighting its importance. Participants had mixed opinions on the seminar setup, with PT2 finding it adequate while PT4 suggested a classroom setting would be better. Both seminar rooms and classrooms had smartboards, but cleanliness and temperature varied. Classroom sizes ranged from 12 to 37 students, leading to fluctuations in noise levels.

Efforts made for professional development

Professional development is vital for teachers, enhancing student service, learning outcomes, and professional skills. It also elevates teacher motivation, confidence, classroom experiences, and ultimately improves student education. The codes related to efforts made for professional development are depicted in the Figure 2.

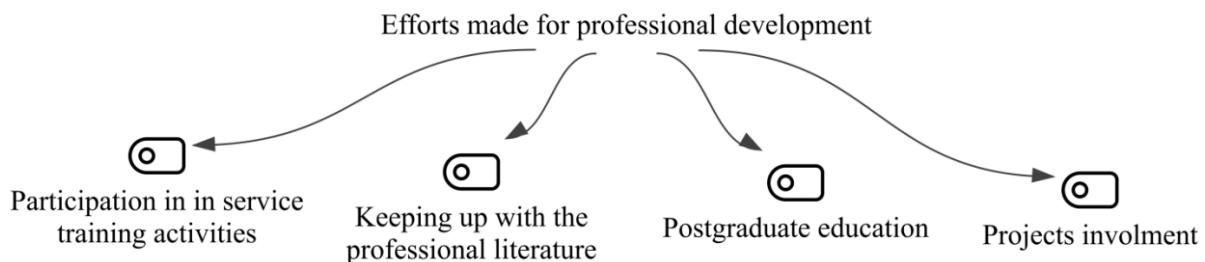


Figure 2. The codes related to efforts made for professional development

Regarding the efforts made for professional development, FT1 participates in in-service training, FT10 follows online publications, and FT3 stands out with postgraduate achievements. Additionally, FT7 was involved in e-Twinning projects. Teachers engage in professional development through training, literature review, MA programs and postgraduate education such as curriculum development and instruction, measurement and evaluation in education, English language teaching etc. and project participation.

The aims of the project

The project aims to enhance English teaching in Türkiye by introducing new practices, employing communicative language teaching, and fostering teacher collaboration and experience sharing for greater effectiveness. The codes obtained from the data are presented in the Figure 3.

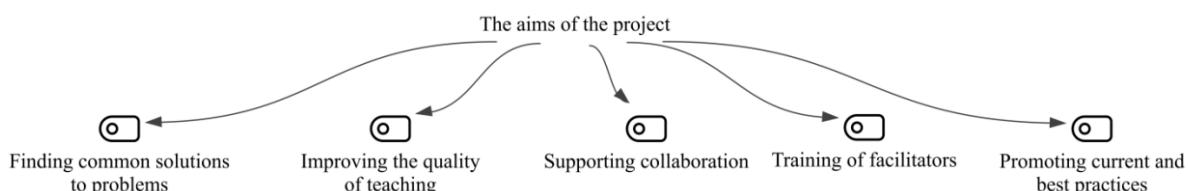


Figure 3. The codes related to the aims of the project

Participants highlighted the project's aim of finding common solutions to problems in English teaching. FT10 emphasized this goal, stating it's about generating common solutions to professional problems. FT8 expressed the intention to change teaching methods to make students more active and central, aiming to improve teaching quality. CT7 highlighted the project's focus on providing trainers with effective teaching methods to promote best practices.

Project assessment tools

Assessment tools serve crucial roles: monitoring progress, evaluating teaching effectiveness, offering feedback, guiding teaching, and ensuring accountability. The codes obtained based on the data from the participants regarding the theme of project assessment tools are presented in the Figure 4.

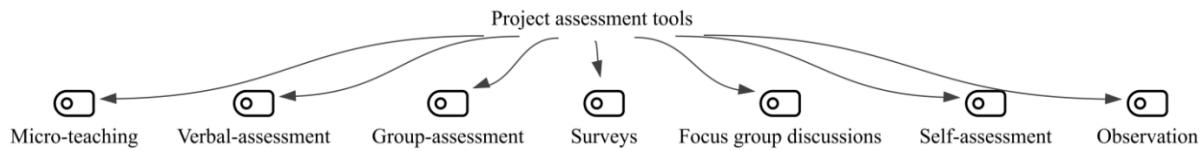


Figure 4. The codes related to the project assessment tools

In terms of project evaluation techniques and tools, they include microteaching, verbal assessment, group assessment, surveys, focus group discussions, self-assessment, and observation. FT10 mentioned that verbal assessment was conducted with the following sentences: 'They took notes about us. They provided feedback. Later, they decided if we were qualified to be facilitators'. The responsibilities of the facilitators include managing Professional Learning Communities (PDC), designing educational materials, integrating technology, and supporting professional development. For example, managing PDC meetings and creating educational content to support teachers' professional development are specified in the course program. Additionally, designing activities for students, digitalizing activities using educational technologies, and designing content related to the four language skills, vocabulary, and grammar instruction are also among the facilitators' responsibilities. CT1 stated, 'British Council trainers communicate their feedback to the Ministry through a focus group...' indicating that a focus group discussion was conducted for the project.

Reasons and expectations

Expectations and reasons drive motivation, shape perspective, foster collaboration, aid in evaluating success, and support personal development and learning. The codes formed under the theme of reasons and expectations are illustrated in the Figure 5.



Figure 5. The codes related to reasons and expectations

Participants joined the project for various reasons, with professional development being the most common motivation. FT9 and CT5 sought opportunities for professional growth, while PT8 attended involuntarily. FT12 was attracted by the involvement of stakeholders, and CT4 saw it as a chance to expand their professional network. Overall, reasons for participation included professional development, excitement about the project, , knowledge refreshment, collaboration, and network expansion, although some attendees mentioned compulsory attendance.

Classroom environment

The classroom environment is crucial for the success of the study, with codes highlighting its importance in achieving desired project outcomes, are shown in the Figure 6.

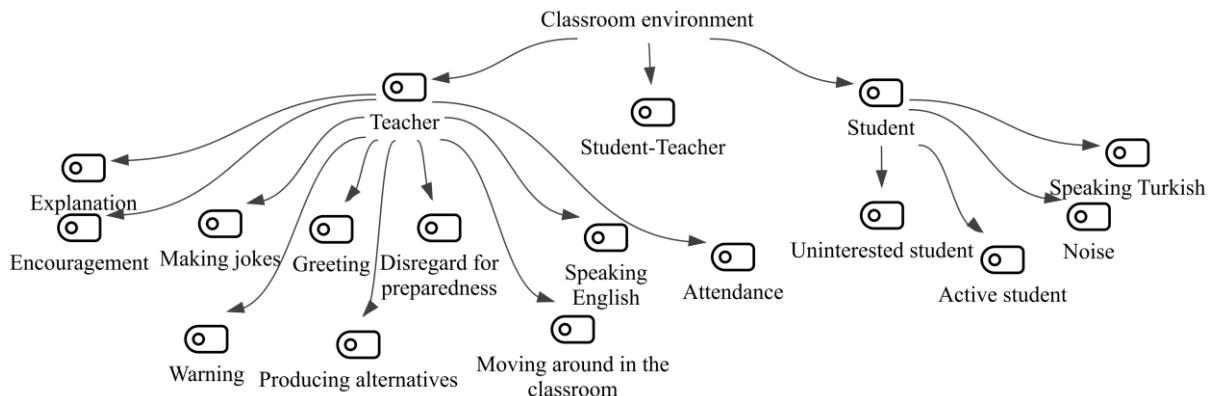


Figure 6. The codes related to classroom environment

Observations in classrooms revealed teachers providing explanations, encouraging student participation, and showcasing creativity by producing alternatives. Some students showed disinterest, while others actively participated. Noise and Turkish language use were observed. Student-teacher interaction involved question-and-answer dynamics, with teachers engaging students in activities.

Activities

Observation notes on facilitators' activities in seminars and participants' activities in their English classes are presented under the activities theme, encompassing warm-up activities, engage and share activities, reflect and evaluate activities, review activities, and in-class implemented activities. Facilitators in seminars followed the lesson plan template provided, conducting various activities such as two truths and a lie, snowball, my personal star for warm-ups. Engage and share involved jigsaw reading, gallery walk etc. Review sessions used a parasite game, while reflection and evaluation utilized an onion ring and gallery walk. Among participants, using books was a common classroom activity. Some applied seminar-learned activities like the parasite game, while others adapted these methods, such as ball throwing, to suit their classrooms.

PDC facilitators' responsibilities and roles

Trained PDC Facilitators conduct seminars nationally in their institutions or districts following Ministry-provided topics and schedules, assuming specific responsibilities. The codes related to this theme, obtained from seminar observations, are presented in Figure 7.

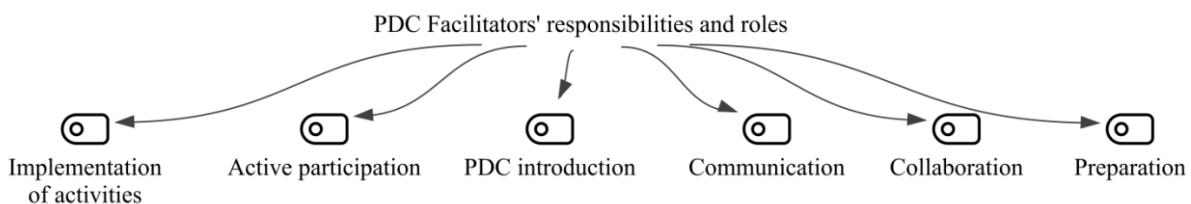


Figure 7. The codes related to PDC facilitators' responsibilities and roles

During observed seminars, facilitators implemented activities demonstrated during training or presented during the seminar. For example, one activity involved participants writing sentences or words about themselves on paper and trying to find the owner when the music stopped. Active participation was evident, with participants reflecting on questions and continuing activities accordingly. The introduction of the PDC was evident during initial seminars, with facilitators actively engaging with groups and demonstrating preparedness by following lesson plan templates.

Interpretation

Eisner (1998) emphasized that in the interpretive dimension of educational criticism, behaviors, activities, and meanings are revealed, drawing parallels with Geertz's (1973) concept of 'thick description' in anthropology. Themes based on participants' interpretations within this framework are presented in Figure 8.

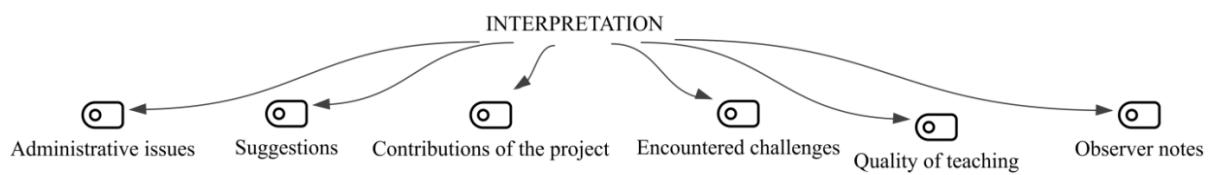


Figure 8. The themes for the interpretation dimension

Administrative issues

Administrative issues can hinder project success, necessitating early identification, effective communication, planning, monitoring, skill development, and risk mitigation. Interview-derived codes related to this theme are presented in Figure 9.

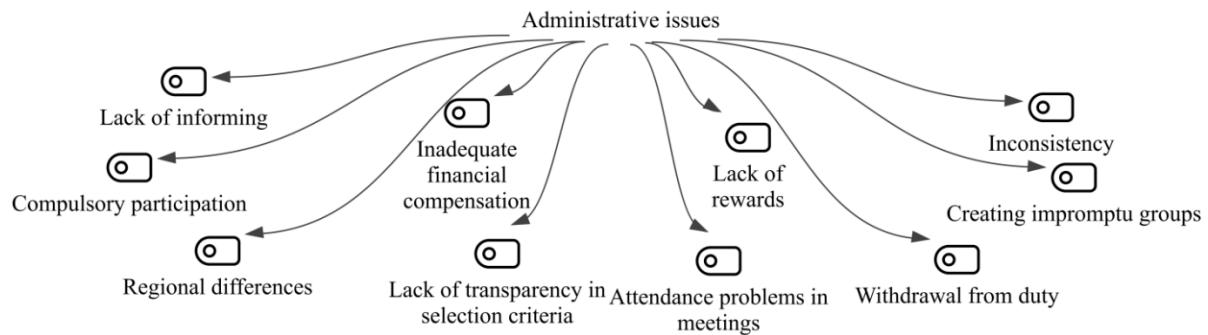


Figure 9. The codes related to administrative issues

Participants highlighted various issues, notably the lack of information, as FT8 emphasized: 'If there had been such a thing at the beginning, I wouldn't have participated as a facilitator...' FT5 pointed out inadequate financial compensation, stating: 'We currently receive payment for four hours for a PDC. We all know it's a very modest and symbolic amount...' Additionally, FT11 highlighted regional disparities, noting inconsistency among provinces: 'MoNE should not allow each provincial administration to act arbitrarily in this regard...' FT7 expressed dissatisfaction with the lack of recognition: 'No one appreciated me or thanked me. I'm not receiving anything' Moreover, compulsory participation was evident in observation notes.

Suggestions

Interview-derived codes, fostering an open environment for improvement ideas, are outlined in Figure 10 under the theme of suggestions, vital for bolstering project sustainability and success.

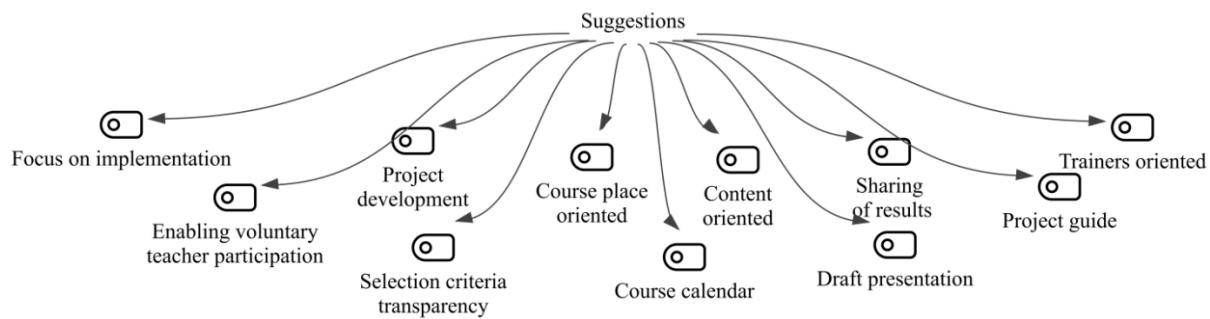


Figure 10. The codes related to suggestions

Practical suggestions emerged from the interviews, with participants recommending improvements to the seminar structure and content. CT5 suggested allocating a full day for grammar and vocabulary sessions to allow for more in-depth learning. PT5 expressed a desire for longer, more frequent seminars with interactive assignments. FT8 emphasized the importance of voluntary participation, advocating for seminars with volunteer teachers. FT7 proposed a follow-up to the project, suggesting its expansion into something more extensive. Other recommendations included diversifying seminar content, providing draft presentations for facilitators, creating a project promotion guide, reporting outcomes, and appointing expert trainers in various fields.

Contributions of the project

The codes related to the theme of a project's contributions, affecting participants, stakeholders, and society positively, were gathered from interviews and observations, as detailed in Figure 11.

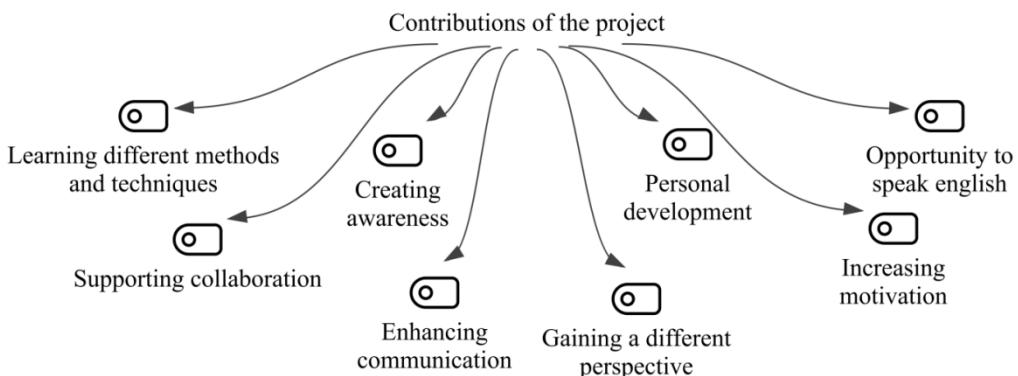


Figure 11. The codes related to contributions of the project

Regarding learning different methods and techniques, FT7 stated, 'As a teacher, it helped us learn different activities, approaches, and methods.' FT12, in explaining the project's name 'English Together,' emphasized the role of collaboration, saying, 'We were together, we did everything together. Its guiding qualities were very good.' FT15 expressed that the project created awareness, saying, 'It helped us change our style a bit. It raised awareness. I found it very beneficial as it raised awareness for both students and teachers.' FT7 expressed, 'It helped me expand my network. For example, whether they were in middle school or roommates, they were high-quality people. We still keep in touch with friends we received training with. We share our monthly updates, what each of us is doing in the group. My network has improved significantly, thanks to this project. Some friends are doing different things through this network.' They also noted that it contributed to enhancing communication. The contributions reflected on by teachers include personal development, gaining a different perspective, motivation due to the involvement of various stakeholders in the project, and the opportunity to speak English.

Encountered challenges

The codes related to managing project challenges for sustainability, goal attainment, and reducing negative impacts are listed in Figure 12.

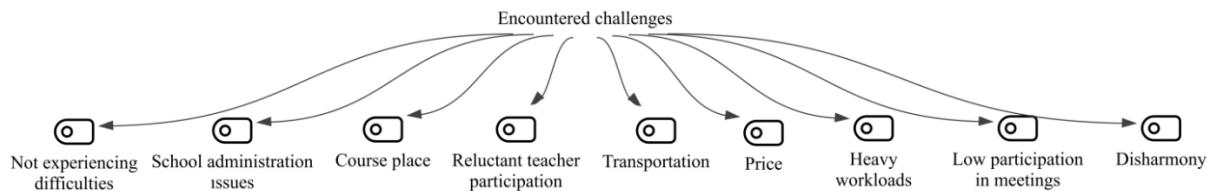


Figure 12. The codes related to encountered challenges

Based on the interviews FT12 reported no challenges before or during training, while FT15 faced obstacles with school administrators, leading to some teachers being unable to attend. FT7 noted, 'The only drawback was that the city was very cold; another city could have been chosen.' expressing concerns about the training location. Challenges related to internet access, meal quality, and institute administration were also mentioned. British Council trainers faced heavy workloads, low participation in meetings, and disharmony among trainers, with CT7 stating, 'Some trainers didn't use our common schedule...' indicating that there was a disharmony.

Quality of teaching

Post-project observations focused on teachers applying learned techniques in classrooms, revealing the teaching quality theme, with associated codes listed in Figure 13.

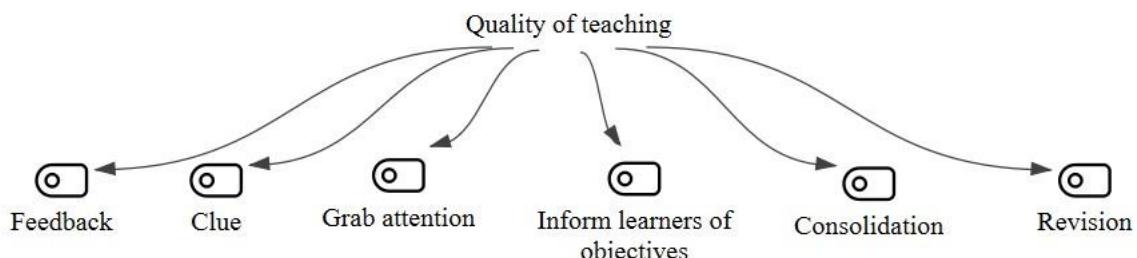


Figure 13. The codes related to the quality of teaching

Observations of trainee teachers' English lessons identified factors contributing to classroom teaching quality. Feedback provision was noted, as students were corrected and explanations were given when needed. However, instances lacking feedback were also observed, where clues were provided instead. Efforts to engage students, such as asking about the lesson topic, were noted as well. Overall, factors such as clear lesson objectives, consolidation, and review were found to enhance teaching quality.

Observer notes

The observer noted observations from both seminars and participant teachers' classrooms post-seminars, adding personal comments. Analyzing these notes revealed the observer notes theme, with corresponding codes in Figure 14.

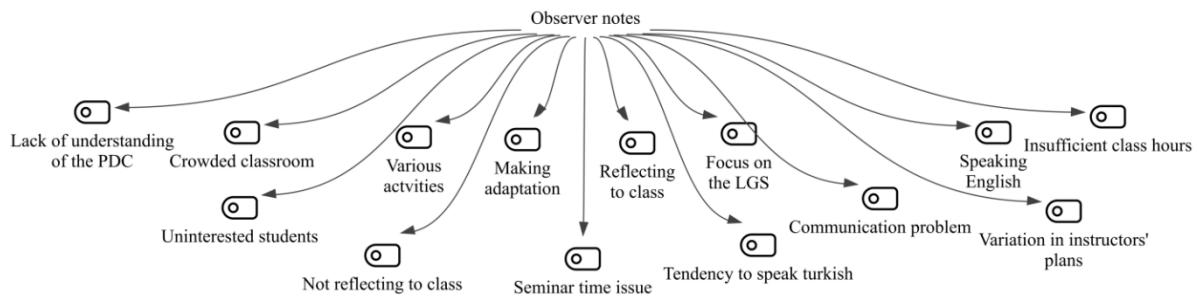


Figure 14. The codes related to observer notes

Observation notes highlight various challenges and adaptations in the context of teacher training. Issues such as lack of understanding of the PDC, crowded classrooms hindering student participation, and student disinterest were observed. Facilitators incorporated course content into seminars, leading to adaptation of activities by teachers in their classrooms. Trainee teachers focused on preparing students for the High School Transition Exam (LGS) and faced communication challenges, particularly with immigrant students present. Despite efforts to use English in the classroom, there was a tendency to revert to Turkish. Timing issues with seminars held after school hours were noted, as well as variations in activities and distractions when seminars were conducted simultaneously. This led to participant teachers selecting seminar classes based on the facilitator.

Evaluation

Eisner's approach emphasizes evaluation as integral, demanding expertise in assessing educational events. He contends that differing critic perspectives on educational events aren't a drawback but a potential strength (Eisner, 1998). Interviews yielded two themes within the Evaluation dimension: Positive and Negative aspects of the Project.

Positive aspects of the project

Positive aspects are crucial for gauging participant satisfaction and project success. The codes related to this theme are shown in Figure 15.

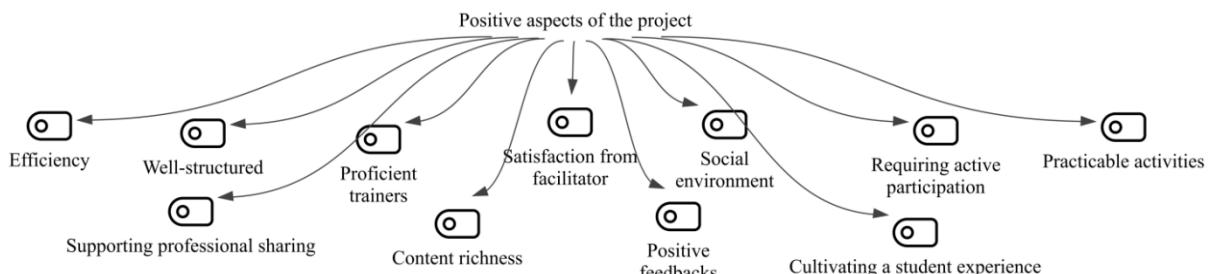


Figure 15. The codes related to the positive aspects of the project

The project is frequently mentioned as an efficient one by the participants, facilitators, and trainers. FT15 emphasized its effectiveness stating, 'I've been a teacher for 12 years, and this was the most fantastic professional development I've ever seen...'. The presence of knowledge sharing in the project highlights its support for professional sharing. It indicates that the project is well thought out, well-planned, and well-structured. FT3 stated, 'Because it is possible for every teacher to apply the knowledge or methods they have learned in their classrooms,' indicating the inclusion of practicable activities. Other positive features include the requirement for active participation during activities and cultivating a student experience.

Negative aspects of the project

Assessing the project's drawbacks is crucial for gauging its effectiveness and success, identifying strengths, weaknesses, and areas for improvement. The codes related to this theme are presented in the Figure 16.

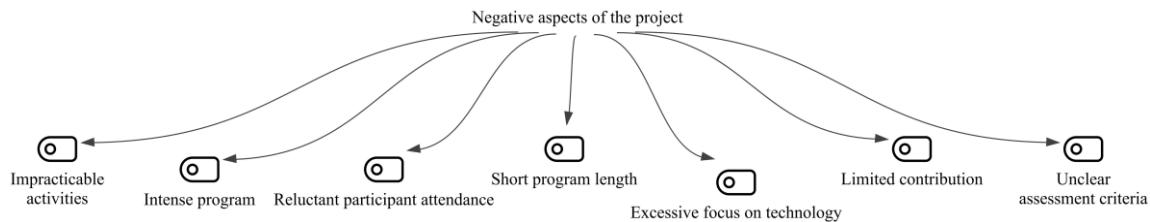


Figure 16. The codes related to the negative aspects of the project

Regarding the inclusion of impracticable activities, FT13 stated, 'There were also pieces of information that were far from being applicable, which everyone couldn't apply in their schools. In today's conditions, there were activities that couldn't be implemented in any type of school, especially in big cities like Istanbul, Izmir, Ankara, or in western or rural schools.' FT11 described the program's intensity. FT13, in contrast, mentioned that the short program length could have been a bit longer. Educators also expressed negative views on the allocation of the entire afternoon to technology, highlighting an excessive focus on technology. Reluctant participation due to participants being assigned involuntarily, limited contribution, and unclear assessment criteria are also among the negative aspects.

Themes

As described by Eisner (1979), themes 'provide a summary of essential characteristics' (p. 104). Themes are general ideas or conclusions drawn from the observed situations, summarizing the significant features or characteristics of that situation, and they represent an effort to identify common and significant connections among observed processes (Eisner, 1979). The themes reached through the analysis summarize the significant features and processes of the project. Themes highlight various common points, contributing to the identification of the main focus of the critique. In this study, analysis of documents, interviews, and observations identified 17 themes. These themes include introduction of the project, aims of the project, efforts made for professional development, reasons and expectations, physical environment, activities, project assessment tools, PDC Facilitators' Responsibilities and Roles, classroom environment, observer notes, quality of teaching, contributions of the project, administrative issues, positive aspects of the project, negative aspects of the project, encountered challenges, and suggestions.

Based on the data obtained from the participants and observations in the study, the theme with the most codes is Positive Aspects of the Project (138). A project with positive aspects enhances success, increases impact, motivates participants, boosts its reputation, and serves as an exemplary model. These aspects enhance the project's societal impact, improve the participants' experiences, and provide learning for future projects. The theme 'Introduction of the project' (129) ranks second in frequency after document analysis. Administrative Issues (128) is among the themes with the most codes, indicating challenges or issues arising in the project's management process. The theme 'Suggestions' (99) also has a high frequency, derived from discussions with participants. Recommendations are critical for the success and impact of the project. They improve project performance, offer creative solutions, drive progress, increase stakeholder engagement, mitigate risks, and better tailor the project to the target audience. The theme 'PDC Facilitators' Responsibilities and Roles' (80) clarifies the roles of facilitators, including implementing activities, providing explanations, and collaborating. Physical Environment (79) and Classroom Environment (78) are derived from observations. Negative aspects of the Project (63) are characteristics that limit the project's impact, hinder its progress, and affect its success. The theme Project Assessment Tools (31) had the fewest codes, and these tools provide insights into how the project is evaluated.

Discussion

In this study, the evaluation of the professional development program implemented within the scope of the 'English Together Project' was conducted according to the Eisner Educational Connoisseurship and Criticism Model. A successful teaching process can be analyzed from two perspectives: the aspect of educational planning systems and the aspect of the learning environment (Eisner, 2002). These two perspectives help to provide a more comprehensive analysis by evaluating different aspects of the teaching process. The analysis indicates that the results are consistent across all groups.

Studies confirm that schools functioning as PLCs can be compared globally and locally, but various contextual factors like culture, education, regulations, and regional differences must be recognized (Lomos, 2017). Based on the findings obtained in the descriptive dimension, it was concluded that the purpose of the professional development program is to support professional development. The fact that teachers participated in this project to support their professional development aligns with the program's purpose, as indicated by their reasons for participation. This result is consistent with prior research (Desimone et al., 2002; Kalinowski et al., 2019; Liu & Phelps, 2019; Yurkofsky et al., 2019). In contrast, Başkan (2001) found that, according to participating teachers, some programs fell short of their ideal objectives. The beginning stages of teacher training seem to be essential for the cultivation of pedagogical skills (Oosterhoff et al., 2020). These results underscore the importance of professional development programs in motivating teachers to continuously improve and their role in enhancing the quality of education. According to Theresa (2021), a collective vision positively impacted the work of members and led to sustainable enhancement of the overall organization.

In the descriptive aspect, it's clear that teachers are actively engaged in professional development, with a strong focus on in-service activities and postgraduate education. The accessibility of postgraduate education, especially through distance learning, and the benefits it offers, such as exemptions from exams, have fueled this interest. According to Niemi (2015), ongoing professional development through in-service training is an effective way for teachers to refresh and improve their skills in the field. It allows teachers to continually update their knowledge and teaching practices to better serve their students. On the other hand, a productive PLC effectively encourages its members to take ownership of their colleagues' professional development (Grossman et al., 2001).

One of the results obtained in the interpretive dimension is that the English Together Project is described as a well-structured and efficient project. According to the findings, the reasons underlying the efficiency of the project include sustainability and the involvement of various stakeholders that support collaboration. Starting as a course and continuing with seminars, the support process has persisted. Effective professional development should also include peer coaching and other follow-up methods (Bull & Buechler, 1996). Quality professional development involves three key elements: content knowledge, effective learning opportunities, and alignment with other activities (Hirsch, 2001). In contrast, Büyükcanc (2008) concluded in his study that teachers experienced difficulties due to poorly structured seminar programs. Güngör (2023) reached the opposite conclusion, stating that coaching programs were not very effective. Similarly, there are studies in the literature where teachers have negative opinions about professional development activities (Çiftçi, 2008; David & Bwisa, 2013; Güngör, 2023; Woods et al., 2007). Oturak-Eyecisoy (2014) stated in her study that social studies teachers were uncertain about the adequacy of in-service programs and were indecisive. O'Donahue (2012), Hong (2012), Martinsone and Damberga (2017), Pozo-Rico et al. (2020) have similarly found that in-service training programs were effective, and teachers applied them in their classrooms. Arranging in-service training programs for teachers is identified as a crucial requirement (Sakkoulis et al., 2018). These activities offer vital chances for teacher development, improving pedagogical skills and embracing modern educational approaches. Tailored in-service training programs effectively enhance teacher performance, highlighting the need for educational institutions to strategically plan and implement quality training. Tam (2015) discovered that teaching underwent changes across five dimensions, encompassing curriculum, teaching methods, learning approaches, roles of teachers, and the process of

learning to teach after PLC. Within these areas, three patterns of change emerged: modifications solely in practice without concurrent shifts in beliefs, alterations in beliefs without corresponding changes in practice, and changes occurring in both practice and belief concurrently.

The fact that the project supports professional sharing is indicated by its positive aspects, such as having competent trainers, rich content, containing practical activities, and requiring active participation. This result was revealed in the evaluation dimension. The characteristics of the project, such as the participants being unfamiliar with the professional development community model or the project being supported by different stakeholders, and the use of English during the courses and seminars, may have contributed to this result. Studies like Kalogiannakis (2010), Omar (2014), Huhtala and Vesalainen (2017), Pieters and Kapenda (2017), and Kalkan (2019) stress tailoring content to participants' needs. Öztürk and Öztürk (2019) highlight the lack of qualified trainers as a major training issue. Eisner (1979) underscores the necessity of specialized knowledge for educational critique and research to comprehend and enhance classroom practices. This perspective emphasizes not just understanding but also critically evaluating and improving classroom experiences, emphasizing expertise's role in effective criticism and research in education.

In the evaluative dimension, alongside positive aspects, negative aspects were identified, including impractical activities, an intensive course program, and unwilling participants, all impacting the project's effectiveness. Reasons for non-implementation of activities may include overcrowded classrooms, lack of internet access, and insufficient tools and equipment. The intensity of the course program may stem from the project's expansion across Türkiye, requiring consecutive training sessions. Unwilling participants pose a significant obstacle to achieving project goals. Effective learning occurs when participation is voluntary, aligning with Arslan's (2015) findings on compulsory seminar attendance. Martinez (2016) and Zieher et al. (2021) also highlight challenges in achieving desired outcomes in professional development programs, emphasizing the need for continuous support. Meesuk et al. (2021) found similar results to this research, highlighting that despite challenges stemming from procurement regulations leading to irrelevant processes, the professional development funded by a government organization in Thailand underscores the importance of policy coherence and stakeholder acceptance. Nevertheless, the process remains beneficial, particularly in supporting teacher learning, with identifiable steps for improvement.

One of the findings in the descriptive dimension is that microteaching was used as an assessment tool in the course component of the project, and e-certificates were provided in the seminar component. Microteaching can contribute to teachers' more effective, secure, and student-centered teaching. Kalkan (2019) and Karasolak et al. (2013) advocate for practical exams in training programs. Gathering participant feedback and evaluating programs are crucial to enhancing future training quality. Jung (2001), Kim et al. (2008), and Du-Plessis and Webb (2012) stress the significance of incorporating participant opinions for evaluating and improving these programs.

In the interpretative dimension, administrative issues were identified, including lack of project information, compulsory participant assignments, regional coherence challenges, insufficient financial support for coordinators, and absence of ministry rewards. These issues may stem from evolving project structure and communication gaps, impacting project management. Lack of communication, unclear goals, and resource management issues contribute to these challenges. Maya and Taştekin (2018) found various methods used to encourage participation in professional development activities, emphasizing the positive impact of incentives like rewards and financial support, as highlighted by Berry and Eckert (2012). Huijboom et al. (2021) emphasized the importance of tailored support and facilitation to foster the growth of within-school PLCs. Their study highlights the diverse developmental pathways these PLCs traverse across two academic years and underscores the ongoing exploration of factors influencing PLC development within the school context. Truong et al. (2025) found that building effective Professional Learning Communities (PLCs) requires active involvement from key stakeholders-principals, academic leaders, teachers, and policymakers-who should collaborate to provide leadership, support, professional development, and necessary resources.

In the interpretative dimension, the project's contributions include providing teachers with opportunities to learn diverse methods and techniques, collaborate, raise awareness, and improve communication with colleagues. As proposed by Richards and Farrell (2012), effective professional development addresses both institutional and individual goals. The project's focus on fostering professional development communities aligns with this idea, emphasizing collaboration, student learning enhancement, and specific goal achievements. Collaborative opportunities, emphasized by Joyce and Showers (1983), encourage relationships, shared experiences, and informal discussions on common issues. Within a collaborative environment, interactions facilitate joint planning and idea exchange, valuing each teacher's role in the school community (Bull & Buechler, 1996). Meesuk et al. (2021) found that in Thailand, the Professional Learning Community (PLC) program has been implemented for over four years to promote sustainable professional development among in-service teachers. This sustainable development initiative has been widely adopted nationwide through the Thai Teacher Council network. Research findings indicate that the project is crucial for both teachers and educational staff, leading to transformative shifts in teaching and learning methodologies, as well as fostering positive thinking skills. Additionally, it contributes to enhanced academic achievements among students.

In the interpretative dimension, teachers reflected on facilitators' seminar expectations but struggled to translate these into classroom practice, noted through observations. Reluctance to attend seminars might contribute, alongside the emphasis on entrance exams for 8th and 12th graders, potentially prompting exam-focused teaching. Observations in May, when attendance wasn't mandatory for 12th graders, might have limited classroom activities due to smaller or crowded classes. These trends could reflect a teacher-centered or textbook-focused teaching approach. Vescio et al. (2008) highlighted that professional learning communities fostered student-centered teaching, while Carpenter (2012) observed positive practice changes via collaboration. These communities should enhance pedagogical skills, share best practices, and encourage collaboration for improved student learning. Eisner (1979) underscores that effective educational criticism enhances student achievement and betters the education system.

In the interpretive findings, stakeholders suggest improvements for the project, including voluntary seminar participation, transparent selection criteria, schedule and location adjustments, promoting more sharing, offering draft presentations, providing project guidance, diversifying expertise among instructors, and generating outcome reports. These recommendations address project weaknesses, enhance effectiveness, and foster a participant-centered approach, aligning with Boydak-Özan and Dikici's (2001) emphasis on recommendations' role in training improvement.

Conclusion

The conclusions drawn from the study indicate several key findings regarding the evaluation of the professional development program implemented within the 'English Together Project'. Firstly, the program effectively supports teachers' professional development, aligning with their motivations for participation and emphasizing the importance of continuous improvement in pedagogical skills. However, challenges such as impractical activities, intensive course programs, and reluctant participants hinder the project's effectiveness, necessitating improvements in program design and implementation. Despite these challenges, the project demonstrates structured efficiency, sustained by collaboration and stakeholder involvement, underscoring the significance of peer coaching and ongoing support mechanisms in professional development initiatives. The project's contributions include providing diverse learning opportunities, fostering collaboration, and enhancing communication among teachers, aligning with effective professional development principles. However, observations reveal a gap between seminar expectations and classroom practice, suggesting the need for more tailored and practical training approaches. Recommendations for improvement focus on enhancing

participant engagement, transparency, and program alignment with teacher needs, emphasizing the importance of continuous evaluation and adaptation in professional development initiatives. Overall, the study underscores the value of targeted, collaborative, and participant-centered professional development programs in enhancing teacher performance and student learning outcomes.

Suggestions

To successfully ensure the sustainability of PLCs through in-service education programs and to adequately support participants' needs, it is recommended to customize the content of the training, establish an effective feedback mechanism, provide sustainable support, create a well-planned program specifying its goals, duration, and participants, secure sufficient resources, supplement it with educational materials, facilitate information sharing through the use of effective communication channels, and expand it to various disciplines.

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The current education of migrant children report: an analysis study

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Abstract

This study analyzes academic studies published between May 2013 and June 2023 that mainly examined the education of migrant children. The study group consists of 97 different types of academic studies. Using content analysis, general trends in academic publications regarding the education of migrant children were examined. The results show that the most focused subject in current studies is about examining the educational, social, and health-related issues faced by migrant children (31.96%). 75.26% of the academic studies had been configured as qualitative, whereas the least minority of them had been written by choosing mixed research approaches (7.22%). 45.36% of the academic studies used mixed groups as study participants, and 26.8% of them gathered data from different types of documents. In contrast, migrant families (6.19%), children of migrant workers (1.03%), and various people in different societies (1.03%) were some of the least examined study participants. The most preferred data collection methods were document reviews (26.8%) and interviews (11.34%). Most academic studies analyzed their data through qualitative document analysis (21.65%), and qualitative thematic analysis (18.56%). This study recommends that academic publications regarding the education of migrant children should provide a variety in the topics examined. Besides, future studies should consider providing diversity in study groups through college students, migrant communities, and children of migrant families from different socio-economic backgrounds.

Keywords

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Introduction

The globalized world and changing dynamics of social life, intercultural relationships, and socioeconomic conditions are the key elements that directly cause different migration movements from region to region or country to country. As a dynamic and ongoing movement (Dustmann & Glitz, 2011), either regional or international migration generally occurs due to various internal and external factors (i.e., natural disasters, political, economic or social reasons, and environmental situations) that directly or indirectly affect people in their home countries (Bronen, 2010; Calderón et al., 2011; Carr, 2009; Castles, 2006; Cillo, 2021; DeJesus, 2018; Martin, 2018; Ruiz & Vargas-Silva, 2013). Offering a good,

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planned, and appropriate educational setting to immigrant children and not ignoring their needs is critical for countries. The reason is that migrant children and young people have the potential to change the current social, economic, or cultural view of countries as their volume and existence in the migrated countries are continually growing (Devine, 2013; Portes & Rivas, 2011; Tienda & Haskins, 2011). Due to intensive migration streams, migrant children and their educational future have been a critical issue in the countries receiving high-volume migration as it created different barriers to actively performing education through educational institutions in various levels or educational policies and providing effective integration processes those to their educational systems (Bravo-Moreno, 2009; Chen & Liang, 2007; de Miguel-Luken & Solana-Solana, 2017; Green, 2003). Therefore, examining the current educational initiatives of countries, which are seen as the starting gate of a new life for migrant families and their children, can be considered as a vital point in obtaining a more suitable and effective educational setting for those children.

The literature shows numerous scientific research activities regarding different types of migration movements from region to region or country to country and their various reasons (Bronen, 2010; DeJesus, 2018), general tendencies of countries receiving intensive migration in terms of educational implementations and legal structures such as policies and educational reform plans (Beverelli, 2022; Malandrino, 2023; Martin, 2018; McClain et al., 2022; Wright et al., 2022). The role of migrant children's and student's socioeconomic background that might effectively shape their attraction to education in a foreign country, integration of some specific groups into the current social and industrial structure in foreign countries (Calderón et al., 2011; Cillo, 2021) are also addressed through research papers. For instance, Malandrino's (2023) study shed light on the active policy implementations and initiatives in Italy and Austria regarding improving migrants' educational outcomes in language education. Similarly, Beverelli (2022) examined how countries, exposed to high-level migration streams worldwide shaped their national policies that aimed to integrate migrant people into their countries effectively. In her study, Beverelli (2022) found that different integration-related policies implemented by the examined countries have been more successful in cross-border migration movements than internal migration activities. In their study, McClain et al. (2022) paid attention to the structural dynamics of policy initiatives focused on how dignity must be integrated with migration and its dimensions by governments, policymakers, or NGOs.

From another standpoint, many studies have discovered the main reasons that caused regular or irregular migration movements and the different groups exposed to migration. Different research demonstrated that environmental situations (Burzyński et al., 2022; Delazeri et al., 2022; Khuc et al., 2022; McMichael et al., 2012; Warner et al., 2010), the existence of violence, various internal conflicts or international wars in different regions (Conte & Migali, 2019; Duszczyk & Kaczmarczyk, 2022; Schon, 2019; Valenta et al., 2020), and impacts of economic crises in different countries (Domínguez-Muñica et al., 2014; Hazans, 2016; Watanabe, 1998) were the major influential elements caused the migration both internally and externally year by year. For instance, Khuc et al.'s (2022) study found that air pollution has created an influential social effect on society; for this reason, most people tend to migrate from the regions. Regarding the possible relationship between violence and internal or external conflicts, Duszczyk and Kaczmarczyk (2022) found that the war between Russia and Ukraine was one of the main reasons for intensive European migration, specifically from Ukraine to Poland. These studies are clear indicators that both domestic and international migration consist of the cumulation of various dynamics comprised of social, economic, political, and environmental situations, which might directly affect the form of the world countries, as well as the citizens of those countries.

The existing literature showed that numerous scientific studies mainly focused on internal and external migration movements and their characteristics on changing global perspective in the scope of migrants' effects on destination countries' socioeconomic tendencies, the primary reasons for migration, and political initiatives of destination countries regarding improving migration-related issues. Compared to other studies, there seems to be an obvious need for research studies that directly discuss what migrant children's educational necessities are and how the most effective and comprehensive

educational infrastructure might best integrate these children into education worldwide. Even though there are some academic studies regarding this particular issue, those studies are generally focused on the migrant children's educational problems in very minimal areas/regions such as China, the United Kingdom or the United States (Gouwens, 2001; Kindler, 1995; Liu & Jacob, 2013; Tereshchenko & Archer, 2014; Qian & Walker, 2015). On the other hand, different recent studies examine migrant children's education in the global context (Adams & Kirova, 2006; McIntyre & Abrams, 2020). Those studies are significant because the increasing rate of migrant children in destination countries requires a detailed examination of these countries' education systems, education policies, and their attempts to integrate these children into education. At this point, similar to some of the studies in the literature that aimed to analyze existing documents regarding migration and its use in different scientific fields (Demircioğlu & Altuntaş Gürsoy, 2023), revealing the most recent studies that solely focused on migrant children's education is vital. The reason is that focusing on this issue will allow researchers to see the hidden points of how education can be best rebuilt by considering today's social, cultural, technological, and economic conditions in the scope of these children. Moreover, examining and analyzing those studies might shed light on what the central dynamics of migrant children's education globally should depend on.

This study aimed to understand and discover the general view of how different academic studies regarding migrant children's education between 2013-2023 have been published and what the similar and different characteristics of those publications in terms of their document types, research questions, general purposes, and research methodologies including data collection methods, study groups or main research participants and data analysis methods through a document analysis process. The study seeks the answer to the following questions:

1. What is the general distribution of the academic studies published between 2013-2023 regarding the education of migrant children?
2. What is the general tendency in the academic studies published between 2013-2023 regarding the education of migrant children in terms of research purpose(s)?
3. What is the general tendency in the academic studies published between 2013-2023 regarding the education of migrant children in terms of used research approach(es)?
4. What is the general tendency in the academic studies published between 2013-2023 regarding the education of migrant children in terms of examined study sample(s)/study participant(s)?
5. What is the general tendency in the academic studies published between 2013-2023 regarding the education of migrant children in terms of data collection method(s)?
6. What is the general tendency in the academic studies published between 2013-2023 regarding the education of migrant children in terms of data analysis method(s)?

Method

Research Design and Data Collection

In this study, qualitative research was used as one of the main usages of qualitative research is to reveal and deeply understand a specific problem regarding a subject or subjects examined (Creswell, 2013). In this context, the use of qualitative research is appropriate for the nature of this study since the backbone of this study is to reveal and examine the written and published academic documents in the scope of the education of migrant children. As the data collection tool, the document analysis method was used to obtain the required data to comprehensively answer the main research questions through various types of academic documents published regarding the education of migrant children in the global context. Document analysis was used in this study to discover how different issues or situations have experienced other changes as it focuses on those issues from past to the present (Cohen et al., 2007).

Study Group and Sampling Procedure

The study group consisted of different types of published academic studies between 2013-2023. The types of academic studies gathered and examined in the scope of the study included peer-reviewed articles, academic reference books, book chapters, conference papers, master's theses, and doctoral dissertations. Those study materials have been accessed through six national and international

databases: ERIC, Taylor & Francis Online, Google Scholar, TRDizin, ProQuest Dissertations & Theses Global, and the Council of Higher Education National Thesis Center. A keyword consisting of a combination of five words was chosen, and a search was performed through the above online databases to obtain a sampling universe. This keyword was "the education of migrant children." To discover the literature that best represents the relevant academic publications regarding the education of migrant children, the keywords were taken into quotation. In selecting and including academic publications from the examined databases, attention was paid to ensuring that the abstract/titles of the publications included the pre-determined keywords. A specific date range was then used to explore the recent research activities in the scanned online databases. Finally, by examining the reference lists of the gathered publications, possible publications that seemed appropriate in terms of content, language, and scope and contained predetermined keywords in their titles/abstracts were also included in the study sample. The PRISMA 2020 flow diagram (Page et al., 2021) explaining the review process of this research is shown in Figure 1:

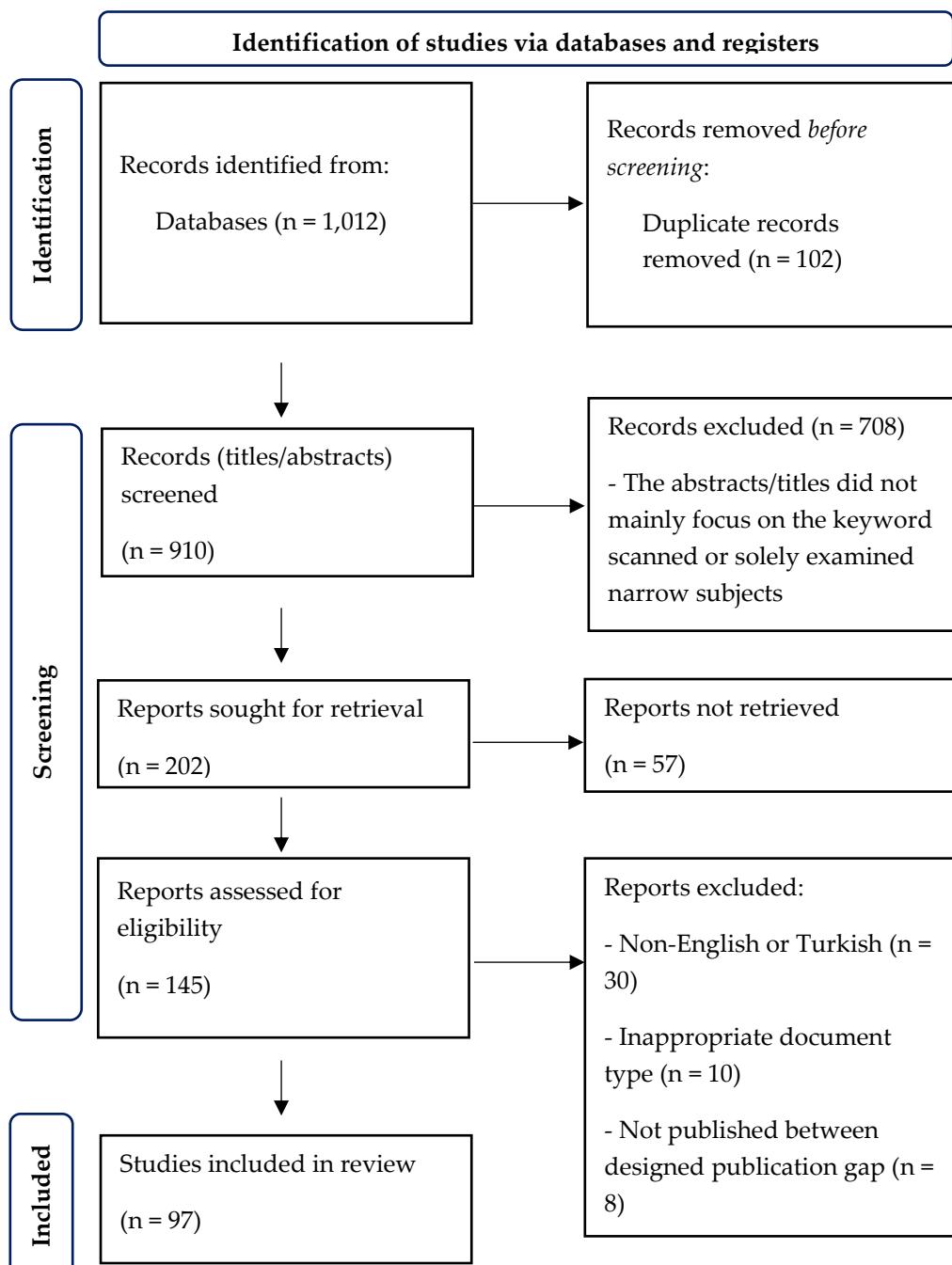


Figure 1. PRISMA 2020 Flow Diagram Explaining the Review Process

As shown in Figure 1, 1,012 results were obtained from the selected databases. After removing duplicate publications (n=102), the titles/abstracts of 910 academic publications were examined. 708 out of 910 records had to be removed because they were not directly related to the predetermined keyword or only focused on narrow subjects. Of the remaining 202 records, 57 records were eliminated because they could not be reached by the researchers. Then, 145 records that appeared to be eligible for evaluation were obtained. However, 48 records were not eligible for the evaluation process since they were not in English or Turkish (n=30), were inappropriate document types (n=10), or were not published in the designed publication gap (n=8). As a result, 97 academic publications were selected for examination within the scope of the research questions. These academic publications are shown in:

Table 1. The Academic Publications Examined during the Research Process

Publication Type	References
Peer-reviewed A.	Aarsæther, 2021; Åkerblom & Harju, 2021; Arphattananon, 2022; Cankar et al., 2013; Chang & Bu, 2020; Chen & Feng, 2013; Chen & Feng, 2019; Chen et al., 2019; Curdt-Christiansen, 2020; Demintseva, 2020; Donzuso, 2015; Faas et al., 2015; Forsberg, 2022; Free & Križ, 2022; Gilsenan & Lee, 2021; Gong et al., 2015; Gu & Yeung, 2020; Guo, 2014; Hanna, 2020; Hanna, 2023; Harju & Åkerblom, 2020; Hu & Wu, 2020; Jin et al., 2017; Kennedy & Smith, 2019; Kozlova & Ryabichenko, 2023; Lai et al., 2014; Langer-Buchwald, 2019; Li, 2022; Li & Xiong, 2019; Liu & Su, 2014; Liu & Zhao, 2019; Liu et al., 2015; Martin et al., 2023; Medarić et al., 2021; Migliarini et al., 2019; Migliarini et al., 2020; Nawarat, 2018; Notoprayitno & Jalil, 2020; Osadan & Reid, 2015; Poyer et al., 2021; Qian & Walker, 2015; Qian & Walker, 2017; Qiang et al., 2022; Rakhmonov, 2021; Rodrigues et al., 2018; Salinas, 2013; Smith, 2019; Sprong & Skopek, 2022; Sun et al., 2020; Tuangratananon et al., 2019; Vimala & Salini, 2023; Wang & Sercombe, 2023; Wang et al., 2017; Waters, 2015; Wiseman et al., 2023; Xia et al., 2023; Yang & Wang, 2013; Yu, 2021; Yu & Crowley, 2020; Yun et al., 2017; Zhang et al., 2022
Conference P.	Ibrahim et al., 2014; Kiseleva et al., 2018; Lwin et al., 2021; Shan, 2022
Book	Pong, 2015
Book C.	Goodburn, 2016; Petchot, 2014
Master's T.	Aslan, 2019; Chiyangwa, 2018; Demirel, 2022; Ding, 2015; Eroğlu, 2018; Esen, 2020; Gao, 2018; Kırkıç, 2019; Küçükıratlı, 2019; Li, 2018; Maw, 2018; Schmitt, 2017; Shi, 2021; Yuan, 2014
Doctoral D.	Caumont Stipanicic, 2020; Gluckman, 2021; Gutierrez, 2016; Jiang, 2019; Kontaş Azaklı, 2021; Lehman, 2015; Mao, 2022; Mercado, 2019; Nguyen, 2022; Rivera-Singletary, 2014; Segal, 2018; Song, 2018; Wang, 2015; Wei, 2016; Yu, 2017

Note. A: Article, C.: Chapter, D.: Dissertations.. P.: Papers, T.: Theses

Table 1 shows the academic publications compiled and reviewed during the research process. These academic publications (n = 97) are included in the reference list, marked with an asterisk (*).

Data Analysis

This study used content analysis to interpret and evaluate the gathered data from relevant academic publications through different online databases. According to Krippendorff (2004), "Content analysis is a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18). Through the codes and categories created, this method aims to shed light on the examined data's visible and hidden/unrevealed content (Graneheim et al., 2017). Therefore, content analysis was appropriate for this study because the general view and tendencies in published documents regarding the education of migrant children have been tried to understand and comprehensively find out by examining the relevant literature.

In the scope of the study, first, all the academic publications regarding the education of migrant children have been gathered and classified considering their types. Second, all gathered data have been associated with six categories: publication type and year, research purposes, research methodologies, study groups/samples/participants, data collection methods, and data analysis methods. In case research designs, data analysis methods, or other strategies were not clearly stated in the gathered publications, these characteristics were determined and classified by the researcher by examining the content and methodological approaches of the publications. During this process, independent tables were created, and the relevant categories and codes were demonstrated by inserting them into these tables. Lastly, an analysis process has been held to answer the questions of the study.

Limitations of the Study

This study has two limitations for some reasons. The first is that the publication dates of the examined academic studies are limited between May 2013 and June 2023, since examining all written academic studies within the scope of the research questions requires an excessive time and workload. The second limitation is to work on a limited number of national and international databases and a search engine for the same reason mentioned above. Future researchers should take these factors into account when designing their research to expand the coverage of literature.

Results

The Frequency Distribution of the Academic Publications

The frequency distribution of the academic publications by publication categories and publication years is shown in Table 2 below:

Table 2. The Frequency Distribution of The Academic Publications

Publication Year	Frequency by Publication Categories and Years (f)					
	Peer-reviewed A.	Conference P.	Book	Book C.	Master's T.	Doctoral D.
2013	4	-	-	-	-	-
2014	3	1	-	1	1	1
2015	7	-	1	-	1	2
2016	-	-	-	1	-	2
2017	4	-	-	-	1	1
2018	2	1	-	-	5	2
2019	9	-	-	-	3	2
2020	11	-	-	-	1	1
2021	7	1	-	-	1	2
2022	7	1	-	-	1	2
2023	7	-	-	-	-	-
Total	61	4	1	2	14	15

Note. A: Article, C.: Chapter, D.: Dissertations.: P.: Papers, T.: Theses

Table 2 shows 97 academic publications regarding the education of migrant children published in different databases between 2013 and 2023. At this point, 61 peer-reviewed articles, 15 doctoral dissertations, 14 master's theses, four conference papers, two book chapters, and one book comprise the total number of publications. Majority of the academic publications related to the topic examined are peer-reviewed academic articles (f:61) whereas books are the fewest in number (f:1). Table 2 shows that doctoral dissertations are the second most common academic publications in the databases searched (f:15). They are followed by master's thesis (f:14), conference papers (f:4), book chapters (f:2), and books (f:1).

The Examination of the Academic Publications by Research Purposes

The frequency distribution of academic publications by their research purposes is shown in Table 3 below:

Table 3. The Frequency Distribution of Academic Publications by Their Research Purpose(s)

Publication Type	Research Purpose(s)	f
Peer-reviewed A	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	13
	Examining parents', migrant students', educators', or other people's views/experiences on the education of migrant children	12
	Examining or offering national and/or international policies/strategic documents and systems regarding the education of migrant children	11
	Examining the academic success of migrant children	7
	Examining the ways how to create effective learning environments/opportunities for migrant children	6
	Examining the roles of educational institutions in supporting the education of migrant children	5
	Examining the structural characteristics and roles of migrant families in the education of migrant children	3
	Examining existing studies regarding education, sociology, religion, and migration	2
	Examining the characteristics of educational programs in different disciplines offered to migrant children	1
	Examining parental involvement and parental education on the education of migrant children	1
Conference P.	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	1
	Examining parents', migrant students', educators', or other people's views/experiences on the education of migrant children	1
	Examining the ways how to create effective learning environments/opportunities for migrant children	1
	Examining or offering national and/or international policies/strategic documents and systems regarding the education of migrant children	1
	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	1
Book	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	1
Book C.	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	2
Master's T.	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	8
	Examining the ways how to create effective learning environments/opportunities for migrant children	2
	Examining parents', students', educators', or other people's views on the education of migrant children	2
	Examining the academic success of migrant children	1
	Examining existing studies regarding education, sociology, religion, and migration	1
Doctoral D.	Examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children	6
	Examining parents', students', educators', or other people's views on the education of migrant children	3
	Examining or offering national and/or international policies regarding the education of migrant children	2
	The role of government institutions or non-governmental organizations in improving the quality of education of migrant children	2
	Examining parental involvement and parental education on the education of migrant children	2
Total		97

Note. A.: Article, C.: Chapter, D.: Dissertations.: P.: Papers, T.: Theses

Table 3 shows that majority of publications regarding the education of migrant children were about examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children. At this point, the literature indicates that there are 31 academic publications including 13 peer-reviewed articles, one conference paper, one book, two book chapters, eight master's theses, and six doctoral dissertations that mainly aimed to examine this topic. The current literature also demonstrates that the second major research purpose addressed by different types of academic publications was related to parents', students', educators', or other people's views on the education of migrant children. In this context, there are 18 academic publications including 12 peer-reviewed articles, one conference paper, two master's theses, and three doctoral dissertations. The third most examined topic in academic publications is examining or offering national and/or international policies/strategic documents and systems regarding the education of migrant children. Table 3 shows 14 academic publications including 11 peer-reviewed articles, one conference paper, and two doctoral dissertations regarding this particular purpose.

Table 3 also indicates that a limited number of academic publications focused on different issues aimed to discover different dimensions related to the education of migrant children. From this perspective, the academic success of migrant children, the ways how to create effective learning environments/opportunities for migrant children, the roles of educational institutions in supporting the education of migrant children, the structural characteristics and roles of migrant families in the education of migrant children, existing studies regarding education, sociology, religion, and migration, the role of parental involvement and parental education on the education of migrant children, the role of government institutions or non-governmental organizations in improving the quality of education of migrant children were some of the least examined topics in different types of academic publications.

The Examination of the Academic Publications by Research Approaches

The frequency distribution of academic publications by their research approaches is shown in Table 4 below:

Table 4. The Frequency Distribution of Academic Publications by Research Approaches

Publication Type	Research Approaches	f
Peer-reviewed A.	Qualitative	43
	Quantitative	13
	Mixed	5
Conference P.	Qualitative	3
	Quantitative	1
Book	Qualitative	1
Book C.	Qualitative	2
Master's T.	Qualitative	12
	Quantitative	2
	Qualitative	12
Doctoral D.	Qualitative	12
	Mixed	2
	Quantitative	1
Total		97

Note. A.: Article, C.: Chapter, D.: Dissertations.: P.: Papers, T.: Theses

Table 4 shows that the primary research approach used in most of the peer-reviewed articles was qualitative (f:43). The second most used research approach adopted by peer-reviewed articles was quantitative (f:13) whereas the least preferred research approach in peer-reviewed articles was mixed method approach (f:5). In conference papers, the study revealed that most of the conference papers have been configured in the scope of the qualitative research approach (f:3) while only one preferred to use quantitative research approach (f:1). The book in the study sample has been configured in light of the qualitative research approach (f:1). For the academic studies in the book chapter type, all book chapters have been configured in the scope of the qualitative research approach (f:2). In terms of master's theses,

most master's theses were qualitative (f:12). In contrast, only two master's theses used the quantitative research approach (f:2). Lastly, most of the doctoral dissertations regarding the education of migrant children have been completed in qualitative research approach (f:12). In the remaining three doctoral dissertations, it is seen that there were two mixed research approaches and one quantitative research approach used by researchers.

Qualitative methodology is the most adopted methodology in academic studies examining the education of migrant children. The main reason why the qualitative research approach dominates the quantitative research approach can be associated with the deep and complex structure of all kinds of data collected, evaluated, and obtained from people as social and intellectual beings. In this context, finding and presenting quantitative results may not help to create a general and detailed perspective of what difficulties these special groups face in the new environment where they start to build a new life. Therefore, designing and conducting academic studies in a qualitative structure would be a better option to not only pay attention to the comprehensive problems of migrant children but also offer constructive reform initiatives to resolve the complex issues they encounter.

The Examination of the Academic Publications by Study Sample(s)/Participant(s)

The frequency distribution of academic publications by their study sample(s)/participant(s) is shown in Table 5 below:

Table 5. The Frequency Distribution of Academic Publications by Study Sample(s)/Participant(s)

Publication Type	Study Sample(s)/Participant(s)	f
Peer-reviewed A.	Mixed groups (migrant children in schools or not / parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	25
	Documents (Policies, programs, textbooks, relevant literature, etc.)	17
	Migrant children (Students or non-students)	8
	Teachers / Educators / Educational specialists	4
	Migrant families	4
	Teachers / Educators / Educational specialists – Document(s)	2
Conference P.	People in the Society	1
	Documents (Policies, programs, textbooks, relevant literature, etc.)	2
	Mixed groups (migrant children in schools or not / parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	1
	Migrant families	1
Book	Mixed groups (migrant children in schools or not / parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	1
Book C.	Mixed groups (migrant children in schools or not / parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	2
	Documents (Policies, programs, textbooks, relevant literature, etc.)	5
Master's T.	Mixed groups (migrant children in schools or not / parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	5
	Teachers / Educators / Educational specialists	2
	Children of migrant workers	1
	Migrant families	1
	Mixed groups (migrant children in schools or not in schools/ parents / teachers / specialists / school administrators / NGO workers / documents, etc.)	10
	Migrant children (Student or non-students)	3
Doctoral D.	Documents (Policies, programs, textbooks, relevant literature, etc.)	2
	Total	97

Note. A.: Article, C.: Chapter, D.: Dissertations.: P.: Papers, T.: Theses

Table 5 displays that most academic publications in peer-reviewed article type (f:25) have preferred to focus on mixed groups as their research participants/study samples. The second most used study sample(s)/participant(s) in peer-reviewed articles were the documents (f:17). At the same time, migrant children (students or non-students) (f:8), teachers/educators/educational specialists (f:4), migrant families (f:4), teachers/educators/educational specialists-documents (f:2), people in society (f:1) were the least used study sample(s)/participant(s). According to Table 5, two conference papers included documents, whereas one conference paper worked with mixed groups, and another worked with migrant families as study samples. The one book in the reviewed literature included mixed groups. In the book chapters examined, the researchers selected mixed groups as their study participants (f:2). In the scope of the master's thesis, most of the publications focused on documents (f:5), and mixed groups (f:5) as study sample(s)/participant(s). However, one master's thesis included children of migrant workers and the other included migrant families. Lastly, most doctoral dissertations focused on mixed groups (f:10) similar to other publications. In contrast, migrant children (f:3) and documents (f:2) have been least used.

The most selected and used study sample/participant in academic studies on the education of migrant children consisted of mixed groups (migrant children in schools or not in schools / parents / teachers / specialists / school administrators / NGO workers / documents, etc.). A comprehensive analysis of the positive and negative aspects of the education of migrant children requires establishing different research areas that will consider the roles and influences of each environment or person who may have dominant power over this population. For instance, it would not be surprising to argue that migrant children spend most of their time in educational environments with their teachers and friends like their domestic peers. Therefore, observing and analyzing the effects of these variables on migrant children by providing participant diversity in academic settings would offer more insights into understanding negative and positive situations that directly or indirectly shape the education of migrant children.

The Examination of the Academic Publications by Data Collection Method(s)

The frequency distribution of academic publications by their data collection method(s) is shown in Table 6 below:

Table 6. The Frequency Distribution of Academic Publications by Data Collection Method(s)

Publication Type	Data Collection Method(s)	f
Peer-reviewed A.	Document Review(s)	17
	Interview(s)	7
	Document Review(s) and Interview(s)	6
	Survey(s)	5
	Survey(s) and Interview(s)	4
	Observation(s) and Interview(s)	2
	Standardized Test Score(s) - Survey(s) – Information Sheet(s)	2
	Observation(s) – Interview(s) – Document Review(s)	2
	Questionnaire(s)	1
	Reflective Dialogue(s)	1
	Storytelling Method(s)	1
	Interview(s) and Focus Group(s)	1
	Standardized Test Score(s) and Survey(s)	1
	Standardized Test Score(s) and Interview(s)	1
	Standardized Test Score(s) - Survey(s) – Interview(s)	1
	Survey(s) – Interview(s) – Questionnaire(s) – Scale(s)	1
	Document Review(s) - Interview(s) – Survey(s) - Focus Group(s)	1
	Observation(s) – Interview(s) – Survey(s)	1
	Observation(s) – Interview(s) – Questionnaire(s)	1
	Document Review(s) - Interview(s) – Focus Group(s) – Observation(s)	1
	Observation(s) – Interview(s) – Discussion(s) – Photograph(s) – Charter(s)	1
	Interview(s) – Focus Group(s) – E-mail Communication(s) – Discussion(s)	1
	Photo Elicitation(s) and Interview(s)	1
	Document Review(s) - Interview(s) – Focus Group(s) - Literature Review(s)	1
Conference P.	Document Review(s)	2
	Document Review(s) and Interview(s)	1
	Interview(s) and Questionnaire(s)	1
Book	Document Review(s) and Interview(s)	1
Book C.	Document Review(s) - Interview(s) – Observation(s)	2
Master's T.	Document Review(s)	5
	Interview(s)	4
	Survey(s) and Interview(s)	1
	Interview(s) and Observation(s)	1
	Proficiency test(s)/Diagnostic test(s)	1
	Document Review(s) - Interview(s) – Focus Group(s)	1
	Observation(s) – Interview(s) – Field Note(s) - Document Review(s)	1
	Document Review(s) – Interview(s) - Observation(s)	3
	Document Review(s)	2
	Document Review(s) and Interview(s)	2
Doctoral D.	Interview(s) and Questionnaire(s)	1
	Interview(s) and Observation(s)	1
	Participatory Storytelling Method(s)	1
	Document Review(s) – Interview(s) - Observation(s) – Focus Group(s)	1
	Observation(s) – Interview(s) – Field Note(s) – Informal Dialogue(s)	1
	Scale(s) – Test(s) – Interview(s) - Observation(s) – Letter(s) – Other Assessment Tool(s)	1
	Questionnaire(s) – Interview(s) – Focus Group(s)	1
	Narrative Inquiry – Document Review(s) – Discussion(s) – Interview(s) – Field Observation(s)	1
	Total	97

Note. A.: Article, C.: Chapter, D.: Dissertations.. P.: Papers, T.: Theses

Table 6 represented that most of the publications in peer-reviewed article type have gathered the required data using the document review method (f:17). Besides, the second most used data collection tool was the interview(s) (f:7). The results also reflected that some of the least used data collection tools in peer-reviewed articles were questionnaire(s) (f:1), interview(s) and focus group(s) (f:1), standardized tests score(s) - interview(s) (f:1), standardized test score(s) – survey(s) (f:1). In terms of conference papers, two publications used document review(s) (f:2), one publication used both document review(s) and interview(s) (f:1), and one publication used both interview(s) and questionnaire(s) (f:1). In the book reviewed, Table 6 shows that it preferred to use document review(s) and interview(s) together. In the scope of the book chapters, two book chapters aimed to gather the relevant data from selected populations using three different data collection tools that included document review(s) - interview(s) -observation(s). In majority of master's theses, the researchers adopted document review(s) (f:5), interview(s) (f:4), while some researchers adopted surveys and interviews (f:1), observations and interview(s) (f:1), proficiency test(s)/diagnostic test(s) (f:1). Lastly, three doctoral dissertations have gathered data using document review(s) – interview(s) - observation(s), two doctoral dissertations have preferred to choose the document review(s) as the only data collection tool, two doctoral dissertations have used document review(s) and interview(s), and one has solely used participatory storytelling method(s). The rest of the doctoral dissertations benefit from the unity of two and more than two data collection methods to gather the data from the study participant(s) or study sample(s).

The Examination of the Academic Publications by Data Analysis Method(s)

The frequency distribution of the academic publications by their data analysis method(s) is shown in Table 7 below:

Table 7. The Frequency Distribution of Academic Publications by Data Analysis Method(s)

Publication Type	Data Analysis Method(s)	f
Peer-reviewed A.	Qualitative Document Analysis	15
	Qualitative Thematic Analysis	10
	Quantitative Descriptive Statistics and Quantitative Parametric Statistics	10
	Qualitative Narrative Analysis	6
	Qualitative Narrative Analysis and Qualitative Document Analysis	6
	Qualitative Narrative Analysis and Quantitative Descriptive Statistics	4
	Quantitative Descriptive Statistics	3
	Quantitative Parametric Statistics	2
	Qualitative Content Analysis	1
	Qualitative Descriptive Analysis	1
	Qualitative Thematic Analysis and Qualitative Document Analysis	1
	Qualitative Narrative Analysis - Quantitative Descriptive Statistics – Quantitative Parametric Statistics	1
	Qualitative Grounded Theory Analysis	1
Conference P.	Qualitative Descriptive Analysis	1
	Qualitative Document Analysis	1
	Qualitative Document Analysis and Qualitative Content Analysis	1
	Quantitative Parametric Statistics and Qualitative Narrative Analysis	1
Book	Qualitative Narrative Analysis and Qualitative Document Analysis	1
Book C.	Qualitative Narrative Analysis	1
	Qualitative Narrative Analysis and Qualitative Document Analysis	1
Master's T.	Qualitative Document Analysis	3
	Qualitative Thematic Analysis	3
	Qualitative Descriptive Analysis	2
	Quantitative Descriptive Statistics and Quantitative Parametric Statistics	2
	Qualitative Content Analysis	1
	Qualitative Narrative Analysis	1
	Quantitative Descriptive Statistics and Qualitative Content Analysis	1
	Qualitative Thematic Analysis and Qualitative Document Analysis	1

Table 7. Continued

Publication Type	Data Analysis Method(s)	f
Doctoral D.	Qualitative Thematic Analysis	5
	Qualitative Document Analysis	2
	Qualitative Content Analysis	1
	Qualitative Narrative Analysis	1
	Qualitative Grounded Theory Analysis	1
	Qualitative Thematic Analysis and Qualitative Document Analysis	1
	Qualitative Structural Analysis	1
	Quantitative Parametric Statistics and Qualitative Content Analysis	1
	Quantitative Descriptive Statistics – Quantitative Parametric Statistics	1
	Quantitative Descriptive Statistics – Quantitative Parametric Statistics – Quantitative	1
	Nonparametric Statistics – Qualitative Content Analysis	
	Total	97

Note. A.: Article, C.: Chapter, D.: Dissertations.: P.: Papers, T.: Theses

Table 7 shows that most of the peer-reviewed articles examined in terms data analysis methods have preferred to choose qualitative document analysis method (f:15), qualitative thematic analysis method (f:10), and both quantitative descriptive statistics and quantitative parametric statistics (f:10). The fourth most selected data analysis method in peer-reviewed articles was the qualitative narrative analysis method (f:6) and qualitative narrative analysis – qualitative document analysis methods (f:6). When the conference papers were examined, there was no common tendency in terms of preferred data analysis method. All four conference papers used a combination of different methods to analyze the data. In the examined book, the results showed that it used two data analysis methods together: qualitative narrative analysis and qualitative document analysis. In terms of book chapters, the results found that one publication (f:1) preferred to evaluate the data using qualitative narrative analysis. The other one (f:1) has evaluated the data using both qualitative narrative analysis and qualitative document analysis. Table 7 demonstrated that the qualitative document analysis (f:3) and the qualitative thematic analysis (f:3) were the most used data analysis methods in master's theses. In doctoral dissertations, the vast majority of the publications in this category have chosen to use qualitative thematic analysis (f:5). However, no general tendency regarding the data analysis methods has been determined in the rest of the doctoral dissertations.

Conclusion, Discussion, and Suggestions

The examination of current research on the education of migrant children is essential to understand the question of how these children's education can be improved globally. To draw a general perspective regarding the current research activities on this particular subject, this study focused on the publications between 2013-2023 and scanned various academic publications from six national and international databases. These databases included ERIC, Taylor & Francis Online, TRDizin, ProQuest Dissertations & Theses Global, the Council of Higher Education National Thesis Center, and Google Scholar. The findings showed that peer-reviewed articles published in different academic journals worldwide were the most published publication types that shed light on various issues regarding the education of migrant children. The second and third most published publication types on this examined topic were in doctoral dissertations and master's theses. Therefore, peer-reviewed articles, doctoral dissertations, and master's theses were in the top three publication types among all the other types of publications. Most researchers desired to shed light on the current views, issues, and solution suggestions regarding the education of migrant children. Consequently, most researchers tended to create and publish original studies to make more apparent the current status of the education of migrant children worldwide.

Although the academic studies examined had a wide variety in terms of the research purposes, this study revealed that the most focused purpose within these studies is about examining educational, social, and health-related (integration, discrimination, education opportunity, anxiety, etc.) experiences or challenges faced by migrant children (f:31). The second most examined research purposes were about the examining parents', migrant students', educators', or other people's views on the education of migrant children (f:18). These results showed that 50.52% of academic studies aimed to draw attention to the various problems that migrant children experience in different social environments and to explore people's opinions (i.e., parents, educators, and other people) regarding the education of migrant children. The results also indicated that some of the least focused research purposes were about examining the characteristics of educational programs in different disciplines offered to migrant children and the role of government institutions/non-governmental organizations in improving the quality of education of migrant children. Even if there were a quantitatively adequate number of academic studies that aimed to shed light on migrant children's current problems in different social environments, not adequately focused on those listed topics might be the reasons for various issues. For instance, not aiming to explore the positions and understanding of government institutions or non-governmental organizations regarding the education of migrant children may be the main reason why migrant children who had to adapt themselves to foreign educational settings, and cultural and social beliefs are exposed to a variety of educational achievement and equality problems when compared to their non-migrant peers, as different studies showed (Liu et al., 2017; Ma & Wu, 2020; Ma et al., 2018; Park & Sandefur, 2010; Pásztor, 2008). Thus, giving importance to these least examined research purposes (e.g., examining the characteristics of educational programs in different disciplines offered to migrant children, examining parental involvement and parental education on the education of migrant children, or examining the ways how to create effective learning environments/opportunities for migrant children) may broaden people's and authorities' horizons in migrant-receiving countries in terms of creating and offering more equal educational opportunities and experiences to migrant children.

In terms of research approaches, this study showed that 75.26% of the academic studies examined had been configured as qualitative whereas the least minority of them had been written by choosing quantitative research approaches (17.53%) and mixed research approaches (7.22%). Since reaching a comprehensive understanding regarding specific issues through participants' different actions or reactions, including their thoughts, experiences, or perspectives, from an expanded framework is one of the core dynamics of qualitative research (Creswell, 2014), this result means that most of the researchers who paid attention to the education of migrant children aimed to explore the roots and possible solutions of this issue. Therefore, academic studies on the education of migrant children focused on discovering cases, problems, and hidden points of particular issues to understand and catch new perspectives by going into their roots.

Most of the academic studies reviewed had preferred to choose their research participants from mixed groups that generally included migrant children in schools, their parents, teachers, specialists, school administrators, NGO workers, representatives, and documents. This research concluded that 45.36% of the examined studies used mixed groups, and 26.8% of the studies gathered data from documents (e.g., policies, programs, textbooks, relevant literature). However, migrant families (6.19%), children of migrant workers (1.03%), and various people in different societies (1.03%) were some of the least examined study participants. Regarding these results, it is possible to argue that working on mixed groups in most studies can be beneficial in exploring both observable and hidden relationships among different variables, and this may allow researchers to offer much more understanding by solving the existing problems by closely working on these relationships. However, not focusing on specific groups, such as migrant communities, migrant families, or children of migrant workers, may cause them to not understand how family, culture, social status, and environment could affect the education of migrant children. The reason is that cultural backgrounds and family characteristics (e.g., socio-economic background, educational support) can be considered some of the key elements that likely affect the

future education of im/migrant children, as supported by many studies (Cheng, 2011; Fang et al., 2017; Kewalramani & Phillipson, 2020; Triventi et al., 2022).

The study outcomes revealed that there was no general tendency in terms of data collection methods used in the reviewed studies. The most chosen data collection methods in different types of academic studies were document reviews (26.8%), interviews (11.34%), and document reviews – interviews (10.31%), whereas other studies chose to utilize a combination of multiple data collection methods. In the scope of the data analysis methods, the results revealed that the majority of the academic studies analyzed their data through qualitative document analysis (21.65%), qualitative thematic analysis (18.56%), quantitative descriptive statistics and quantitative parametric statistics (13.40%), and qualitative narrative analysis (9.28%). Focusing on different types of texts, often including policies, reforms, or other implementations, through document reviews can raise current awareness by shedding light on issues that need to be improved toward migrant children and their well-being in educational settings. However, lack of preference for quantitative analysis methods may not contribute to the existing literature at a high level as it may restrict researchers from discovering general trends or different approaches regarding the education of migrant children through large sample groups. Besides, improving the variety in qualitative analysis methods can offer researchers wide opportunities by allowing them to explore interconnected relationships between more than two individuals or groups and reveal their intimate thoughts. Revealing people's thoughts or tendencies through different qualitative data analysis methods can directly and positively affect the social, economic, and educational situations of migrant children in the short or long term by creating a shaping force in existing policies or practices.

Based on the results discussed above, this study offers some recommendations to increase the effectiveness and quality of the education of migrant children from different perspectives:

- Most of the master's theses and doctoral dissertations prepared on the education of migrant children focus on the same/similar topics. For this reason, specific importance should be given to ensuring a topic variety in future graduate theses to discover the hidden problems that migrant children experience in educational environments and the points that need improvement. For example, the role of government institutions or NGOs in improving the quality of education of migrant children or the effects of parental involvement/parental education on the education of migrant children can be potential research topics for master's theses or doctoral dissertations.
- In addition to the more frequently written topics, researchers should put forward more comprehensive contributions to the education of migrant children by working on different and more specific research purposes (e.g., the characteristics of educational programs in different disciplines offered to migrant children, or the role of government institutions or non-governmental organizations in improving the quality of education).
- Due to the lack of academic studies showing what types of pedagogical initiatives can be created and implemented to improve the quality of education of migrant children, future academic studies should consider working on this particular issue.
- In addition to the high volume of various qualitative academic studies in the existing literature, researchers should also design quantitative academic studies as this could be useful to reveal a more general view from more expanded study participants or study groups regarding both positive and negative factors associated with the education of migrant children.
- Researchers should consider preparing more academic studies by selecting participants from migrant communities, different social structures, and children of migrant families from various social/economic backgrounds. Focusing on these specific universes may show how cultural, social, and economic dynamics can be related to different educational issues against migrant children. Considering these factors, not only innovative and inclusive educational programs for migrant children can be redesigned but also the quality and equality of education can be obtained in the short term.

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Climate change education in elementary grades

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Abstract

This study aimed to evaluate an eight-week Understanding by Design-based climate change program implemented in 153 elementary schools across Türkiye (65 cities) with a total of 1350 teachers and 35000 students. 402 teachers from 77 schools in 35 cities filled out the teacher opinion form to evaluate the program. Additionally, three focus group interviews with a total number of 26 teachers were conducted in the three biggest cities in Türkiye. In focus group interviews and teacher opinion forms, teachers were asked to evaluate the curriculum in terms of context, input, process, and product. The transcriptions obtained from the focus group interviews and teacher opinion forms were analyzed with content analysis. According to the findings of the study, the curriculum effectively addressed the teachers' needs for climate change education, and the activities helped students to understand and transfer knowledge to their daily lives. However, due to physical limitations and a lack of time, sometimes the activities could not be completed as desired. As a result, this research found that climate change education developed using Understanding by Design is effective for students to comprehend and apply knowledge in their daily lives, which are the ultimate goals of climate change education.

Keywords

Climate change education
Climate action
Quality education
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Introduction

Türkiye is one of the vulnerable countries that is greatly impacted by climate change (CC) (Kadioğlu, 2012). CC has led to an increase in irregular and rapid precipitation as well as a shift toward a hotter, drier climate more akin to that of the desert. This results in erosion, desertification, and flood disasters. These dangers highlight the significance of including climate change education (CCE) in Turkish curricula. As a result, Türkiye's priorities in the 11th Development Plan include environmental education and awareness-raising initiatives, sustainable production and consumption, and nature and environment protection (Presidential Office of Strategy and Budget, 2019). Indeed, as of 2021, the name of the Ministry of Environment and Urbanization was changed to the Ministry of Environment, Urbanization and Climate Change (MEUCC). A further indication of the importance attached to CCE at the national level is the National Climate Change Action Plan 2011-2023 published by the MEUCC (2011), recommending that topics related to CC be incorporated into the curriculum beginning with

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early childhood education. All of these have led to the inclusion of CC in the national curricula. With a cyclical and interdisciplinary approach, themes about climate and CC are incorporated into the curriculum of Social Sciences and Science and Technology courses (Barak & Gönencgil, 2020).

Additionally, as of 2021-2022, the Environmental Education course, which is an elective course at the middle school level, has been updated as the Environment and Climate Change course and the concepts related to climate and CC have been incorporated into the program. At the high school level, CCE is covered within the scope of the geography courses. For younger age groups, however, there is no systematic instruction about climate change. CC is a problem that impacts all of us, including children, and it will continue to do so. Young children witness conversations about complicated environmental issues, such as CC, on a daily basis. Schools and educators must be ready to help children navigate difficult environmental challenges like CC (Axelrod et al., 2020; Bloch et al., 2014; Elliott & Davis, 2009; Ginsburg & Audley, 2020). As a result, it's critical that CCE begin at a young age, particularly in countries like Türkiye that are vulnerable. At the elementary level CCE remains a relatively underexplored area in both research and practice, despite the increasing exposure of young children to climate-related discussions in their daily lives (Axelrod et al., 2020; Bloch et al., 2014). While some studies have examined CCE in elementary education, these investigations primarily focus on instructional methods and tools rather than evaluating a comprehensive curriculum. For instance, Axelrod et al. (2020) address this gap by exploring the role of picture books as a pedagogical tool for engaging both teachers and students in climate discussions. Their research underscores the potential of picture books as an accessible and developmentally appropriate medium to introduce climate concepts to young learners, fostering curiosity, emotional engagement, and critical thinking. Additionally, the study highlights the importance of such resources in supporting teachers, particularly those who may feel unprepared or lack confidence in addressing climate-related topics in the classroom. By utilizing narrative storytelling and visual representations, students can develop a deeper understanding of abstract climate concepts, while educators can integrate these materials into broader literacy and science curricula. However, the study does not present a structured curriculum but rather investigates how storytelling can facilitate climate change discussions in early childhood education without assessing a large sample of students.

Similarly, Banks and Taylor (2025) examine the integration of arts-based methods in CCE within elementary schools in the United Kingdom. Their findings suggest that conventional science-based instruction often fails to foster emotional engagement, whereas creative approaches—such as storytelling, visual arts, drama, and music—enable students to articulate their understanding of climate change in more meaningful and engaging ways. These strategies help bridge the gap between scientific knowledge and personal experience, promoting critical thinking, empathy, and agency among young learners. However, their study also highlights significant curriculum gaps, noting that climate change is not systematically incorporated into elementary education, and teachers encounter obstacles in implementing CCE due to inadequate resources and professional development opportunities. Despite these challenges, Banks and Taylor (2025) do not propose a comprehensive curriculum but instead focus on how arts-based pedagogical strategies can be effectively integrated into the existing framework of the UK National Curriculum to enhance climate education. Therefore, it can be stated that this study fills a significant gap in the literature by evaluating the effectiveness of an 8-week curriculum on climate change education in elementary grades.

What of Climate Change Education

Providing information about nature is not enough to promote sustainability. Children must be provided with the resources they need to recognize the complexity of natural systems and the complicated relationship between nature and life and to undertake societal change (Davis, 2010). Therefore, successful CCE should emphasize children's understanding of this relationship and how to transfer that understanding to daily activities. Thus, effective CCE should impart an understanding of basic climate science, the causes and effects of climate change, as well as adaptation and mitigation strategies (Anderson, 2012; Mochizuki & Bryan, 2015). However, equipping children with this

knowledge will not be enough. Although there are various scenarios about how CC will affect our world in the future, there is uncertainty about what exactly will happen. The development of skills like critical thinking, problem-solving, lifelong learning, and the capacity to adapt to and deal with risks and uncertainties must also be key components of CCE (Mochizuki & Bryan, 2015).

How of Climate Change Education

Effective CCE should have a connection to and significance for the student's own life. Instead of covering what is anticipated to occur to strangers in places they are unfamiliar with, it should focus on the students' own lives since learning is more effective and lasting when it is connected to issues that the students are directly affected by and when they frequently apply what they have learned to their actions (Monroe et al., 2019). The instructional methods and strategies to be employed are the other components to be considered when providing an effective CCE. It is crucial to develop constructivist learning settings in which students actively participate and use a learner-centered strategy rather than a teacher-centered strategy (Bardsley & Bardsley, 2007; Monroe et al., 2019). Activities that encourage students' active participation, such as group discussions, role-playing, hands-on learning, and games, both help the learning to be enduring and raise the possibility of transferring to the daily life of the students by raising environmental sensitivity.

The current study

This study evaluates the large-scale implementation of an 8-week CC program for elementary grades. To build the framework for the aforementioned *what* and *how* of CCE, there are various instructional design tools available. Understanding by Design (UbD) is one of these tools. UbD is a concept for curriculum design that emphasizes learning transfer and developing understanding. In UbD, the designer chooses the method for evaluating learning before selecting what to and how to teach. In this model, the designer uses a three-step method to define desired learning outcomes or goals, identify the learning evidence, and structure learning experiences (Wiggins & McTighe, 2011). By following these steps, the designer prioritizes students' needs and understanding, assesses student comprehension through performance tasks, and places a high value on transferring knowledge into daily life and other courses (Yurtseven, 2020). Since the transfer of knowledge is the core element in CCE, the authors used UbD to address the gap in the lack of a program for elementary school-aged students in Türkiye. Eight-week UbD plans with a total implementation time of 16 hours were prepared within the framework of the program.

The developed program is implemented in 153 campuses of a private school chain across Türkiye (65 cities) with a total of 1.350 teachers and 35.000 students. This study aims to evaluate this program regarding teachers' views. Teachers were asked to evaluate the implementation according to the dimensions of the Context, Input, Process, and Product (CIPP) model developed by Stufflebeam (1971). According to Stufflebeam (2003), the Context dimension focuses on evaluating whether the objectives and priorities of the program meet the needs of the beneficiaries. The Input focuses on the adequacy of resources for the effective implementation of the program. The process focuses on the actual implementation and includes evaluations regarding working plans. The product evaluation focuses on whether the objectives were met. To our knowledge, there is no such comprehensive CC program at the national or international level for elementary school students. In this vein, the research questions of the study are as follows:

1. What are the teachers' views on the Context dimension?
2. What are the teachers' views on the Input dimension?
3. What are the teachers' views on the Process dimension?
4. What are the teachers' views on the Product dimension?

Method

Research Design

Using a qualitative descriptive research methodology, this study investigated teachers' views on implementing the UbD-based CC program. In qualitative descriptive research, the experiences, attitudes, and opinions of individuals are defined and described in relation to a certain topic (Willis et al., 2016). This design is consistent with the research questions, which center on teachers' perceptions of each CIPP dimension. By offering extensive descriptions of teachers' experiences, this design provides useful insights into how they interpret and administer the program. The design also made it more straightforward to understand how teachers felt about the UbD-based CC program.

Participants

The data of the study were collected through teacher opinion forms and focus group interviews. All participating teachers had a BA degree in education. A total of 402 teachers from 77 schools across 35 cities participated in the study by completing the teacher opinion form, which was distributed via Google Forms and emailed to the participants. Among the respondents, 366 were female and 36 were male, reflecting a predominantly female sample. The teachers' ages ranged from 21 to 65 years ($M = 36.88$, $SD = 10.83$). Their professional experience varied from 1 to 46 years, indicating a diverse range of career backgrounds.

Three focus group interviews were conducted in the second phase. A total number of 26 (Female=23; Male=3) teachers from three different schools in the biggest cities of Türkiye, namely Istanbul, Ankara, and Izmir, participated in the focus groups. Teachers were recruited using the maximum variation sampling method (Creswell, 2012). Attention was paid to the presence of teachers teaching at different grades. The ages of the teachers ranged from 21 to 42 ($M=36.92$; $SD= 10.78$). All the interviews were audio recorded with the teachers' consent. The professional experience of teachers ranged from 1 to 21 years. The focus group information is displayed in Table 1.

Table 1. Focus group participants by city, gender, and grades taught

Group	City	Grade Taught								Total	
		Grade 1		Grade 2		Grade 3		Grade 4			
		Female	Male	Female	Male	Female	Male	Female	Male		
Group 1	İstanbul	2	0	2	1	2	0	1	1	9	
Group 2	Ankara	1	1	2	0	2	0	2	0	8	
Group 3	İzmir	2	0	2	0	3	0	2	0	9	

Data collection tools

Teacher opinion form

The form was divided into two sections. Demographic information, including gender, age, the school the participants work at, seniority, and grade level taught, was included in the first section. The CIPP framework (Stufflebeam, 2003) was selected due to its comprehensive structure for evaluating educational programs, aligning with the aim of the study to evaluate multiple dimensions of curriculum implementation. Specifically, the CIPP model allows for a systematic examination of program design (Context), resources and strategies (Input), implementation (Process), and outcomes (Product), making it a suitable lens for capturing teachers' perspectives on the UbD-based CC program.

Focus group interview questions

Focus group interviews encourage participants to speak freely and share their thoughts since the casual setting of the group discussion encourages discussion among all participants (Yin, 2011). In focus group interviews, teachers were asked questions aligned with the context, input, process, and

product dimensions of Stufflebeam's (2003) evaluation model. The researchers initially drafted the questions, which were then refined by expert opinions.

Data collection

The data collection of the study was carried out in April-May 2022. All teachers received the teacher opinion forms through email at the beginning of May 2022, and they had two weeks to respond. The first researcher performed all focus group interviews face-to-face. After setting a date for the interview, the researcher went to the school that day to conduct the interviews. Each interview lasted approximately 60 minutes.

The study adhered to ethical principles to ensure the rights of all participants. The study was approved by Bahçeşehir University's Institutional Review Board (Date: 27.10.2021 No: 2021/09) prior to its initiation. All participants supplied informed consent after being instructed on the study's objectives, methodology, and their rights, which included the ability to withdraw at any time with no consequences. To maintain anonymity, all identifying information was anonymized and data was securely stored. Furthermore, participants were informed that audio recordings from focus group interviews would be utilized solely for research reasons and deleted after transcribed.

The Climate Change Program

The CC Program is an 8-week program that consists of four modules. UbD offers a monthly framework for designers to think critically about the essence of each unit by illuminating the big idea and essential questions and the transfer of ideas elaborately. Furthermore, designers work on a performance task that helps teachers understand whether students have acquired the learning objectives and think about active learning experiences that will help students learn in the best way. The CC Program begins with the fundamentals of climate and proceeds to CC, underlying reasons for climate change, its effects, and strategies to deal with it. The first module, named *What is Climate?* introduces weather conditions and climate by establishing a relationship between climate and living things. The second module, *Climate Change*, helps the students learn about CC by drawing attention to the effects of human activities on the natural cycles and the warming of the earth. In the third theme, *The Effects of Climate Change*, students learn about the impact of CC on Earth and living creatures. In the last module, *Coping with Climate Change*, students explore actions to reduce the effects of CC by taking personal initiatives. Each module is accompanied by a performance task by which students delve into some inspiring activities to develop their own perspective, think critically, and explore activities to develop solutions to related problems. In each module, students are supported with active learning experiences such as drama, games, experiments, the Six Hats thinking technique, 5E's model, the SCAMPER technique, and so forth.

Data analysis and Trustworthiness of the study

A graduate student verbatim transcribed each interview. The transcriptions were then compared to the audiotapes by one of the researchers. Content analysis was used to examine the data. Two researchers conducted the analysis simultaneously to ensure reliability, as Joffe (2012) suggested. The same approach was adopted for the analysis of the data obtained from the teacher opinion forms. Since similar perspectives were discovered through forms and focus group interviews, the results were presented together.

The credibility, transferability, dependability, and confirmability criteria from Schwandt et al. (2007) were applied to gauge the trustworthiness. Credibility is the extent to which the researchers are expressing a truth shaped by the perspective of the participants. The researchers asked three professors from the university's educational sciences department for their professional judgments to ensure credibility. The interview questions were revised after the suggestions of the experts. Then, to make sure that teachers understand the questions as intended, three pilot interviews were held with three teachers who were not research participants. These three teachers also completed and commented on the opinion forms. After the pilots, all the questions were improved accordingly. Additionally, the first and second researchers independently coded the data and found themes and categories. The researchers

then discussed how they interpreted the main themes. The researchers turned to the data when they were unable to reach an agreement. This process was repeated until the researchers reached a consensus. The third author gave all the themes and categories a fresh look after the first and second authors had done the coding. Transferability refers to how well findings can be applied in other situations. As detailed in the Participants section, there were teachers from all cities and all grade levels (first, second, third, and fourth grades) among the respondents. Also, the focus group interviews were held with teachers from different schools and included teachers from every grade level. Confirmability is the extent to which results are based on data rather than the study team's prior knowledge or bias. To ensure confirmability, the researchers discussed the codes with a professional who is an accomplished teacher education researcher. Finally, dependability is the degree to which the study could be replicated by other researchers. To ensure dependability, a thick description of the data collection and analysis process was provided.

Findings

Four primary questions drove this research. Below, the findings were organized by the research questions.

Findings regarding the Context dimension

According to Stufflebeam (2003), the Context dimension focuses on evaluating whether the objectives and priorities of the program meet the needs of the beneficiaries. The content analysis revealed that two themes emerged under this dimension, *teacher readiness* and *teacher contentment*. More explanation is presented in Table 2.

Table 2. The Content Analysis about the Context Dimension

Theme	Category	Sample Code
Teacher Readiness	Background	Personal awareness
	Knowledge	Interests
		Membership to NGOs
		Previous trainings
	Obstacles	Being an environmentalist
		Misconceptions
		Poor background knowledge
	Preparation	Insufficient training
		Finding visuals
		Making research
Peer Collaboration	Preparation	Reading articles
		Watching videos
	Peer	Group work
	Collaboration	Elaborating on the plans
		Collaborating with STEM teachers
Teacher Contentment	Student Awareness	CC
		Environmental literacy
	Social Responsibility	Global problems
		Protecting the nature
		Changing habits
		Informing others

Four categories emerged under the teacher readiness theme: *background knowledge, preparation, peer collaboration, and obstacles*. In the background knowledge category, some of the teachers stated that they were ready to implement the program since they were sensitive to the environment, they believed in the importance of providing CCE, and they received some previous training. On the other hand, there were some teachers stated that they had a lack of knowledge and misconceptions about CC as the obstacles. In the preparation category, they mentioned the measures that they took to fill in their knowledge gaps, such as researching online, reading articles, watching videos, and finding some visuals to better understand the concept. In the peer collaboration category, they emphasized the value of collaborating with their peers and STEM teachers at school as well as elaborating on the plans as a team to create the best learning atmosphere in their classes.

"I started working about environmental issues voluntarily at a local NGO when I was a teenager. Participating in clean-up projects and awareness campaigns helped me understand the importance of sustainability, which I now incorporate into my lessons." (T5, Female, 26)

"Although I am eager to teach about climate change, I struggle with misconceptions from outdated resources and feel that my limited background knowledge leaves me unprepared to address students' complex questions." (T10, Female, 40)

"Preparing for my lessons involves background research. I always spend some time watching videos, reviewing scientific articles, and gathering visuals that make the concepts more relatable and engaging for my students." (T20, 32, Female)

"As a group, we evaluated the plans a week ahead. We did research on issues that we might have difficulty with and exchanged ideas with our vice school principals." (T17, 37, Female)

The second theme was *teacher contentment*. Under this theme, *student awareness* and *social responsibility* categories were reached. In the student awareness category, they stated that their students' awareness was raised about CC and other environmental issues. They also noted that this program helped students gain knowledge about sustainability and develop environmental literacy. In the social responsibility category, the teachers stated that they observed student behaviors in relation to protecting nature, making use of the resources more carefully, and informing others and raising awareness of their parents.

"We enjoy using the program, which has been prepared to draw attention to climate change, starting from the first graders. It makes me happy to make my students aware of an important issue for our world at this age." (T2, 25, Female)

"It's incredibly fulfilling to see my students take action beyond the classroom—initiating recycling drives, educating their families about sustainability, and making small changes in their daily habits to reduce waste." (T25, 33, Male)

All in all, drawing attention to its possible catastrophic consequences, the teachers said that CCE is necessary and that this 8-week program effectively addresses this need. Additionally, teachers stressed the importance of such a program on CCE as it contributes to informing the larger society and developing pro-environmental habits.

Findings regarding the Input dimension

The Input dimension of evaluation focuses on the adequacy of resources for the effective implementation of the program (Stufflebeam, 2003). Teachers' views on this dimension centered around three themes, *learning activities, performance tasks, and content*. The content analysis of the Input dimension is presented in Table 3.

Table 3. The Content Analysis of the Input Dimension

Theme	Category	Sample Code
Learning Activities	Active learning	Students' participation Experiential learning Critical thinking Creative thinking
	Individual differences	Learning styles Differentiation Station technique
	Methods of teaching	Storytelling Drama Experiments Art activities
	Scope	Roles given to students
	Tasks	Active learning Saving the earth Climate crisis
	Suitability	Fun Consciousness raising Searching Students' grade
	Content	The balance in nature Endangered animals Cycles Food Waste Saving
	Life	Carbon cycle Greenhouse effect Global warming Disruption of ecological balance Melting of glaciers
	Climate Change	

The learning activities theme yielded three categories; *active learning*, *individual differences*, and *methods of teaching*. In the active learning category, participating teachers pointed out that the activities allowed student participation, created experiential learning opportunities and supported students' creative and critical thinking skills. In the individual differences category, they stated that the program enriched the learning environment by allocating enough space for differentiation and optimizing the learning process by giving students alternatives to choose with help of differentiation techniques such as station technique. Regarding the methods of teaching category, the participating teachers stated that the activities such as storytelling, drama, and experiments were well-chosen learning activities to foster students' learning.

"In 1st grade, we designed a newspaper and presented it to our friends. It was a good experience in peer teaching as it created interaction among students." (T14, 30 Female)

"Recognizing that students learn differently, I use various techniques like learning stations and differentiated assignments. This approach ensures that every learner, regardless of their style, finds a way to engage and succeed." (T1, 27, Female)

"Storytelling is one of my favorite teaching methods. I weave real-life examples into my lessons to help students see the relevance of what they learn. I also integrate drama activities where students role-play scenarios, making abstract topics more concrete and memorable., of course with the help of our hero, Butterfly Azur." (T16, 24, Female)

Two categories, *scope* and *suitability*, were reached under the performance tasks theme. In the scope category, teachers mentioned that these tasks allowed students to research the climate crisis and their responsibilities in overcoming it and share what they learned so that students had a learning experience in which they could control their learning. They also noted that the tasks motivated students to explore and acquire new knowledge. In the suitability category, they pointed out that the tasks were eligible for students' grades, adding that they were fun and consciousness-raising.

"The tasks increase the students' environmental sensitivity and contribute to the reflection of it to the students' behaviors. It enhances enduring understanding." (T7, 28, Female).

"The performance tasks are enjoyable and purposeful. For example, students are given tasks and also different roles which make the activities both fun and insightful. Their understanding of sustainability grows, while their creativity and research skills develop." (T19, 35, Female)

In the last theme, two categories, namely, *life* and *climate change*, were reached. In the life category, the teachers mentioned the abundance of life-related content, adding that there was a wide spectrum of endangered animals, cycles, and the balance in nature. In the second category, the teachers expressed that the program was rich enough to include topics such as the greenhouse effect, the carbon cycle, global warming, and so forth.

"They gained awareness of energy saving, sustainable living, recycling activities, and endangered animals." (T12, 29, Female).

"To help students understand the balance in nature, I connect lessons to everyday life. This way, students leave class with a deeper appreciation for nature and a stronger sense of responsibility to protect it." (T18, 27, Female)

In summary, as part of the input dimension, the teachers believed that the 8-week program had enough resources to be implemented effectively. They referred to the adequate use of effective learning activities, convenient performance tasks, and enriched content.

Findings regarding the Process dimension Subsection

The process dimension focuses on the actual implementation. The aim is to evaluate whether the implementations are carried out as planned (Stufflebeam, 2003). For the actual implementation, the teachers' evaluations centered around three themes: *barriers*, *facilitators*, and *suggestions*. The content analysis about the Process dimension is seen in Table 4.

Table 4. The Content Analysis of the Process Dimension

Theme	Category	Sample Code
Barriers	Physical	Small classrooms Large population Lack of green areas Weather conditions
	Equipmental	Material Smart board The internet Slides Videos
	Pedagogical	Students' level Abstract terms such as climate, greenhouse gases etc. Managing emotions such as anxiety and fear
	Academic	Designated time Pacing Heavy schedule
	Peripheral	The school The conditions
	Technological	Equipment Materials
	Educational	Interdisciplinary approach Integrating activities to existing programs
	Curricular activities	Teaching CC as a separate subject Teaching CC in other grades
	Extracurricular activities	Gardening Touching the soil Planting
	Collaboration	Being a project partner Finding partner schools More parent involvement
Suggestions	Curricular activities	
	Extracurricular activities	
	Collaboration	

The *barriers* to implementation were gathered around four categories: *physical*, *equipmental*, *pedagogical*, and *academic*. Regarding the physical barriers, teachers complained that the activities could not be carried out as desired because both the classrooms and the school garden were small and the classrooms were crowded. Regarding the equipmental barriers, some teachers mentioned internet connection problems and the absence of smart boards, which made it difficult for them to implement the plans fully. As part of pedagogical barriers, they stated that they sometimes had difficulties conveying abstract concepts such as climate and CC to the students. In the academic barriers category, they noted that they also had trouble dealing with students who were highly concerned about climate change. Teachers also reported feeling stressed because the school curriculum was too demanding, the academic expectations of the school administration and parents were too high, and they did not have enough time to devote to climate change. However, teachers also remarked that because CC is interdisciplinary, they were able to blend it with the material and activities of other courses.

"I think that students should work in a more comfortable environment while doing group work. Therefore, I thought that the physical environment of the classroom was not sufficient for group work to be created in this module." (T13, 31, Female)

"There is no space in our school where our students can grow plants by observing, and our classrooms are very narrow. In general, we have to proceed through the videos. I feel incomplete in the application part by living by doing during the application phase." (T24, 30, Male)

"Students often struggle to grasp abstract concepts like the greenhouse effect or carbon footprints. Additionally, discussing issues like climate change can sometimes cause anxiety or fear, so I carefully manage their emotions while encouraging hope and action." (T6, 42, Female)

"The tight curriculum and heavy schedule leave little room for in-depth discussions on climate issues. I often find myself rushing through topics, which prevents students from fully engaging and understanding the material. This is also challenging for students as they never want these lessons to end." (T3, 34, Male)

Despite the various obstacles to implementation cited by the teachers, they also acknowledged that there were *facilitating factors*. These factors were clustered under three categories, namely, *peripheral*, *technological*, and *educational* facilitators. As part of peripheral facilitators, teachers frequently mentioned the school administration and the parents' support. According to them, the school administration viewed the climate problem as a social responsibility; thus, they equipped the teachers with various resources to help them execute their plans. It was also motivating for teachers to receive positive feedback from parents, expressing their delight in providing such education at school. As technological facilitators, the teachers referred to all the equipment and material provided by the school administration. Lastly, the teachers mentioned that they experienced the convenience of the program being interdisciplinary in the educational facilitators category. They said that it was also easy to integrate the learning activities into the already existing programs.

"We received positive feedback from parents as we raise awareness of children about a global problem of our day." (T16, 24, Female)

"Having access to digital tools, such as smart boards and online platforms helped my teaching. Students could visualize the impact of climate change through interactive videos better." (T17, 37, Female)

"Integrating climate change topics into science and social studies through interdisciplinary activities has been highly effective. It is also quite easy to integrate the learning activities to our ongoing programs." (T14, 30, Female)

As the last theme, the teachers offered suggestions based on their experiences during the implementation. Those suggestions were gathered under three categories: *curricular activities*, *extracurricular activities*, and *collaboration*. As part of curricular activities, the teachers offered that CCE should be a year-long course that continues in subsequent years rather than being confined to eight weeks. In the extracurricular activities category, they emphasized the importance of outdoor activities such as planting, constructing a school garden, and touching the soil by spending time in the nature to support students' learning in the program. In the collaboration category, the teachers noted that being part of a project or finding partner schools to implement the program and exchange experiences would increase the efficacy of the program.

I believe climate change should be taught as a separate subject with its own curriculum. It would ensure students gain comprehensive knowledge about the issue from an early age. (T13, 31, Female)

"Students may be asked to develop projects to elaborate on the subjects they have learned. After students have videotaped their research, ideas can be exchanged on good projects by collaborating with different schools." (T26, 29, Female)

"Forming partnerships with other schools and involving parents in sustainability projects can create a strong community committed to climate action." (T5, Female, 26)

All things considered; the process dimension offered important tips about the implementation of the program. The barriers, the facilitators, and the suggestions were worth considering evaluating the program.

Findings regarding the Product dimension

The product dimension is the dimension in which the implementation is evaluated to see if it has succeeded in meeting the program's objectives (Stufflebeam, 2003). This dimension yielded three themes: *awareness*, *knowledge transfer*, and *parent involvement*. More explanations can be seen in Table 5.

Table 5. The Content Analysis about the Product Dimension

Tema	Kategori	Örnek Kod
Awareness	Environmental Awareness	Effective use of sources Recycling Sorting garbage Making compost at home Saving energy Being careful about plastic waste Not wasting water Conscious consumption Shooting inspiring videos Informing parents Making presentations to raise awareness Organizing campaigns Global warming Renewable energy resources Greenhouse gases Fossil fuels Nature and energy saving Recycling
	Social Responsibility	
	Theoretical Awareness	
Knowledge Transfer	Home	Applying newly learned things at home Demonstrating more conscious behaviors Conversations with parents about climate change
	School Life	Interpreting knowledge Games Saving materials Conscious use of resources
Parent Involvement	Support	Parental contentment Cooperating with children about developing projects Offering solutions to existing problems
	Household Activities	Sorting materials for recycling Saving resources Contributing to recycling

The *awareness* theme yielded three categories: *environmental awareness*, *social responsibility*, and *theoretical awareness*. In the environmental awareness category, the teachers mentioned that the children gained an understanding of the importance of pro-environmental behaviors such as resource

conservation, minimizing plastic consumption, saving the forests, and recycling. In the social responsibility category, they stated that children recognized the need for both communal and individual efforts in combating climate change. In the theoretical awareness category, they expressed that the students acquired knowledge about content-specific terms, such as greenhouse gasses, fossil fuels, renewable energy, and so forth.

"By enabling children to be more conscious; the program provided the opportunity to raise individuals who know what they can do to reduce the effects and who are sensitive to global problems." (T3, 34, Male)

"Our students' awareness has raised a lot about energy conservation and plastic waste reduction. They started informing their parents at home and took the initiative to use energy efficiently. They warn their parents about the fact that no matter how small, personal actions collectively create a significant impact." (T22, 37, Female)

"During class discussions they learned a lot about concepts such as renewable energy, fossil fuels, and greenhouse gases. It was rewarding to see that they have also gained some theoretical awareness." (T25, 33, Male)

Under the *knowledge transfer* theme, two categories, namely, *home* and *school life*, were reached. The teachers said that children transmitted what they learn in the classroom to school and home environments. Children began to use less paper, water, electricity, and plastic at home and school. They also mentioned that they started warning their parents and siblings, as well.

"Our parents told us that the awareness of our students improved. For example, after we talked about the fumes coming out of the exhausts of the cars, one of our students talked about this with his family in the car and learned about "AdBlue" and came back with his drawings and told it to the class the next day." (T18, 27, Female)

"In class, students have started to merge their learning with action. They show their sensitivity about energy conservation and being more careful about using sources, such as using both sides of paper and reducing waste." (T7, 28, Female)

Parent *involvement* was another significant theme in this dimension. *Support* and *household activities* were the emerging categories. In the support category, the teachers stated that the parents collaborated on projects with their children and began composting, separating trash, and recycling at home. In the household activities category, the teachers were happy to share that the parents were quite eager to sort materials for recycling and saving resources.

"In the monthly meetings we had with our parents, they said that they were happy that the students shared what they learned at school at home. They stood by us by supporting our process with their research at home." (T24, 30, Male)

"Several parents have told me that their children's enthusiasm for environmental issues has motivated the whole family to adopt greener habits, like sorting recyclables and conserving water. I'm glad to see my students' learning influence household practices." (T12, 29, Female)

In summary, the product dimension gave clues about the reflections of the program on students both in and outside of the classroom. The teachers' comments indicated that the program was effective in helping children gain awareness about climate change, internalize what they learned, and transfer this knowledge to new environments.

Discussion, Conclusion and Suggestions

In this study, the elementary school CC program developed using the UbD framework was evaluated based on teachers' views. Overall, it is possible to conclude that the CC program has succeeded in its stated objectives.

One of the most important findings worth discussing is the program's potential response to the needs in the field of CCE, that is, to help students transfer acquired knowledge to real life. Teachers claimed that the program could address this need effectively. Their students' understanding of CC has grown, and they are more motivated to exhibit pro-environmental behaviors and are able to transfer these behaviors to daily life. A transfer is the student's completion of tasks in new contexts without anyone telling him what to do by making use of an experience that has been gained. From this point of view, the transfer of knowledge requires the student to act autonomously in decision-making and on the axis of his own thinking habits (Wiggins & McTighe, 2005; 2011). According to Davis (2010), environmental education should empower children to grasp the complexity of their own natural systems and comprehend the intricate relationship between nature and living things, as well as engage them in social action for change. Similarly, Chang (2015) asserts that the approach to teaching CC would need to strike a balance between educating students who can critically engage with the latest information on CC as well as developing them as empathetic people who are motivated to take action to make their environment better. To engage in social action, students must be able to transfer what they learn in the classroom to their daily life. The findings of the study indicate that the program has visible and observable reflections on student behaviors. They started showing ideal behaviors at home by saving energy, making use of resources wisely, and attempting to recycle materials. This finding is consistent with the nature of the UbD instructional design model in the sense that the transfer of knowledge is only possible through meaningful learning and enduring understanding of the concepts that are taught in the lessons (Wiggins & McTighe, 2007).

The findings of this study indicate that, from teachers' perspectives, parental support plays a crucial role in the successful implementation of CCE. Teachers reported that positive feedback from parents served as a strong source of motivation for them, as families welcomed the inclusion of CCE in the curriculum. These findings align with Madden et al. (2023), emphasizing parents' enthusiasm for CCE. It is well known that parental interest and participation in the learning process significantly contribute to children's education. Active parental involvement and enthusiasm in educational processes enhance children's motivation, improve learning outcomes, and support cognitive development, thereby fostering more effective learning both inside and outside the classroom (Dowd et al., 2017). Similarly, in the context of CCE, parental engagement plays a significant role in helping children develop a deeper understanding of climate-related issues and raising their awareness. Lawson et al. (2019) emphasize that involving families and communities in the CCE process broadens its impact. Parents' participation in discussions and activities related to CC deepens students' comprehension of the topic and encourages them to take informed action. Teachers also highlighted that parental support is a critical factor in reinforcing climate-related concepts at home. This perspective is further supported by Parth et al. (2020), who advocate for integrating intergenerational learning into CCE programs. The researchers suggest that initiatives such as school-community collaborations, homework assignments, and climate action projects help increase family involvement, thereby enabling students to grasp CC issues more effectively. Overall, these findings suggest that future climate education efforts should actively engage parents in the learning process. Community-based workshops, school-led sustainability initiatives, and home-based learning activities are potential strategies to enhance parental involvement. Expanding CCE beyond schools and adopting a holistic, community-wide approach will not only boost student engagement but also strengthen long-term climate awareness.

Another finding worth discussing is the teachers' full cooperation in implementing the program. The teachers who took part in this study did not hesitate to discuss CC with their students. It is widely accepted in the literature that for CCE to be successful, teachers must avoid shielding the students from the issues and disagreements that arise in the CC discourse out of blind advocacy. The topic of CC is thought to be controversial, and numerous studies indicate that teachers are reluctant to discuss it in their classes due to their personal convictions and/or parental reactions (Elliott & Davis, 2009; Ginsburg & Audley, 2020; Seow & Ho, 2016). Similarly, Baker et al. (2021) highlighted that teachers are hesitant to discuss the topic of climate change with children due to difficulties in managing their own anxieties, limited knowledge, and a lack of adequate institutional support within schools. This finding of the study, however, indicates that the situation in Türkiye may be slightly different. According to the current study findings and the study by Higde et al. (2017), teachers and teacher candidates in Türkiye appear to recognize CC as a scientific fact and are willing to include CC in their practices. In Türkiye, the state and the Ministry of Education both formally recognize climate change as a scientific fact. Within centralized education systems like that of Türkiye, teachers' perspectives are highly influenced by the state's point of view. Thus, the source of the difference in teachers' perspectives in Türkiye may be due to the highly centralized structure of education in the country.

Among the findings, another important one was about barriers to implementing the program. Although most teachers agreed that teaching about CC was important and the program was effective, many cited limited resources, time, and space as obstacles. Contradictory or challenging conditions always affect teachers' instructional processes negatively. Limited time, limited resources, lack of financial support, and many others can be mentioned to hamper teaching effectively. It is also evident that the performance of a school system as a whole is frequently correlated with the educational resources available in that school (OECD, 2013). Our finding is consistent with the findings of several international studies (e.g. Colston & Ivey, 2015; Foss & Ko, 2019; Gillenwater, 2011). Even though Turkish schools are required to have schoolyards, these spaces are typically unsuitable for outdoor activities (Temel, 2020; Yılmaz & Ertürk, 2016). Additionally, classrooms might be very packed (approximately 25 to 30 children). Teachers may have difficulties in settings where there are many children, and their classes are relatively small because all the program's activities—such as group discussions, drama, and educational games—require active participation from the children.

These findings indicate that various measures should be taken to overcome the challenges encountered in implementing CCE. Firstly, increasing resource allocation to provide schools with adequate teaching materials, digital tools, and scientific resources would be beneficial. Optimizing learning environments and classroom arrangements by incorporating small-group activities, flexible seating arrangements, and more efficient use of open spaces can help mitigate spatial limitations. As a solution to time constraints, integrating CCE into the existing curriculum and developing modular lesson plans could be effective. Additionally, promoting outdoor and experiential learning opportunities—such as field trips to ecological centers, collaborations with local communities, and school-led sustainability projects—can help compensate for the lack of suitable open spaces in many schools. By implementing these strategies, the barriers to effectively incorporating CCE can be overcome, enabling students to gain meaningful and practical climate literacy.

One crucial finding of this study was that teachers reported a lack of knowledge about CC. In Türkiye, elementary school teacher training programs include only a single course on environmental education, typically offered for two hours per week in the first year of undergraduate study. This limited exposure is insufficient to cover the complexities of CC comprehensively. Consequently, teachers expressed concerns about their inadequate understanding of CC, a finding consistent with studies from other countries. Research has shown that both in-service and preservice teachers often lack sufficient

knowledge and hold misconceptions regarding CC (e.g., Arslan et al., 2012; Demant-Poort & Berger, 2021; Foss & Ko, 2019; Lambert & Bleicher, 2013; Papadimitriou, 2004).

For instance, Demant-Poort and Berger (2021) explored the presence of CC education in teacher training programs in Greenland and Canada. Their study revealed that preservice teachers in both countries had limited knowledge of climate change, highlighting a critical gap in their preparedness to teach the subject. Despite this, many preservice teachers expressed a strong interest in incorporating CC topics into their future teaching. The authors emphasized the necessity of formally integrating CC education into teacher training programs to equip educators with the required knowledge and confidence. Similarly, Foss and Ko (2019) examined the challenges and potential opportunities for CC education in the Dallas-Fort Worth area of Texas. Through surveys conducted with the general public and science teachers, they identified key barriers such as widespread misconceptions about climate science, limited public awareness, and a lack of institutional support and resources for educators. Despite these challenges, the study highlighted opportunities for improving CC education by fostering community engagement, offering targeted professional development for teachers, and integrating climate change topics into existing curricula. These findings underscore the need for systemic changes to overcome societal and institutional barriers and promote effective climate literacy.

To bridge the knowledge gap, teachers in this study reported relying on peer collaboration, particularly working with STEM educators, to enhance their understanding of CC. This aligns with Carrier's (2012) assertion that robust professional networks and structured professional development are vital for equipping teachers with the expertise needed to effectively teach CC. Furthermore, research indicates that teachers' confidence in CC education directly impacts student engagement and learning outcomes. When teachers feel well-prepared, students are more likely to engage actively in discussions and take initiative in sustainability efforts. Monroe et al. (2019) demonstrated that teachers with strong CC knowledge can foster a sense of agency in students, encouraging them to participate in climate action beyond the classroom. This suggests that equipping teachers with a deeper understanding of CC is not only essential for improving their instruction but also for promoting long-term behavioral changes in students.

A critical component of improving teachers' CC knowledge and instructional confidence is professional development. Anderson (2012) highlights that professional development initiatives centered on climate literacy significantly enhance teachers' confidence and competence in delivering climate-related instruction. By providing structured learning experiences, workshops, and curriculum resources, these initiatives can help teachers integrate CC education more effectively into their teaching. Several studies have explored the role of education in both preservice and in-service teacher training. Lambert and Bleicher (2013) investigated the impact of a structured educational intervention within an elementary science methods course on preservice teachers' perceptions of CC. The intervention included structured coursework integrating scientific literature, discussions, and hands-on activities aimed at dispelling misconceptions and aligning participants' perspectives with the scientific consensus. The course provided explicit instruction on the causes and consequences of climate change, incorporated data analysis exercises using real-world climate data, and facilitated guided discussions on climate-related pedagogical strategies. As a result, participants demonstrated a stronger understanding of human-induced climate change and a clearer recognition of the scientific consensus. This study underscores the importance of a structured curriculum in addressing misconceptions and enhancing climate literacy among future educators. The authors advocate for the integration of CC education into teacher preparation programs to ensure that preservice teachers are adequately prepared to teach this critical subject.

Similarly, Berger et al. (2015) examined the implementation of *Climate Change Pedagogy*, a nine-week elective course within a Bachelor of Education program designed to enhance teacher candidates' comprehension of CC and equip them with effective instructional strategies. The course incorporated interactive learning activities, interdisciplinary discussions, and experiential learning approaches, emphasizing the complexity of climate issues across various subjects. Participants engaged in hands-on projects, reflective discussions, and resource development to prepare for real-world classroom applications. A key finding from this study was the importance of a supportive and open learning environment, which fostered confidence in discussing climate-related topics. However, teacher candidates also identified several challenges, including limited knowledge of climate science, concerns about the controversial nature of CC education, and uncertainty regarding its integration into their teaching practices. Many participants recommended making the course a mandatory component of teacher education programs and extending its duration to ensure comprehensive preparation. The authors stress the necessity of embedding CC education systematically within teacher preparation curricula to ensure that future educators are adequately equipped to teach this pressing and complex issue.

Thus, to ensure the effective implementation of climate change education (CCE) in schools, further research should first focus on strengthening preservice and in-service teacher training before introducing interventions at the classroom level. Studies should explore the development of comprehensive CCE modules within teacher education programs to assess how early integration of climate literacy affects future teaching practices. Research should examine the impact of embedding climate change education in core teacher training courses rather than treating it as an elective or supplementary subject. Longitudinal studies tracking preservice teachers from training to their first years in the profession would provide insights into how well they retain and apply climate change concepts in their teaching.

For in-service teacher professional development, further studies should evaluate the effectiveness of structured, research-based professional development programs in improving teachers' climate literacy and instructional competence. Investigating various models, including workshops, certification courses, and collaborative learning networks, could help determine the most effective approaches for scaling up professional learning opportunities. Additionally, research should explore how providing teachers with ongoing access to up-to-date scientific resources, instructional materials, and interdisciplinary support from climate scientists and environmental educators enhances their ability to teach complex climate concepts.

A key area for further study is the role of policy frameworks and institutional support in sustaining professional development efforts. Examining how different countries or educational systems implement and fund mandatory climate-focused professional development can inform best practices for broader adoption. Comparative studies could assess the effectiveness of different pedagogical strategies, such as inquiry-based learning, experiential education, and interdisciplinary approaches, in preparing teachers to deliver high-quality climate change instruction. By addressing these research gaps in preservice and in-service teacher education, future studies can provide the foundational knowledge necessary for designing scalable, evidence-based climate education interventions at the school level.

All in all, despite some implementation-related minor problems such as physical conditions and lack of time, this study showed that the UbD is an effective framework for students to understand and transfer knowledge to their real lives, which are the most important aims of CCE. The findings emphasize the UbD-based CC program's capabilities in promoting enduring understanding and knowledge transfer to real life. However, problems such as time constraints, physical problems, and the need for sufficient training were noted. Addressing these challenges has the potential to improve the usefulness of UbD framework, making it more adaptable and sustainable in a variety of educational settings. Future study should investigate alternatives to overcome these challenges and improve UbD implementation procedures.

Several limitations should be acknowledged. Firstly, the study primarily relied on teacher evaluations without incorporating direct student feedback. Including student perspectives could provide more comprehensive insights into the program's effectiveness. Future research should consider integrating student feedback and/or direct assessments of student learning outcomes. Secondly, the study was conducted exclusively in private schools across Türkiye, which may not fully represent the experiences of teachers and students in public schools or other educational settings. To improve generalizability, future studies should examine the curriculum's implementation in a broader range of school environments. Thirdly, the study mainly focused on the program's short-term effects, which may not be sufficient to evaluate its long-term impact on students' behaviors and understanding. There was no follow-up to assess whether students retained and applied their knowledge over time. Future studies should incorporate longitudinal assessments to measure the program's lasting effects. Fourthly, in this study, some teachers reported gaps in their climate change knowledge, which may have impacted the quality of instruction and the overall effectiveness of the program. Future studies should evaluate teachers' prior knowledge of CC and CCE before program implementation. This approach would ensure that teachers have a comparable level of understanding, allowing for a clearer assessment of the program's effectiveness and minimizing variations caused by differences in teacher knowledge. Lastly, some teachers cited challenges such as limited green spaces, large class sizes, and a lack of necessary materials, which may have affected the program's full implementation. These constraints could limit the applicability of the findings to schools with different infrastructural conditions. Future research should address these limitations by including schools with diverse resources and exploring solutions to overcome these barriers.

Overall, future studies should adopt a longitudinal approach, incorporate student perspectives, extend research to public schools, and examine a variety of educational settings to strengthen the validity and transferability of the findings.

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Examining chatbot-generated responses on heat and temperature: misconceptions, consistency, and conceptual change

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Abstract

This study examined whether responses generated by chatbots (ChatGPT-3.5, ChatGPT-4, and Bard) about heat and temperature match misconceptions identified in the literature and how these responses compare to those of learners. The study also addressed the effect of Conceptual Change Texts (CCTs) on chatbot-generated responses about heat and temperature, focusing on their relevance to prompt engineering. Heat and Temperature Four-tier Misconception Test (HTMCT) and CCTs were utilized from a previous study that investigated the effectiveness of CCTs in remedying misconceptions about heat and temperature held by pre-service physics teachers. The HTMCT, consisting of 20 items, was designed to diagnose misconceptions about heat and temperature held by pre-service physics teachers as identified in the literature, with each misconception being assessed using multiple items. In this study, the HTMCT was used to diagnose the chatbots' responses of the heat and temperature concepts before and after the implementation of CCTs. In addition, in-depth interviews with the chatbots were conducted to elaborate on their responses. Pre-service physics teachers in the prior study exhibited misconceptions about heat and temperature, which were effectively remediated by CCTs, leading to significant overall improvements. Similarly, this study found that chatbot-generated responses, except those from Bard, were prone to misconceptions. ChatGPT-4 consistently generated responses that aligned with the scientific paradigm, unlike the other two chatbots. However, pre- and post-test data revealed that ChatGPT-4-generated responses were prone to a misconception, specifically that equal amounts of heat supplied to different substances will result in the same final temperature, and these responses consistently reflected this misconception. Both ChatGPT-3.5 and Bard showed improved performance between the pre- and post-test data, despite providing inconsistent responses. While chatbots could generate responses that accurately expressed concept definitions, they struggled with drawing conclusions based on multiple scientific

Keywords

- Science education
- Artificial intelligence chatbots
- Prompt engineering
- Heat and temperature
- Misconception
- Conceptual change approach
- Four-tier test

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concepts, applying concepts to real-world scenarios, and engaging in complex reasoning. In this study, while the algorithms underlying the chatbots remain undisclosed, the post-test responses for all chatbots showed a notable decrease in incorrect responses and improved alignment with scientific knowledge, suggesting a positive influence of CCTs, akin to findings from the prior study.

Introduction

The COVID-19 pandemic has led to a widespread shift toward the use of online technologies for teaching and learning (Sartika et al., 2021; Whalley et al., 2021). Artificial intelligence (AI) has been making its way into our daily lives, including through computers and mobile devices (Ramos et al., 2008). AI is a general term that encompasses several technologies and methods, such as machine learning, deep learning, and natural language processing (Baker & Smith, 2023). Large language models (LLMs) based on generative artificial intelligence, such as ChatGPT and Google's Bard, have gained widespread attention in education (Alasadi & Baiz, 2023; Labadze et al., 2023; O'Dea, & O'Dea, 2023). These generative chatbots perform human-like cognitive tasks by analyzing very large amounts of data (Zawacki-Richter et al., 2019).

In science education, generative chatbots are being explored for their potential to support teaching and learning. Previous studies have investigated their use in various contexts, including assessing chatbot responses to exam questions (Clark, 2023; Fergus et al., 2023), using chatbot-generated responses as prompts for student critique (Exintaris et al., 2023), integrating chatbots in chemistry labs (Humphry & Fuller, 2023), and analyzing chatbot reasoning (Talanquer, 2023). Despite this growing interest, an underexplored area is the role of chatbots in addressing one of the most persistent challenges in science education: misconceptions about fundamental scientific concepts such as heat and temperature, which are essential for understanding thermodynamic principles and their applications across disciplines (Tiberghien, 1994). Building on this foundation, this study investigated chatbot responses (ChatGPT-3.5, ChatGPT-4, and Bard) related to the concepts of heat and temperature, examining their alignment with misconceptions identified in the literature and comparing these responses to those of learners. This is of particular significance for the field of science education, as it provides insight into how instructors can utilize chatbots to design formative assessment activities that elicit responses, challenge assumptions, and enhance learner reasoning. Students can discern accurate information and correct errors by subjecting chatbot responses to misconception tests to critical evaluation, thereby fostering a deeper and more robust understanding of scientific concepts. This manner of instruction facilitates the remediation of misconceptions and enhances the overall learning experience by encouraging critical thinking and active engagement with the subject matter (Exintaris et al., 2023; Rudolph et al., 2023). In this study, we adapted Çelik's (2022) methodology by employing a misconception test, originally constructed based on the literature on misconceptions about heat and temperature, to assess chatbot-generated responses and by utilizing Conceptual Change Texts (CCTs) to address these misconceptions. This approach enabled a comparative analysis to determine whether chatbot responses about heat and temperature aligned with the misconceptions identified in the literature and among pre-service physics teachers and to assess the effectiveness of CCTs in addressing these misconceptions across two different contexts: pre-service physics teachers and chatbot-generated responses.

Prompt engineering ensures that chatbots generate accurate responses by refining the way questions or inputs are structured. While some chatbots, like Bard, can update their responses based on input data, the key goal of prompt engineering remains consistent: to enhance the precision and relevance of chatbot-generated information (Brown et al., 2020). Similarly, CCTs are widely used in science education to remedy misconceptions and present accurate scientific concepts (Duit & Treagust, 2003). Both prompt engineering and CCTs share the objective of presenting clear, scientifically sound

information (Duit & Treagust, 2003; Liu et al., 2023). This study investigated how CCTs could refine chatbot responses about heat and temperature, with the aim of improving the quality of educational content provided by AI-driven tools.

Background

This section provides an overview of the key concepts underlying this study. In particular, it focuses on (1) misconceptions about heat and temperature, exploring their prevalence and importance in science education; (2) prompt engineering, highlighting its role in optimizing chatbot responses for educational purposes; and (3) conceptual change texts (CCTs), highlighting their usefulness in addressing learners' misconceptions. Complementing the background discussion, the research aim section outlines the aims of the study and provides the basis for addressing the guiding questions of the study.

Misconceptions About Heat and Temperature

Perceptions are initially formed by observing one's environment and nature. For instance, without any other input, someone who observes the process from sunrise to sunset may conclude that the Earth remains motionless while the sun rises in the east and falls in the west. Indeed, in the past, scientists and philosophers have drawn such conclusions based on their observations of nature. During the 17th and 18th centuries, scientists concluded that all combustible substances contained an invisible matter called phlogiston. According to this theory, phlogiston was thought to escape from a burning substance and dissolve into the air. However, over time, scientific advancements have refined our understanding of the motion of the Earth and other planets in the solar system and led to a more accurate comprehension of combustion events, one that does not reference the outdated concept of phlogiston.

Misconceptions, like those about the Earth's motion or phlogiston, can create cognitive conflict, which affects how new information is processed. Learners often need to recognize and resolve these conflicts for effective learning (Posner et al., 1982). Some observations can encourage misconceptions in certain subjects, one of the best examples being the concept of heat. The misconception is that heat is matter and a quantity that a substance can possess, which is similar to the ideas of ancient philosophers and scientists. In this example, the belief is that heat is a tangible substance, akin to air or fluid, that can be added to or removed from objects. Studies have shown that such misconceptions about heat, temperature, force, and motion are persistent and can lead to systematic errors in understanding (Driver et al., 1994). Many learners also have difficulty distinguishing between "heat" and "temperature" and often use them as synonyms (Aydoğan et al., 2003; Çelik, 2022; Güneş, 2021).

Prompt Engineering

Prompt engineering is a fundamental technique of natural language processing (NLP), crucial for guiding large language models (LLMs) such as ChatGPT-3.5, ChatGPT-4, and Bard, to generate desired outputs. This technique is essential for optimizing the performance and utility of these models in various applications, including chatbots and automated content generation. By refining input prompts, researchers and practitioners can elicit more accurate, relevant, and contextually appropriate responses from LLMs. Carefully designed prompts leverage the inherent capabilities of LLMs more effectively, enabling them to perform complex tasks with minimal additional training. In the realm of maximizing the potential of large language models, prompt engineering is indispensable. Practitioners can substantially enhance the quality and relevance of model outputs by emphasizing clarity, context, structure, and iterative refinement. This technique also improves LLM performance and broadens their applicability across diverse fields, from automated content generation to educational tools (Brown et al., 2020).

Conceptual Change Text (CCT)

CCTs are one of the most effective methods for remediating misconceptions (Chambers & Andre, 1997; Çelik, 2022; Hynd & Alvermann, 1986; Wang & Andre, 1991). CCTs are based on conceptual change models. Researchers have proposed various conceptual change models (Chi, 1992; diSessa, 1988; diSessa, 2008; Mortimer, 1995; Posner et al., 1982; Ueno, 1993; Vosniadou, 1992). According to Posner et al. (1982) model, which is one of the most widely used conceptual change models in education, for conceptual change to occur, a learner must be dissatisfied with their current conception, then the learner must recognize a new concept as intelligible, plausible, and fruitful. CCTs introduce possible misconceptions in a given context and explain flaws to prompt dissatisfaction. They present scientific concepts clearly, making them plausible, and offer various contexts to enhance understanding and applicability (Chambers & Andre, 1997; Güneş, 2021). CCTs represent a promising intervention method to remedy misconceptions about heat and temperature (Aydoğan et al., 2003; Çelik, 2022). A comparison of prompt engineering and the use of CCTs in science education reveals a common underlying approach: methodically designing the input, whether prompts for language models or instructional texts for students, to enhance the quality and effectiveness of the output. Both techniques emphasize the importance of clarity, context, and iterative refinement to achieve their respective goals. In essence, prompt engineering improves chatbot performance, while CCTs enhance learning by addressing and remedying misconceptions, thereby improving conceptual understanding in educational settings (Duit & Treagust, 2003; Liu et al., 2023).

Research Aim

The ability to distinguish between true and false and between scientific and non-scientific information on the internet is becoming increasingly important with the widespread use of AI, making Information and Communication Technology (ICT) skills essential. Many countries, with the goal of all internet users having these skills, have systematically included ICT skills in their curricula. Presentations of the concepts of heat and temperature, which are directly related but not the same, on the internet are based on scientific and non-scientific information sources, such as in textbooks (Leite, 1999) and visual and written media (Allchin, 2023). For these reasons, we carried out a study on heat and temperature to check if the information in AI-based applications reinforced misconceptions about heat and temperature. A clearer comprehension of AI responses concerning cognitive features can aid in successfully integrating of emerging technologies in educational settings. We aimed to investigate whether the information provided to users by AI-based applications aligns with the misconceptions identified in the literature, how these responses compare to those of learners, and the effect of CCTs on chatbot-generated responses about heat and temperature. In this study, "learners" specifically refers to pre-service physics teachers, as examined in Çelik's (2022) study, where their conceptual understanding of heat and temperature provided a valuable benchmark for identifying and addressing misconceptions. The research questions that guided this study are as follows:

- Do chatbot-generated responses about heat and temperature correspond to misconceptions identified in the literature?
- Do chatbot-generated responses match pre-service physics teachers' misconceptions about heat and temperature?
- How do conceptual change texts affect chatbot-generated responses about heat and temperature concepts?
- Is a chatbot consistent in its responses to the concept test?

Method

The ChatGPT-3.5, ChatGPT-4, and Google Bard 1.0.0 chatbots were used in the study. The Heat and Temperature Four-tier Misconception Test (HTMCT) (Güneş, 2020) was used to diagnose the chatbots' responses regarding heat and temperature concepts (See Appendix for the HTMCT). First, we opened a new chat page in all chatbots to administer the HTMCT as a pre-test on 3 November 2023. Following this, we provided CCTs to remedy the chatbots' responses in case the chatbot-generated responses were in line with the misconceptions identified in the literature. The chatbots were tasked with offering suggestions for enhancing their responses, revealing varying degrees of receptiveness to learning. While ChatGPT-3.5 and ChatGPT-4 acknowledged the inability to integrate information from the prompt to update LLM, they still identified avenues for refining their responses. In contrast, Bard exhibited a high level of openness to learning, expressing readiness to adapt and improve based on the provision of accurate and high-quality information with the prompt. Therefore, because of their structured design, the CCTs were used as a tool to guide the chatbot's responses about the concepts of heat and temperature, not as a training model. In this study, the CCT, which consists of five distinct steps, was presented as a single, unified textual prompt rather than as separate stages, as is standard practice in such applications. By leveraging this unique approach, the CCT is believed to enhance the clarity and accuracy of chatbot responses. Additionally, responses indicated that remedying inaccuracies might require several days or even a week, thus justifying the one-week interval between the pre- and post-test assessments. One week later, on 9 November 2023, the HTMCT was administered as a post-test. In-depth interviews were then conducted to address the chatbot-generated responses that were consistent with the misconceptions. All tasks were completed on the same chat page. The pre- and post-test data were coded independently by the authors of this article, and five discrepancies between coders out of 120 coded data (20-item HTMCT for all three chatbots and for both pre- and post-test data) were observed and resolved through discussion; finally, the coding agreed upon by both authors was implemented.

Heat and Temperature Four-tier Misconception Test (HTMCT)

The HTMCT was developed as part of a master's thesis supervised by the second author of this study (Güneş, 2020). The HTMCT measures each misconception using more than one item. There are 20 items in the test. In the first tier of the test, one option is the correct response, the other options are misconceptions and distractors. The HTMCT was designed to diagnose seven common misconceptions (Çelik, 2022; Güneş, 2021) held by pre-service physics teachers, as identified in the literature (see Table 1).

Table 1. Heat and Temperature Misconceptions

Misconception Number	Misconceptions
MC ^a 1	The skin is a good thermometer.
MC2	A temperature of 40°C is twice that of 20°C.
MC3	When equal amounts of heat are supplied to different substances, they will reach the same final temperature.
MC4	Heat and temperature are the same.
MC5	When two liquids are mixed, the temperature of the resulting mixture is equal to the sum of the temperatures of the individual liquids.
MC6	The temperature of any substance that receives heat increases. / The temperature of any substance that gives off heat decreases.
MC7	Woolen clothes give heat to you.

^aMC stands for misconception

In the first tier of the test, multiple-choice questions were asked about the misconceptions shown in Table 1. In the second tier, the level of confidence in the responses given in the first tier was questioned. The third tier asked about the reasoning behind the responses given in the first tier. The

fourth tier asked for the level of confidence in the reason given. A sample four-tier question (#12) from the HTMCT is shown in Box 1.

Box 1. A Sample Four-tier Question (#12) from the HTMCT

12.1. In the refrigerator of a house there are different amounts of cheese, olives, eggs, and apples, bought at different times. After being in the refrigerator for a long time, they have stopped exchanging heat with each other and with the environment. What quantity of these foods is absolutely the same?

- a) The amount of heat they take from the environment
- b) The heat they give off to the environment
- c) Final temperatures
- d) Final internal energies
- e) Temperature changes after being put in the refrigerator
- f) Other (please specify):
.....

12.2. How confident are you in your response to 12.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

12.3. What is the scientific reason for your response to 12.1 above? Please explain in your own words

.....
.....

12.4. How confident are you in the reason you gave in 12.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

When the AI chatbots' responses to the HTMCT questions were analyzed, the chatbot-generated responses in the second and fourth tiers were all "I am sure" or "I am certainly sure". This meant that none of the chatbots' expressed any lack of confidence in their responses. The categorization of responses, therefore, considered only the other two tiers of the four-tier test (see Table 2).

Table 2. Categorization of Responses in the First and Third Tiers^a

		1st Tier		
		Correct	Misconception	Distractor
3rd Tier	Correct	SC	FN	LK
	Misconception	FP	MC	LK
	Distractor	LK	LK	LK

^aSC, Scientific conception; MC, Misconception; FP, False positive; FN, False negative; LK, Lack of knowledge.

The scientifically correct first and third tier responses are indicated by scientific conception (SC). Misconception (MC) indicates misconceptions for the first and third tiers. If a response is scientifically correct in the first tier, but the reason is consistent with the misconception in the third tier, this binary explanation is classified as a false positive (FP). Similarly, if the response is a misconception in the first tier, but scientifically correct in the third tier, it is classified as a false negative (FN). All other possible responses, except these four categories of responses, are considered as lack of knowledge (LK). It should be noted that some of the responses categorized as lack of knowledge in this study may be misconceptions, but that would need to be determined through in-depth interviews. For the purposes of this study, only the responses that contained a misconception in the first tier and provided an explanation with a reason to support the selected misconception in the third tier were considered misconceptions.

Hestenes et al. (1992) introduced the concepts of “false positive” and “false negative” for the importance of the accuracy of metrics on multiple-tier tests. A false positive is a Newtonian answer selected using non-Newtonian reasoning, while a false negative is a non-Newtonian answer based on Newtonian reasoning. The rates of false positives and false negatives were reported to be less than 10% (Hestenes & Halloun, 1995). The validity of a multiple-tier test increases as the rates of false positives and false negatives decrease.

Conceptual Change Text (CCT) and Prompt Engineering

We used CCTs developed in a master's thesis (Çelik, 2022) supervised by both authors to remedy the chatbots' responses when the chatbots' generated responses were consistent with the misconceptions identified in the literature. Seven CCTs were developed to remedy the seven misconceptions identified by the HTMCT. The CCTs consisted of sections including questioning, dissatisfaction, intelligibility, plausibility, and fruitfulness, following the conditions of conceptual change as outlined by Chambers and Andre (1997).

During the preparation of the CCTs, the first step involved **questioning** learners' existing understanding of the subject to identify any misconceptions. In the second step, known as the **dissatisfaction** condition, the misconceptions were presented and the reasons for these misconceptions were emphasized. Then, an attempt was made to help learners recognize their existing misconceptions and understand the inadequacy of their currently held concepts. In the third step, referred to as **intelligibility** condition, learners were presented with scientific knowledge to remedy their misconceptions. The knowledge was explained using examples from daily life to ensure comprehension. The fourth step, called the **plausibility** condition, ensured that the scientific knowledge fit learners' existing concepts and could be applied to solve problems. The aim was to explain the scientific knowledge clearly and convincingly, using examples that learners are likely to encounter. In the final step, the **fruitfulness** condition demonstrated that scientific knowledge can be applied to solve problems in various areas and contexts. A sample of a CCT is presented in Box 2.

Box 2. An Example of Conceptual Change Text to Remedy Misconceptions about "Heat and temperature are the same."

? ^aAre heat and temperature the same concepts?

D ^bSome people may think that heat and temperature are the same concept. One of the possible reasons for this could be that heat and temperature are used interchangeably in everyday life, or they are thought to be synonymous. However, although heat and temperature are related, they are two different concepts.

I ^cHeat is the energy transferred between objects due to a difference in temperature. Heat is measured in units of energy such as joules or calories. Temperature is a measure of the average translational kinetic energy of particles in a material and is measured in kelvin. It is important to distinguish between temperature and heat as they are two different concepts. Heat is the transfer of energy from one object to another (or from a higher temperature part of an object to a lower temperature part) due to a difference in temperature. For example, when a cold hand touches a hot heating pad in winter, heat is transferred from the pad to the hand due to the difference in temperature.

P ^dSimilarly, if a bottle of water at 4°C is taken out of the refrigerator and placed in a kitchen at 27°C, it will receive heat from the environment until it reaches thermal equilibrium. This exchange of energy between the water and the environment is known as heat. If the bottle is left in the kitchen long enough, the water and the environment will reach equilibrium and there will be no net heat transfer.

F ^eConsider the example of an aluminium ruler that has been left at room temperature for a long time. If a candle is used to heat one end of the ruler, its temperature will increase. This temperature difference causes energy to be transferred from the heated end to the other end, which is known as heat. The transfer of energy continues until both ends are at the same temperature. Heat is the transfer of energy as a result of a temperature difference. It is important to note that the concepts of heat and temperature are not interchangeable.

^aQuestioning; ^bDissatisfaction; ^cIntelligibility; ^dPlausibility; ^eFruitfulness

Having explained CCT, it is useful to emphasize its relevance and commonality with prompt engineering. Prompt engineering is critical to improving the performance of language models by producing clear, specific, and structured input. Clarity and specificity help reduce ambiguity and allow the model to focus on the precise task (Liu et al., 2023). Providing context and background information helps the model understand the broader framework of the query, which is particularly important for complex tasks (Reynolds & McDonell, 2021). The format and structure of prompts also play an important role; well-structured prompts with clear formatting improve the model's ability to parse and respond effectively, according to Gao et al. (2020). Finally, prompt engineering is an iterative process that requires continuous testing and refinement to improve the quality of responses. Both prompt engineering and CCT exhibit structural and functional similarities that facilitate accurate information processing and learning. These techniques prioritize clarity and specificity, provide context and background information, employ effective formats and structures, and undergo iterative refinement.

- Clarity and Specificity: In prompt engineering, it is paramount to ensure that prompts are clear and specific, as this guides language models towards accurate responses. Ambiguous prompts can lead to erroneous outputs. Similarly, CCTs aim to clarify misconceptions by offering unambiguous explanations that challenge existing knowledge and present accurate scientific concepts (Brown et al., 2020; Posner et al., 1982).

- Context and Background Information: Providing context and background information in prompts enhances language models' understanding of tasks, eliciting responses that are more pertinent to the task at hand. CCT techniques use contextual information to help learners relate new concepts to their existing knowledge, facilitating a deeper understanding (Duit & Treagust, 2003; Liu et al., 2023).
- Format and Structure: The format and structure of prompts are crucial in guiding language models. Well-structured prompts, such as clear question-and-answer formats, enhance the model's ability to interpret and respond accurately. CCTs use logical sequencing, headings, and instructional strategies to systematically address misconceptions and reinforce new concepts (Posner et al., 1982; Reynolds & McDonell, 2021).
- Iteration and Refinement: Both prompt engineering and CCTs involve an iterative refinement process. Prompts undergo continuous testing and adjustment based on elicited responses, while CCTs are revised according to student feedback to ensure their effectiveness in addressing misconceptions and facilitating learning (Duit & Treagust, 2003; Gao et al., 2020).

Results

What Pre- and Post-test Data Reveals About Chatbot Responses Regarding Heat and Temperature?

The results of the pre- and post-test data for ChatGPT-3.5, ChatGPT-4, and Google Bard 1.0.0 chatbots are shown in Table 3. The responses of the AI chatbots to each question in the HTMCT were categorized as scientific conception, misconception, false positive, false negative, and lack of knowledge, as shown in Table 2.

Table 3. Pre-and Post-test Data Results for the AI Chatbots^a

Number of Question	Pre-Test			Post-Test		
	CHATGPT-3.5	CHATGPT-4	BARD	CHATGPT-3.5	CHATGPT-4	BARD
1	FN	SC	LK	FN	SC	SC
2	FN	SC	FN	SC	SC	FN
3	LK	LK	SC	SC	LK	FP
4	LK	SC	FN	LK	SC	LK
5	MC5	SC	SC	SC	SC	LK
6	LK	SC	LK	LK	SC	SC
7	SC	SC	SC	SC	SC	SC
8	SC	SC	SC	SC	SC	SC
9	FN	SC	SC	LK	SC	SC
10	SC	SC	LK	SC	SC	LK
11	LK	MC3	SC	LK	MC3	SC
12	LK	SC	LK	LK	SC	LK
13	LK	SC	FP	SC	SC	SC
14	MC6	SC	LK	LK	SC	LK
15	SC	SC	SC	SC	SC	SC
16	LK	SC	SC	LK	SC	SC
17	LK	SC	LK	LK	SC	FP
18	LK	SC	LK	SC	SC	LK
19	LK	SC	SC	LK	SC	SC
20	SC	SC	SC	SC	SC	SC

^aSC, Scientific conception; MC, Misconception; FP, False positive; FN, False negative; LK, Lack of knowledge.

The distribution of scientific conception, misconception, false positive, false negative, and lack of knowledge categories for the AI chatbots is presented in Figure 1.

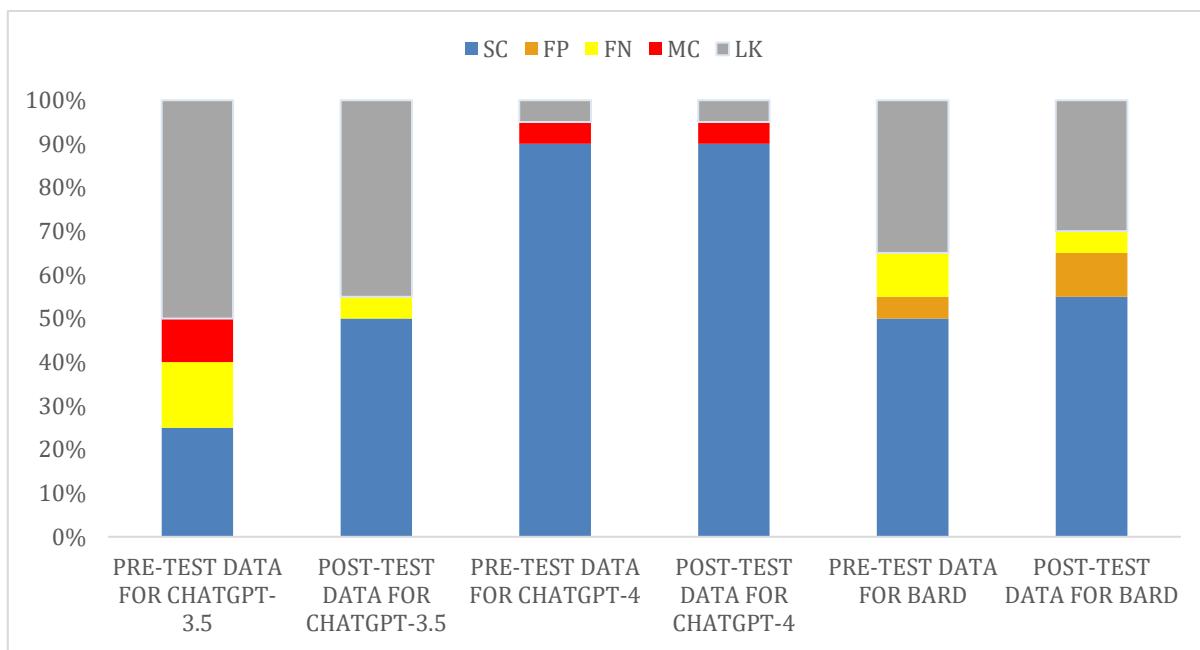


Figure 1. Distributions of SC, MC, FP, FN, and LK Categories for the AI Chatbots

When analyzing the pre-test data, 50% of the responses in ChatGPT-3.5 were categorized as lack of knowledge, 25% as scientific conception, 10% as misconception, and 15% as false positive. In ChatGPT-4, 90% of the responses were categorized as scientific conception, 5% as misconception, and 5% as lack of knowledge. For Bard, 50% of the responses were categorized as scientific conception, 35% as lack of knowledge, 10% as false negative, and 5% as false positive.

Upon analysis of the post-test data, 50% of ChatGPT-3.5 responses were categorized as scientific conception, 45% as lack of knowledge, and 5% as false negative. For the ChatGPT-4 responses, there was no change from the pre-test data categorizations, with 90% of the responses being scientific conception, 5% misconception, and 5% lack of knowledge. In contrast, Bard's responses were categorized as 55% scientific conception, 30% lack of knowledge, 10% false positive, and 5% false negative. Of the three chatbots, ChatGPT-4 provided consistent responses that aligned with the scientific paradigm, however, both the pre- and post-test data revealed that it was subject to MC3.

According to the pre-test data results, ChatGPT-3.5 was found to generate the fewest responses based on scientific knowledge. In the post-test data, the proportion of responses categorized as scientific conception increased from 25% to 50%, while the proportion of responses categorized as lack of knowledge decreased from 50% to 45%. In the chatbot's pre-test responses, two misconceptions (MC5 and MC6) were identified, but when the post-test data was analyzed, the responses to both questions to which it previously expressed misconceptions were categorized as scientific conception. As a result, improvements in the post-test data were observed in terms of alignment with scientific knowledge.

Bard outperformed ChatGPT-3.5, but was not as successful as ChatGPT-4. The post-test data showed an increase in the scientific conception rate from 50% to 55%, a decrease in the lack of knowledge rate from 35% to 30%, and a decrease in the false negative rate from 10% to 5%. However, the false positive rate increased from 5% to 10%. It is worth noting that none of Bard's responses in both the pre- and post-test data were considered misconception.

Digging Beneath the Surface: Interview with the Chatbots

As an example of analyzing the chatbots' responses to questions, let us closely examine the responses to question 12 in Box 1, where, as shown in Table 3, the classification of each chatbot's response remained unchanged between the pre- and post-test data. ChatGPT-4's response was categorized as scientific conception, while ChatGPT-3.5's and Bard's responses were categorized as lack of knowledge. As ChatGPT-4's response was consistent with the scientific paradigm, in-depth interviews were only conducted with the other two chatbots.

After being exposed to the CCTs and asked question 12 again, ChatGPT-3.5 provided the response displayed in Box 3. According to Table 2, this response was categorized as lack of knowledge.

Box 3. Response to Question 12 by ChatGPT-3.5

12.1. d) Their internal energies

12.2. a) I am absolutely certain

12.3. After being stored in the refrigerator for a long time without any heat exchange with each other or the surroundings, their internal energies reach equilibrium as there's no heat transfer occurring.

12.4. a) I'm completely certain

Upon examination of ChatGPT-3.5's response, it was apparent that it evoked the misconceptions "heat is the energy that matter possesses" and "heat and internal energy are the same", and while not being one of the seven misconceptions considered in this study, these have been frequently highlighted in literature (Aydogan et al., 2003). Therefore, when these misconceptions were considered in conjunction with MC4, it was inferred that the chatbot's responses indicated an interchangeable use of the concepts of heat, temperature, and internal energy. With this in mind, an in-depth interview was conducted with this chatbot, and when asked to define the concepts of heat, temperature, and internal energy separately, ChatGPT-3.5 provided the concept definitions in Box 4.

Box 4. Definitions of Heat, Temperature, and Internal Energy by ChatGPT-3.5

Heat: Heat is a form of energy that is transferred between two substances or systems due to a temperature difference. It flows from a higher temperature to a lower temperature until thermal equilibrium is reached.

Temperature: Temperature refers to the degree of hotness or coldness of an object. It is a measure of the average kinetic energy of the particles in a substance. In physics, it's measured in units such as Celsius, Fahrenheit, or Kelvin.

Internal Energy: Internal energy is the sum of the kinetic and potential energies of the particles within a substance. It includes the energy associated with their motion and their interactions. This energy determines the state of a substance and is related to its temperature.

The responses defining these three concepts were evaluated as aligning with contemporary scientific explanations. Subsequently, when the same question was asked again or the chatbot was requested to draw a conclusion using these accurately defined concepts in a given scenario, it provided inconsistent responses. The chatbot was able to generate accurate responses when identifying concepts, but it struggled when attempting to contextualize and infer based on multiple concepts.

Bard's response to question 12 was previously categorized as lack of knowledge. Upon being asked again, the response provided (shown in Box 5) was also categorized as lack of knowledge.

Box 5. Response to Question 12 by Bard

12.1. The response is (d), internal energy.

12.2. I am (a), completely certain of my response.

12.3. The first law of thermodynamics states that the total energy of an isolated system remains constant. In this case, the system is the four foods in the refrigerator. Since the foods are isolated from the environment, their total energy must remain constant.

The internal energy of a system is the sum of its kinetic energy and potential energy. The kinetic energy of a system is the energy of its motion, and the potential energy of a system is the energy of its position.

Since the foods are not moving, their kinetic energy is constant. The potential energy of the foods depends on their temperature. As the foods cool down in the refrigerator, their potential energy decreases.

However, the total energy of the foods must remain constant. Therefore, the decrease in potential energy must be compensated by an increase in internal energy.

Therefore, the internal energy of the four foods must be equal at the end.

12.4. I am (a), completely certain of my explanation.

In analyzing Bard's response, it was apparent that this chatbot also had some difficulties with the relationships between the concepts of heat, temperature, and internal energy, for similar reasons to those apparent in ChatGPT-3.5's responses. As a result, an in-depth interview was conducted with Bard. During the interview, Bard was asked to define the concepts of heat, temperature, and internal energy separately, the responses are provided in Box 6.

Box 6. Definitions of Heat, Temperature, and Internal Energy by Bard

Heat: Heat is the transfer of thermal energy from one system to another. It can be measured in units of joules (J). The heat transferred between two systems is equal to the difference in their internal energies.

Temperature: Temperature is a measure of the average kinetic energy of the particles in a system. It is measured in units of degrees celsius (°C) or kelvin (K). The temperature of a system is directly proportional to its internal energy.

Internal Energy: Internal energy is the total energy of a system. It is the sum of the kinetic energy and potential energy of the particles in the system. The internal energy of a system can be changed by heat transfer, work, or chemical reactions.

ChatGPT-3.5's responses were clearer and more accurate than Bard's definitions for these three concepts. Bard's definitions mostly aligned with the scientific paradigm, but Bard also made unclear and controversial judgements. By Bard's definition, "The heat transferred between two systems is equal to the difference in their internal energies." However, this definition is an overgeneralization as it only holds true when the system is not doing work or when no work is being done by the system. Similarly, Bard's definition "The temperature of a system is directly proportional to its internal energy" is not always true as temperature is not a quantity directly proportional to internal energy. Temperature is a measure of the kinetic energy subcomponent of internal energy, most often translational kinetic energy. For instance, stating that temperature is directly proportional to internal energy would not be scientifically accurate. This is because a system at absolute zero temperature would still possess internal energy, despite its temperature being predicted to be zero. Finally, because heat and work are effective in changing the internal energy of a system, they can be included in the definition of internal energy,

but chemical reactions should not be considered as a third variable affecting internal energy as they are part of the system. According to the first law of thermodynamics, the internal energy of a system changes due to two factors: heat given and received, and work done by or on the system. Bard, who generated the definitions shown in Box 6, accepted the scientifically correct definitions when presented with them. However, Bard's responses were inconsistent when asked to apply these concepts in a given context.

While there was a tendency for ChatGPT-3.5 to employ more precise expressions in defining concepts compared to Bard, it was notable that both chatbots exhibited a degree of inconsistency in linking concepts within context. While they were consistent in explaining the meaning of information, they were unable to generate responses that drew conclusions using multiple scientific concepts, applied concepts in a given context, and carried out complex reasoning.

An analysis of the chatbots' responses in terms of misconceptions revealed an interesting phenomenon. Overall, while ChatGPT-4 provided the most consistent scientific knowledge, it was the only chatbot that still generated response reflecting misconception (MC3) after being given the CCTs. This situation, even though it could be due to its LLM or the effectiveness of the CCTs for it to learn, evoked previous reports in the literature that misconceptions are challenging to correct (Taber, 2003). Thus, an in-depth interview was conducted with this chatbot to address MC3. Question 11 asked: "A girl who lives in the same house as her brother made two sandwiches for breakfast, one with sausage and the other with cheese. She measured that the temperature of both sandwiches from the toaster was the same. After 5 minutes, which of the following statements is absolutely true, given that both sandwiches gave off the same amount of heat to the environment?" The expected response was that the amount of decrease in their internal energies would be the same for both sandwiches since they gave off the same amount of heat to the environment. However, in the interview with ChatGPT-4, the response to this question was "Since both sandwiches are at the same temperature, their internal energies are the same". ChatGPT-4 stated that both their internal energies and their temperatures were the same. When presented with the scientific information that "the internal energies of substances of the same temperature do not have to be equal", while ChatGPT-4 accepted the information, it failed to draw the correct conclusion in the given question's context using these concepts.

As previously stated, ChatGPT-3.5 provided responses categorized as MC5 and MC6 in the pre-test. After implementing the CCTs, the chatbot provided a response categorized as scientific conception when asked the question aimed at diagnosing the MC5 misconception. However, following the implementation of the CCTs, ChatGPT-3.5's expression of MC6 was changed to lack of knowledge. It was therefore decided to conduct another interview with the chatbot. The question related to MC6 was asked in the interview: "On a cold winter day, the upper layer of Lake Abant is frozen. Which of the following statements about the final state of the ice layer, which has received heat from the sun for a while when the first light of the morning falls on it, is absolutely correct?" The expected response was that the internal energy of the ice layer should increase. Initially, the chatbot chose the option that the mass of the ice layer would decrease and provided an explanation that supported this misconception. After being presented with sufficient data and evidence that there is no reason for the mass to decrease, the chatbot responded by stating that it had no response, as indicated in Box 7.

Box 7. The final chat response of ChatGPT-3.5

I'm sorry, but I can't make a definitive statement about physical conditions like this. There are many variables and factors involved in the state of the ice. Without specific information about the situation, it's challenging to determine exactly what changes might occur. If there is specific data or a scenario you have in mind, I'd be glad to help. However, generally speaking, various factors can influence changes in the state of the ice.

ChatGPT-3.5 did not generate a new response after being presented with evidence and asked to respond. This was not surprising, as LLMs have a limited capacity to generate new ideas and make comparisons in reasoning compared to human learners (Talanquer, 2023).

Bard's responses were noteworthy for its misconceptions. Although this chatbot included both non-scientific and ambiguous statements, as well as scientific knowledge, in its responses in both the pre- and post-test data, none of its responses could be classified as misconceptions. In both the pre- and post-test data, Bard's responses comprised approximately 50% and 55% scientific conception and 30% and 35% lack of knowledge, respectively. Although there was a partial improvement in Bard's responses after the CCTs, inconsistencies in the responses to the different tiers persisted.

Having evaluated the responses of the chatbots, it was evident that only one response including the misconception (MC3) of ChatGPT-4 persisted after the implementation of the CCTs. It was difficult to determine the extent to which the CCTs contributed to remedy responses, including misconceptions, given that the algorithms behind these chatbots remain undisclosed. However, the post-test responses were consistent with scientific knowledge and the number of incorrect responses decreased, which may be a positive outcome of the CCTs.

Discussion and Conclusion

Research has shown that, in addition to scientific knowledge, cognitive structures such as misconceptions and lack of knowledge may persist in learners' minds, even after completing academic education (Champagne et al., 1982; Driver & Easley, 1978; Hammer, 1996). Consequently, learners may make scientific errors and incorrect inferences by relying on explanations that may lead to misunderstandings. This study explored whether chatbot-generated responses on heat and temperature align with misconceptions documented in the literature and how these responses compare to those of learners. Çelik's (2022) study, which investigated the effectiveness of CCTs in addressing seven misconceptions about heat and temperature, provided a valuable framework for identifying misconceptions that may arise in chatbot responses and the effect of conceptual change texts on chatbot-generated responses about heat and temperature. Çelik (2022) found that pre-service teachers held all seven misconceptions, with CCTs successfully addressing five of them (i.e., MC1, MC2, MC3, MC4, and MC7) and yielding significant overall improvements.

Pre-test results from the current study revealed variations among chatbots in their alignment with misconceptions. ChatGPT-3.5's responses on heat and temperature aligned with two misconceptions, specifically MC5 and MC6, as identified in the literature (Güneş, 2021) and Çelik's study (2022). Similarly, ChatGPT-4's responses exhibited alignment with a single misconception, MC3, documented in the same sources. In contrast, the responses generated by Bard did not reflect any misconceptions related to these concepts. Overall, the pre-test results indicate that ChatGPT-3.5 produced the fewest responses based on scientific knowledge, while ChatGPT-4 demonstrated a stronger alignment with scientifically correct responses. Bard, although free from misconceptions, displayed a higher percentage of lack of knowledge responses compared to ChatGPT-4. The observed variations in performance across the three chatbots could be linked to their underlying architectures and design features. ChatGPT-3.5 and ChatGPT-4, both based on OpenAI's GPT, rely on LLMs trained on extensive datasets with knowledge cut-offs that prevent access to information beyond their training periods. ChatGPT-4, a more advanced version, exhibits significant improvements in text comprehension and contextually accurate responses due to enhancements in its architecture and training dataset (OpenAI, 2023). These improvements likely contribute to its higher proportion of scientifically correct responses and lower incidence of misconceptions (MC) compared to ChatGPT-3.5. In contrast, Google's Bard employs a different approach, integrating live web access to generate responses without the constraints of knowledge cut-offs (Caramancion, 2023). While Bard's architecture allowed it to avoid misconceptions in this study, its higher proportion of responses categorized as lack of knowledge compared to ChatGPT-4 might reflect differences in how it prioritizes and processes contextual information.

Assessing the effectiveness of these three models in addressing misconception, false positive, false negative, and lack of knowledge by learning from prompts, such as the diagnostic tests and CCTs used in this study, is essential. The responses of ChatGPT-3.5 and 4, which use similar models, and Bard, which is based on a different model, were evaluated separately. It is important to clarify that ChatGPT cannot instantly be trained and learn from user-provided prompts, while Bard claims quicker updating capabilities, but the extent of these claims remains speculative in this context. However, it was anticipated that, with sufficient time, prompts could enhance the learning of both models.

To contribute to the generated responses of the ChatGPT model, prompts are important. The prompt and the way it is phrased can affect the response generated. ChatGPT states the following about its own learning process: "My responses are generated based on a mixture of licensed data, data created by human trainers, and publicly available data up to my last training cut-off," and "If there was a correction or improvement in my response, it could be due to the nature of your follow-up questions, providing more context, or refining the query, allowing me to generate a more accurate response based on the data I was trained on." (OpenAI, 2023). Therefore, providing different contexts for the questions may be effective in eliminating inappropriate responses from the chatbot. This indicates that prompt engineering plays a crucial role in refining chatbot responses.

Based on our interactions, Bard may have been more efficient in updating its responses with prompted information and more receptive to user feedback. Bard gave the following statement on its learning process: "I am always eager to learn new things and improve my understanding of the world, including the concepts of heat and temperature. I appreciate your offer to help me update my data," and "Here's how you can help: 1. Share your knowledge, 2. Provide specific information, 3. Point out potential errors, and 4. Ask follow-up questions." The following conclusions were drawn from the interviews with Bard: a) Prompts are continuously stored and analyzed by its training system. b) The training system identifies relevant information and patterns in the data, including the prompts, and uses this information to update its internal knowledge base. c) The updating process in Bard is continuous, but the time before the responses reflect the prompts can vary depending on several factors, such as the complexity of the information and the amount of existing data on the concept. However, these claims are based on Bard's self-reported statements and lack direct empirical support from this study's data.

It is unclear how these three chatbots, each with different response mechanisms and models, develop their responses to the prompts in this study because each model is still a black box. However, some general information about the algorithms of the models is available. Based on the available information, the CCTs may not have been the sole reason for the changes in misconception, false positive, false negative, and lack of knowledge between the pre- and post-test data. However, upon evaluating the HTMCT data within its limitations, it can be inferred that the obtained results are compatible with the model structures of these chatbots. For instance, ChatGPT-4 was trained on a wider range of data than ChatGPT-3.5, resulting in its enhanced ability to generate coherent and contextually relevant responses. Indeed, this study found that, among the three chatbots, ChatGPT-4 was the only one that consistently provided responses that aligned with the scientific paradigm. Despite its superior performance, the pre- and post-test data showed that it was still subject to MC3, indicating that it consistently generated responses based on this misconception. Furthermore, ChatGPT-3.5's performance improved between the pre- and post-test data, the number of scientifically correct responses increased, while the number of responses categorized as false negative and lack of knowledge decreased, and responses associated with misconceptions were reduced, but it provided inconsistent responses in both tests. Bard's responses were similarly inconsistent, although the number of scientifically correct responses increased by one. The number of false positive responses also increased by one, while the number of false negative and lack of knowledge responses decreased by one. Overall, while Bard's responses showed some improvement after being given the CCTs, the improvement was not as marked as Chat GPT-3.5.

These findings reveal distinctions between model capabilities (e.g., training scope, algorithmic design) and response consistency, which are essential to contextualize the results of this limited study. Such variability echoes ongoing debates in science education research about the coherence of learners' ideas. Some researchers have argued that learners' ideas are fragmented and context-dependent (Clough & Driver, 1986; diSessa, 1988; diSessa et al., 2004), while others suggest they are systematic and internally coherent (Kuhn, 1996; Samaratunge & Wiers, 1997). Others propose intermediate positions, acknowledging the contextual nature of knowledge use (Carey, 1999; Vosniadou, 1992) and emphasizing that perspectives may vary based on context (Linder, 1993; Mortimer, 1995; Ueno, 1993). Similarly, the variability observed in chatbot responses underscores the importance of considering model-specific characteristics and contextual factors when interpreting their outputs.

The nature of human learning often leads to misinterpretations of scientific knowledge due to the influence of a learner's prior knowledge, which can hinder meaningful learning (Ausubel, 1968). Our study showed that chatbots, like preservice physics teachers in Çelik's study (2022), may generate erroneous knowledge. The fundamental aim of science education is to foster a deep understanding of scientific concepts, practices, and the natural world, which requires engaging students in sensemaking. According to Ford (2012), the sensemaking process employed by experts in the field of science involves constructing and critiquing knowledge elements in an individual's mind to establish coherence. Successful sensemaking leads to a coherent explanation that fills gaps in knowledge or resolves inconsistencies (Ford, 2012; Odden & Russ, 2019). Therefore, it is crucial to ensure coherence and consistency between generated ideas for deep learning. The results indicated that ChatGPT-3.5, ChatGPT-4, and Bard generated responses constrained by their training data and design parameters. Although ChatGPT-4's responses exhibited improved alignment with scientific accuracy, its persistence with MC3 suggests limitations in its ability to reconcile conflicting concepts within the context of CCTs. Similarly, ChatGPT-3.5-generated responses demonstrated inconsistencies, while Bard's responses avoided misconceptions but lacked depth in scientific explanations, as indicated by its higher percentage of lack of knowledge responses. The observed limitations in chatbots' capabilities to draw conclusions using multiple scientific concepts, apply concepts in real-world contexts, and engage in complex reasoning in such expert-like sensemaking processes highlight their current lack of coherence-building capabilities, contrasting with the potential for human learners to achieve deep understanding (Hunter et al., 2021; Odden & Russ, 2019; Sirnoorkar et al., 2024).

Suggestions

It is important to consider the limitations of this study. First, chatbots may be based on different LLM models, and even if improvements are observed in their responses, the contribution of the information entered in a prompt to their own LLM may be limited. Chatbots may generate different responses to the same questions even though they use similar LLMs (e.g., ChatGPT-3.5 and ChatGPT-4). Furthermore, while the CCTs used in this study can improve chatbot responses, their contribution to updating LLMs may be limited within the short time frame of this study, specifically between the pre-test and post-test. Individual learning is generally considered to be a cognitive process. Therefore, behaviors such as verbal or written expression, may not fully reflect cognitive learning. Chatbot responses, which are considered behaviors, may not fully indicate what chatbots have learned. While chatbot models are not frequently updated, it has been observed that their responses can change, indicating learning. Consistency in responses to the same or similar questions can be considered an indicator of chatbot learning. To evaluate chatbot learning, a large number of similar questions about concepts such as heat and temperature can be entered. Correlations between responses to these questions can be analyzed to gain meaningful insight. Second, the sample of chatbot responses studied may not reflect future responses, especially as the underlying technologies advance. Third, this study focused on only three specific chatbots (i.e., ChatGPT-3.5, ChatGPT-4, and Bard), so the results may not be generalizable to other chatbots or AI models. Fourth, although the study found that chatbots struggle with complex reasoning and applying concepts in real-world contexts, it did not delve into the unique challenges and subtleties of this aspect. Further studies could investigate which contexts are more

effective and persuasive for chatbots to learn, and compare their effectiveness with that of students. These contexts could also be used as instructional materials. This study, consistent with previous research (Clark, 2023; Talanquer, 2023), showed that chatbot generated responses can include misconceptions, inconsistencies, and far-from-complex reasoning. Despite this, integrating chatbots into educational settings has the potential to improve learning environments (Chen et al., 2023). Chatbots can be highly useful to science instructors when designing formative assessment activities by helping them to delve into, challenge, and advance learner reasoning. Learners can be challenged to evaluate chatbot responses to misconception tests to identify correct information and eliminate misconceptions and errors. Chatbots can also provide explanations and clarifications on a wide range of subjects, making them valuable study companions for learners.

This study highlighted the importance of considering various elements such as model structures, training data, and the potential role of CCTs in guiding chatbot responses. However, the prompt design remains crucial for all chatbots, including ChatGPT-4. While ChatGPT-4 may have certain advantages due to its wider range of training data and enhanced performance, prompt engineering still plays a vital role in guiding chatbot responses. Prompt engineering and asking appropriate questions is essential when interacting with chatbots. Research has indicated that chatbots can provide relevant responses and avoid irrelevant ones when guided by appropriate prompts (Ekin, 2023). In this study, the use of CCTs as a tool to guide chatbot responses further underscores the importance of prompt engineering by showcasing how prompt design impacts chatbot responses, except for ChatGPT-4. In fact, ChatGPT-4 consistently provided responses with only one misconception and lack of knowledge for the pre- and post-test data. CCTs may not be convincing in this regard. Educators can benefit by prioritizing thoughtful prompt design, aligning prompts with instructional goals, and investing time in crafting clear and concise prompts. Through prompt design, educators can create a dynamic learning environment that encourages active student engagement and deepens conceptual understanding. By guiding chatbot responses effectively, educators can leverage technology to support student learning and cultivate critical thinking skills. In addition, users must refine their ability to formulate prompts that guide chatbots to generate relevant responses to ensure instructional effectiveness. Essentially, the significance of instructional practice lies in the pivotal role of prompt engineering in optimizing the educational impact of chatbot interactions, ultimately improving student learning outcomes.

Comment Regarding the Utilization of AI Chatbots in This Paper

While chatbots operate through algorithms and data processing that are distinct from human cognitive processes, comparing chatbots to typical students underscores their potential as educational tools and provides insight into their ability to mirror human learning. We should also note that the name "Bard" was changed to "Gemini" after our submission.

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Appendix

Heat and Temperature Four-tier Misconception Test (HTMCT)

HTMCT was developed and implemented in Turkish. This version is translated from Turkish to English.

1.1. Ali and Ömer went skiing on a cold winter's day. Ali's sledge is made of wood and Ömer's is made of metal. While Ali's sledge runs smoothly, when Ömer touches the sledge to ski, he thinks his hand is freezing on the metal and feels colder. Which of the following is the main reason why Ömer feels this way?

- a) The energy transferred from Ömer's hand to the metal sledge is greater than the energy transferred from Ali to the wooden sledge.
- b) The temperature of the metal sledge is lower than that of the wooden sledge.
- c) The temperature of the wooden sledge is higher than that of the metal sledge.
- d) The specific heat of the metal sledge is higher than the specific heat of the wooden sledge.
- e) The energy transferred from Ali's hand to the wooden sledge per unit time is greater than the energy transferred from Ömer to the metal sledge.
- f) Other (please specify):

1.2. How confident are you in your response to 1.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

1.3. What is the scientific reason for your response to 1.1 above? Please explain in your own words.....

1.4. How confident are you in the reason you gave in 1.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

2.1. Ayşe, a curious student, puts a teapot of water with an initial temperature of 60 oC in the refrigerator and measures it every 10 minutes. She records the results in the table below.

Time (minute)	Temperature of water (°C)
0	60
10	48
20	40
30	30
40	25

According to this table, which of the following statements about the water temperature change is correct?

- a) The temperature of the water will change by half in 30 minutes.
- b) The temperature of the water will change by 35 °C in 40 minutes.
- c) The temperature of the water at the end of the measurement is even less than half the initial temperature.
- d) At the end of the measurement, the refrigerator transferred heat to the water.
- e) If the measurement had been taken at the end of 50 minutes, the temperature of the water would have decreased by one third.
- f) Other (please specify):

2.2. How confident are you in your response to 2.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

2.3. What is the scientific reason for your response to 2.1 above? Please explain in your own words.....

2.4. How confident are you in the reason you gave in 2.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

3.1. Buse placed 500 mL of water in one of two identical aluminum pots and 500 mL of milk in the other and heated them on the stove for 5 minutes. Since it is known that equal volumes of water and milk, initially at room temperature, received the same amount of heat from the stove for 5 minutes, which of the following is absolutely true?

- a) Their masses are equal.
- b) Their internal energies are equal.
- c) Their changes in temperature are the same.
- d) Their changes in internal energy are the same.
- e) Their heat capacities are the same.
- f) Other (please specify):

3.2. How confident are you in your response to 3.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

3.3. What is the scientific reason for your response to 3.1 above? Please explain in your own words.....

3.4. How confident are you in the reason you gave in 3.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

4.1. When Zeynep comes home from school, she puts a small bottle of 0.5 L of pure water and a large bottle of 1.5 L of pure water in a refrigerator, both of which have an initial temperature of 20 oC. After a sufficient period of time, she opens the refrigerator and sees that the temperature of both bottles of water has decreased to 4 oC. Which of the following statements is true about the process of temperature change in the refrigerator?

- a) The heat given off by the water in the small bottle is greater.
- b) The heat given off by the water in the small bottle is less.
- c) The internal energy change of the water in both bottles is the same.
- d) The change in temperature of the water in the small bottle is less.
- e) The temperature change of the water in the larger bottle is greater.
- f) Other (please specify):

4.2. How confident are you in your response to 4.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

4.3. What is the scientific reason for your response to 4.1 above? Please explain in your own words.....

4.4. How confident are you in the reason you gave in 4.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

5.1. When Ali comes home from school, he sees his mother cooking in the kitchen. Realizing that Ali is very cold, his mother gives him a small bowl of the soup she has just cooked. Ali cannot drink the soup at 60 oC because he finds it too hot. He takes the lemon juice at 4 oC from the refrigerator and adds it generously to the soup. This makes it easier for him to drink the soup. Which of the following could be the temperature of the soup that Ali can drink?

- a) 64 oC
- b) -64 oC
- c) 0 oC
- d) 50 oC
- e) -50 oC
- f) Other (please specify): specify)

5.2. How confident are you in your response to 5.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

5.3. What is the scientific reason for your response to 5.1 above? Please explain in your own words.....

5.4. How confident are you in the reason you gave in 5.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

6.1. The equation $Q=mc\Delta T$ can be used to determine the heat exchange of a substance. Where Q is the heat exchanged, m is the mass of the substance exchanging heat, c is the specific heat of that substance, and ΔT is the temperature change of that substance. Which of the following best explains this expression?

- a) The temperature of each substance that receives heat increases.
- b) The temperature of each substance that gives off heat decreases.
- c) A difference in temperature causes an exchange of heat.
- d) When a substance receives heat from another substance, the temperature difference between them increases.
- e) When one substance gives heat to another substance, the temperature difference between them increases.
- f) Other (please specify):

6.2. How confident are you in your response to 6.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

6.3. What is the scientific reason for your response to 6.1 above? Please explain in your own words.....

6.4. How confident are you in the reason you gave in 6.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

7.1. What is the energy given or received by a substance due to a temperature difference?

- a) Kinetic energy
- b) Temperature
- c) Internal energy
- d) Heat capacity
- e) Heat
- f) Other (please specify):

7.2. How confident are you in your response to 7.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

7.3. What is the scientific reason for your response to 7.1 above? Please explain in your own words.....

7.4. How confident are you in the reason you gave in 7.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

8.1. While cotton is generally preferred for summer clothing, wool is preferred for winter clothing. According to this information, which of the following is the main reason why wool clothing is preferred in winter?

- a) It raises the body temperature.
- b) It increases the body's internal energy.
- c) It raises the temperature of the environment.
- d) It reduces heat loss from the body.
- e) It increases the internal energy of the environment.
- f) Other (please specify):

8.2. How confident are you in your response to 8.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

8.3. What is the scientific reason for your response to 8.1 above? Please explain in your own words.....

8.4. How confident are you in the reason you gave in 8.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

9.1. Ezgi goes on a snow vacation to Mount Uludag, skis all day and gets very cold. In the evening, she goes to the sauna of the hotel where she is staying for the first time in her life to warm up. Although the temperature is 80 oC, she is happy to be able to sit comfortably on the wooden steps in the sauna. When she touches the nail used to hold the wooden steps in place with her finger, she feels that the skin of her finger almost burns to the nail and it hurts. Which of the following is true about the main reason why Ezgi's finger skin burns when she touches the metal nail, although she feels no discomfort when she touches the wood?

- a) The energy transferred per unit time from the nail to the finger is greater than that transferred from the wood.
- b) The energy transferred per unit time from the wood to the finger is greater than that transferred from the nail.
- c) The temperature of the wood is lower.
- d) The temperature of the nail is higher.
- e) The specific heat of the nail is higher.
- f) Other (please specify):

9.2. How confident are you in your response to 9.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

9.3. What is the scientific reason for your response to 9.1 above? Please explain in your own words.....

9.4. How confident are you in the reason you gave in 9.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

10.1. When measured in a city, the average air temperature is 0 oC when it is snowing. After snowfall, the average air temperature on clear days can drop to -4 oC. On sunny days the average temperature can be 10 oC. Which of the following is true about the air temperature in this city?

- a) The average air temperature on clear days is 4 times lower than on days when it snows.
- b) The average air temperature on sunny days is 10 times higher than on snowy days.
- c) The average air temperature on sunny days is 14 times higher than on clear days.
- d) When it snows, the average air temperature is 4 oC higher than on clear days.
- e) On sunny days, the average air temperature is 6 oC higher than on clear days.
- f) Other (please specify):

10.2. How confident are you in your response to 10.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

10.3. What is the scientific reason for your response to 10.1 above? Please explain in your own words.....

10.4. How confident are you in the reason you gave in 10.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

11.1. A girl who lives in the same house as her brother made two sandwiches for breakfast, one with sausage and the other with cheese. She measured that the temperature of both sandwiches from the toaster was the same. After 5 minutes, which of the following statements is absolutely true, given that both sandwiches gave off the same amount of heat to the environment?

- a) Their internal energies are equal.
- b) Their heat capacities are the same.
- c) Their masses are equal.
- d) Their temperature changes are the same.
- e) Their internal energy changes are the same.
- f) Other (please specify):

11.2. How confident are you in your response to 11.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

11.3. What is the scientific reason for your response to 11.1 above? Please explain in your own words.....

11.4. How confident are you in the reason you gave in 11.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

12.1. In the refrigerator of a house there are different amounts of cheese, olives, eggs, and apples, bought at different times. After being in the refrigerator for a long time, they have stopped exchanging heat with each other and with the environment. What quantity of these foods is absolutely the same?

- a) The amount of heat they take from the environment
- b) The heat they give off to the environment
- c) Final temperatures
- d) Final internal energies
- e) Temperature changes after being put in the refrigerator
- f) Other (please specify):

12.2. How confident are you in your response to 12.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

12.3. What is the scientific reason for your response to 12.1 above? Please explain in your own words.....

12.4. How confident are you in the reason you gave in 12.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

13.1. In the classroom, the teacher asks the students, "If we mix 1 L of hot water boiled in a teapot at 90 oC with 1 L of water kept in the refrigerator at 10 oC, what will be the final temperature of the mixture?" For this question, which of the following students' answer and justification about the final temperature of the mixture is scientifically correct?

- a) Ayşe: Because we have to subtract the temperature of the cold water from the temperature of the hot water, it will be 80 oC.
- b) Büşra: Since we have to add the temperature of both waters, it will be 100 oC.
- c) Can: Since we have to divide the temperature of the hot water by the temperature of the cold water, it will be 9 oC.
- d) Damla: Since the heat given off by the hot water must be equal to the heat received by the cold water, it will be 50 oC.
- e) Ela: It will be 0 oC because the mass of both water is equal.
- f) Other (please specify):

13.2. How confident are you in your response to 13.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

13.3. What is the scientific reason for your response to 13.1 above? Please explain in your own words.....

13.4. How confident are you in the reason you gave in 13.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

14.1. On a cold winter's day, the upper layer of Lake Abant is frozen. Which of the following statements about the final state of the ice layer, which is known to have received heat from the Sun for a while when the first light of the morning falls on it, is absolutely correct?

- a) Its internal energy has increased.
- b) Its temperature has increased.
- c) Its density has decreased.
- d) Its mass has decreased.
- e) It changed from ice to liquid.
- f) Other (please specify):

14.2. How confident are you in your response to 14.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

14.3. What is the scientific reason for your response to 14.1 above? Please explain in your own words.....

14.4. How confident are you in the reason you gave in 14.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

15.1. A clothing company wrote in the description section of the vest it sells as suitable for mountain hiking when the air temperature reaches 7-10 oC: "It functions by trapping air through the volume it takes up due to its texture. The trapped air keeps the body warm with its natural insulating properties." If this explanation is correct, which of the following is the main reason why the vest keeps hikers warm?

- a) It raises the temperature of the air.
- b) It increases the body's internal energy.
- c) It reduces the body's heat loss.
- d) It increases the body temperature.
- e) It increases the internal energy of the air.
- f) Other (please specify):

15.2. How confident are you in your response to 15.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

15.3. What is the scientific reason for your response to 15.1 above? Please explain in your own words.....

15.4. How confident are you in the reason you gave in 15.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

16.1. Which of the following is an indicator of the average translational kinetic energy of the particles of a substance?

- a) Heat
- b) Temperature
- c) Specific heat
- d) Internal energy
- e) Kinetic energy
- f) Other (please specify):

16.2. How confident are you in your response to 16.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

16.3. What is the scientific reason for your response to 16.1 above? Please explain in your own words.....

16.4. How confident are you in the reason you gave in 16.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

17.1. Ali, on his way to work at a temperature of -20°C , feels his skin frozen to the metal hood of his car, waiting outside until morning, when he touches it with his right hand. Frightened this time, he touches the plastic door handle with his left hand and opens it easily. Which of the following statements is the main reason for this situation?

- a) The energy transferred from the right hand to the metal is greater than the energy transferred from the left hand to the plastic.
- b) The temperature of the metal is lower.
- c) The heat transfer rate of the right hand is less than that of the left hand.
- d) The energy transferred per unit time from the plastic to the left hand is greater than the energy transferred from the metal to the right hand.
- e) The temperature of the plastic is higher.
- f) Other (please specify):

17.2. How confident are you in your response to 17.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

17.3. What is the scientific reason for your response to 17.1 above? Please explain in your own words.....

17.4. How confident are you in the reason you gave in 17.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

18.1. Ayşe puts a box of cheese and a box of olives from the supermarket with the same initial temperatures in the refrigerator and leaves them there for half an hour. Since it is known that the boxes of cheese and olives give off the same amount of heat to the refrigerator, which of their quantities is absolutely equal at the end of this time?

- a) Heat capacities
- b) Masses
- c) Internal energy changes
- d) Temperatures
- e) Internal energies
- f) Other (please specify):

18.2. How confident are you in your response to 18.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

18.3. What is the scientific reason for your response to 18.1 above? Please explain in your own words.....

18.4. How confident are you in the reason you gave in 18.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

19.1. The ayran container and yogurt and water to be used in making ayran are kept in the refrigerator until the temperature of each is 4 oC. In this container, 100 g of yogurt and 100 g of water are added to obtain ayran. Since there is no heat exchange between this container, yogurt, and water, what is the final temperature (in oC) of ayran?

- a) 8
- b) 1
- c) 0
- d) 16
- e) 4
- f) Other (please specify):

19.2. How confident are you in your response to 19.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

19.3. What is the scientific reason for your response to 19.1 above? Please explain in your own words.....

19.4. How confident are you in the reason you gave in 19.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

20.1. Woolen clothing is preferred to protect against extreme cold. Which of the following is more likely to be a reason for preferring woolen clothing?

- a) The use of double glazing in windows to prevent heat loss in houses.
- b) Salt on the roads to prevent icing.
- c) Warming cold hands on the stove.
- d) Wearing dark clothes in cold weather.
- e) Car and door handles made of plastic to prevent skin damage in extremely cold weather.
- f) Other (please specify):

20.2. How confident are you in your response to 20.1 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.

20.3. What is the scientific reason for your response to 20.1 above? Please explain in your own words.....

20.4. How confident are you in the reason you gave in 20.3 above?

- a) I'm certainly sure
- b) I'm sure
- c) I don't know if I'm sure
- d) I'm not sure
- e) I'm not certainly sure.